Fort Bend County, Texas
Request for Proposals

Construction of Fresno Community Center
for Fort Bend County
RFP 24-045

SUBMIT PROPOSALS TO:

Fort Bend County
Purchasing Department
Travis Annex
301 Jackson, Suite 201
Richmond, TX 77469

****NOTE:**
All correspondence must include the term "Purchasing Department" in address to assist in proper delivery

SUBMIT NO LATER THAN:

Tuesday, March 26, 2024
2:00 PM (Central)

MARK ENVELOPE:

RFP 24-045
Fresno Community Center

ALL SUBMITTALS MUST BE RECEIVED AND TIME/DATE STAMPED BY THE PURCHASING OFFICE OF FORT BEND COUNTY ON OR BEFORE THE SPECIFIED TIME/DATE STATED ABOVE.

SUBMITTALS RECEIVED AS REQUIRED WILL THEN BE OPENED AND THE NAMES PUBLICLY READ.

SUBMITTALS RECEIVED AFTER THE SPECIFIED TIME WILL BE RETURNED UNOPENED.

Results will not be given by phone.
Results will be provided to bidder in writing after Commissioners Court award.

Requests for information must be in writing and directed to:
Brooke Lindemann
Senior Buyer
Brooke.Lindemann@fortbendcountytx.gov

Vendor Responsibilities:

- Download and complete any addendums. (Addendums will be posted on the Fort Bend County website no Later than 48 hours prior to bid opening)
- Submit response in accordance with requirements stated on the cover of this document.
- DO NOT submit responses via email or fax.

Prepared: 2/26/2024
Issued: 3/3/2024

COUNTY PURCHASING AGENT
Fort Bend County, Texas

Vendor Information

Jaime Kovar
Purchasing Agent
Office (281) 341-8640

Legal Company Name (top line of W9)			
Business Name (if different from legal name)			
Type of Business	☐ Corporation/LLC ☐ Partnership ☐ Sole Proprietor/Individual ☐ Tax Exempt		Age in Business?
Federal ID # or S.S. #		SAM.gov Unique Entity ID #	
SAM.gov CAGE / NCAGE			
Publicly Traded Business	___ No ___ Yes Ticker Symbol _____		
Remittance Address			
City/State/Zip			
Physical Address			
City/State/Zip			
Phone Number			
E-mail			
Contact Person			
Check all that apply to the company listed above and provide certification number.	DBE-Disadvantaged Business Enterprise ☐ SBE-Small Business Enterprise ☐ HUB-Texas Historically Underutilized Business ☐ WBE-Women's Business Enterprise ☐	**Certification #** _____ **Certification #** _____ **Certification #** _____ **Certification #** _____	Cert Date / Exp Date _____ _____ _____ _____ _____ _____ _____ _____
Company's gross annual receipts	<$500,000 _____	$500,000-$4,999,999 _____	
	$5,000,000-$16,999,999 ___	$17,000,000-$22,399,999 _____	>$22,400,000 _____
NAICs codes (Please enter all that apply)			
Signature of Authorized Representative			
Printed Name			
Title			
Date			

THIS FORM MUST BE SUBMITTED WITH THE SOLICITATION RESPONSE

1.0 SCOPE OF WORK:

Fort Bend County, Texas (hereafter referred to as the "County") seeks Proposals ("Proposals or RFP") for selection of a Contractor ("Respondent") to complete the construction of Fresno Community Center ("Project"), located in Fresno, Texas.

Vendor to construct new 22,022 square foot Community Center facility in Fresno, Texas. The facility will house a full court gymnasium, teen room, game room, and numerous multi-purpose spaces. Also included are administrative offices and a conference room. Outdoor features include a playing field, concrete paving for approximately 50 vehicles, and landscaping.

2.0 GUIDELINES:

By virtue of submitting a proposal, interested parties are acknowledging:

2.1 The County reserves the right to reject any or all proposals if it determines that select proposals are not responsive to the RFP. The County reserves the right to reconsider any proposal submitted at any phase of the procurement. It also reserves the right to meet with select Respondents at any time to gather additional information. Furthermore, the County reserves the right to delete or add scope up until the final contract signing.

2.2 All Respondents submitting proposals agree that their pricing is valid for a minimum of ninety (90) days after proposal submission to the County. Furthermore, the County is by statute exempt from the State Sales Tax and Federal Excise Tax; therefore, proposal prices shall not include taxes.

2.3 This Proposal does not commit the County to award nor does it constitute an offer of employment or a contract for services. Costs incurred in the submission of this proposal, or in making necessary studies or designs for the preparation thereof, are the sole responsibility of the Respondents. Further, no reimbursable cost may be incurred in the anticipation of award. Proposals containing elaborate artwork, expensive paper and binding and expensive visual or other presentations are neither necessary nor desired.

2.4 In an effort to maintain fairness in the process, all inquiries concerning this procurement are to be directed only to the County's Purchasing Agent in writing. Attempts to contact any members of the County's Commissioners' Court or any other County employee to influence the procurement decision may lead to immediate elimination from further consideration.

2.5 When responding to this Proposal, follow all instructions carefully. Submit proposal contents according to the outline specified and submit all hard copy and electronic documents according to the instructions. Failure to follow these instructions may be considered a non-responsive proposal and may result in immediate elimination from further consideration.

3.0 PROPOSAL CONTACT:

This Proposal is being issued by the County Purchasing Agent on behalf of Fort Bend County, Texas. Thus, responses should be directed to the Purchasing Agent, as outlined below. **Respondents are specifically directed NOT to contact any County personnel for meetings, conferences or technical discussions that are related to this Proposal other than specified herein. Unauthorized contact of any County personnel will likely be cause for rejection of the Respondent's proposal. All communications regarding the Proposal shall be directed to the County's Proposal Contact.** Communication with the Proposal Contact is permitted via email, facsimile, or written correspondence.

PROPOSAL CONTACT:

Brooke Lindemann
Senior Buyer
Fort Bend County Travis Annex
301 Jackson, Suite 201
Richmond, Texas 77469
Brooke.Lindemann@fortbendcountytx.gov
Phone: 281.344.3929

4.0 SUBMISSION REQUIREMENTS:

4.1 Submission requirements: one (1) original proposal is required by RFP opening time of **2:00 PM on Tuesday, March 26, 2024**. Four (4) paper copies and one (1) electronic response on flash drive are required to be submitted to Purchasing by 9:00 AM on Wednesday, March 27, 2024. Flash drive must contain only one (1) file in PDF format and must match written response identically. Failure to provide proper flash drive is cause for disqualification. Proposal shall be submitted to the address shown below. Proposal shall be signed, in ink, by a person having the authority to bind the firm in a contract.

Fort Bend County	Proposal Number: R24-045
Purchasing Department	Due Date: March 26, 2024
301 Jackson, Suite 201	Time: 2:00 PM (CST)
Richmond, Texas 77469	For: Fresno Community Center

4.2 Respondents may submit their proposal any time prior to the Opening Date and time. The Respondent's name and address as well as a distinct reference to the Proposal number above shall be marked clearly on the submission. All proposals are time-stamped upon receipt and are securely kept, unopened, until the Opening Date. No responsibility will attach to the County, or any official or employee thereof, for the pre-opening of, post-opening of, or the failure to open a proposal not properly addressed and identified. No oral, telegraphic, telephonic, or facsimile proposals will be considered.

4.3 Proposals may be modified or withdrawn prior to the established opening date by delivering written notice to the proposal contact. Any alteration made prior to opening date and time shall be initialed by the signer of the proposal, guaranteeing authenticity.

4.4 Proposals time-stamped after the due date and time will not be considered and will be returned to the Respondent unopened. Regardless of the method used for delivery, respondents shall be wholly responsible for the timely delivery of submitted proposals.

4.5 The Respondent's name and address shall be clearly marked on all copies of the proposal.

5.0 INCURRED COSTS:

Those submitting proposals do so entirely at their expense. There is no expressed or implied obligation by the County to reimburse any individual or firm for any costs incurred in preparing or submitting proposals, for providing additional information when requested by the County or for participating in any selection interviews, including discovery (pre-contract negotiations) and contract negotiations.

6.0 ACCEPTANCE:

6.1 Submission of any proposal indicates a Respondent's acceptance of the conditions contained in this Proposal unless clearly and specifically noted otherwise in their proposal.

6.2 Furthermore, the County is not bound to accept a proposal on the basis of lowest price, and further, the County has the sole discretion and reserves the right to cancel this Proposal, to reject any and all proposals, to waive any and all informalities and or irregularities, or to re-advertise with either the identical or revised specifications, if it is deemed to be in the County's best interests. The County reserves the right to accept or reject any or all of the items in the proposal, and to award the contract in whole or in part and/or negotiate any or all items with individual Respondents if it is deemed in the County's best interest.

6.3 Although Fort Bend County desires to negotiate toward a contract with a selected Respondent, the Commissioners' Court may award the contract on the basis of the initial proposals received, without discussions. Therefore, each initial proposal should contain the Respondent's best terms.

7.0 INTERPRETATIONS, DISCREPANCIES, AND OMISSIONS:

7.1 It is incumbent upon each potential Respondent to carefully examine these specifications, terms, and conditions. Should any potential Respondent find discrepancies, omissions or ambiguities in this Proposal, the Respondent shall at

once request in writing an interpretation from the County's Proposal Contact. Any inquiries, suggestions, or requests concerning interpretation, clarification or additional information shall be made in writing via e-mail only to the County's Proposal Contact, as specified in Section 3.0. Deadline for submission of questions and/or clarification is **Tuesday, March 19, 2024 at 10:00 AM. (CST).** Requests received after the deadline will not be responded to due to the time constraints of this Proposal process.

7.2 The issuance of a written addendum is the only official method by which interpretation, clarification or additional information will be given by the County. Only questions answered by formal written addenda will be binding. Oral and other interpretations or clarification will be without legal effect. If it becomes necessary to revise or amend any part of this Proposal, notice will be given by the County Purchasing Agent to all prospective Respondents who were sent a Proposal. The Respondent in their proposal shall acknowledge receipts of amendments. Each Respondent shall ensure that they have received all addenda and amendments to this Proposal before submitting their proposals.

8.0 TENTATIVE SCHEDULE:

Release of RFP:	March 3, 2024
Pre-RFP conference:	March 12, 2024
Deadline for Questions:	March 19, 2024
Submission Due Date:	March 26, 2024
Evaluation of Submissions:	Week of March 31st
Commissioners Court Permission to Negotiate:	April 23, 2024
Negotiations:	Beginning April 24, 2024
Final Contract Approval Commissioners Court:	May 28, 2024

9.0 PRE-RFP CONFERENCE:

A Pre-RFP conference will be conducted on **Tuesday, March 12, 2024 at 9:00 AM** (central). The pre-RFP conference will be held at the Fort Bend County Purchasing Department located in the Travis Annex at 301 Jackson, Suite 201, Richmond, Texas 77469. All vendors are encouraged to attend. A site visit will be conducted after the conference, if necessary.

10.0 RETENTION OF RESPONDENT'S MATERIAL:

The County reserves the right to retain all proposals regardless of which response is selected. All proposals and accompanying documents become the property of the County.

11.0 CERTIFICATE OF INDEPENDENT PRICE DETERMINATION:

By submission of a proposal, each Respondent certifies, that in connection with this procurement:

11.1 The prices in this proposal have been arrived at independently, without consultation, communication, or agreement with any other Respondent; with any competitor; or with any County employee(s) or consultant(s) for the purpose of restricting competition on any matter relating to this Proposal.

11.2 Unless otherwise required by law, the prices which have been quoted in this proposal have not been knowingly disclosed by the Respondent and will not knowingly be disclosed by the Respondent prior to award directly or indirectly to ny other Respondent or to any competitor; and;

11.3 No attempt has been made or will be made by the Respondent to induce any other person or firm to submit or not to submit a proposal for the purpose of restricting competition.

12.0 ASSIGNMENT:

The Respondent may not sell, assign, transfer or convey the contract resulting from this Proposal, in whole or in part, without the prior written approval from Fort Bend County Commissioners' Court.

13.0 CONFIDENTIAL MATTERS:

13.1 All data and information gathered by the Respondent and its agents, including this Proposal and all reports, recommendations, specifications, and data shall be treated by the Respondent and it's agents as confidential. The Respondent and it's agents shall not disclose or communicate the aforesaid matters to a third party or use them in advertising, publicity, propaganda, and/or in another job or jobs, unless written consent is obtained from the County.

13.2 Proposals will only be publicly received and acknowledged only so as to avoid disclosure of the contents to competing Respondents and kept secret during negotiation. However, all proposals shall be open for public inspection after the contract is awarded. Trade secrets and any material that is considered to be confidential information contained in the proposal and identified by Respondent as such will be treated as confidential to the extent allowable in the Open Records Act.

14.0 LIMITS OF SUBCONTRACTORS:

14.1 The County has approval rights over the use and/or removal of all subcontractors and/or vendor(s). Subcontractors shall conform to all County policies.

14.2 Any dispute between the Respondent and subcontractors, including any payment dispute, will be promptly remedied by the Respondent. Failure to promptly remedy or to make prompt payment to subcontractor may result in the

withholding of funds from the Respondent by the County for any payments owed to the subcontractor.

15.0 JURISDICTION, VENUE, CHOICE OF LAW:

This Proposal and any contract resulting there from shall be governed by and construed according to the laws of the State of Texas. Should any portion of any contract be in conflict with the laws of the State of Texas, the State laws shall invalidate only that portion. The remaining portion of the contract(s) shall remain in effect. Any lawsuit shall be governed by Texas law and Fort Bend County, Texas shall be the venue for any action or proceeding that may be brought or arise out of, in connection with or by reason of this Proposal process and resulting Agreements.

16.0 INDEPENDENT CONTRACTOR:

The Respondent is an independent contractor and no employee or agent of the Respondent shall be deemed for any reason to be an employee or agent of the County.

17.0 AMERICANS WITH DISABILITIES ACT (ADA)

Proposals shall comply with all federal, state, county, and local laws concerning this type of products/service/equipment/project and the fulfillment of all ADA requirements.

18.0 DRUG-FREE WORKPLACE:

All Respondents shall provide any and all notices as may be required under the Drug-Free Workplace Act of 1988, 28 CFR Part 67, Subpart F, to their employees and all sub-contractors to insure that the County maintains a drug-free workplace.

19.0 PERFORMANCE AND PAYMENT BOND:

The Respondent shall post with Fort Bend County, not later than ten (10) days of the County's award of a contract, a performance and payment bond in the amount of one hundred percent (100%) of the total lump sum price in such form as is satisfactory by County. This bond shall be executed by a corporate surety company duly authorized and admitted to do business in the State of Texas and licensed to issue such a bond in the State of Texas. The Respondent shall notify its corporate surety of any contract changes.

20.0 POWER OF ATTORNEY:

An attorney-in-fact who signs a bid bond, performance bond or payment bond must file with each bond a certified and effectively dated copy of his or her power of attorney.

21.0 TEXAS ETHICS COMMISSION FORM 1295:

21.1 Effective January 1, 2016 all contracts executed by Commissioners Court, regardless of the dollar amount, will require completion of Form 1295 "Certificate of Interested Parties", per the new Government Code Statute §2252.908. All firms submitting a response to a formal Bid, RFP, SOQ or any contracts, contract amendments, renewals or change orders are required to complete the Form 1295 online through the State of Texas Ethics Commission website. Please visit: https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm.

21.2 On-line instructions:

21.2.1 Name of governmental entity is to read: Fort Bend County.

21.2.2 Identification number use: RFP 24-045

21.2.3 Description is: Construction of Fresno Community Center

21.3 Apparent low bidder(s) will be required to provide the Form 1295 within three (3) calendar days from notification; however, if your company is publicly traded you are not required to complete this form.

22.0 INSURANCE:

22.1 All respondents shall submit, with RFP, a current certificate of insurance indicating coverage in the amounts stated below. In lieu of submitting a certificate of insurance, respondents may submit, with RFP, a notarized statement from an Insurance company, authorized to conduct business in the State of Texas, and acceptable to Fort Bend County, guaranteeing the issuance of an insurance policy, with the coverage stated below, to the firm named therein, if successful, upon award of this Contract.

22.2 At contract execution, contractor shall furnish County with properly executed certificates of insurance, which shall evidence all insurance required and provide that such insurance shall not be canceled, except on 30 days prior written notice to County. Contractor shall provide certified copies of insurance endorsements and/or policies if requested by County. Contractor shall maintain such insurance coverage from the time Services commence until Services are completed and provide replacement certificates, policies and/or endorsements for any such insurance expiring prior to completion of Services. Contractor shall obtain such insurance written on an Occurrence form (or a Claims Made form for Professional Liability insurance) from such companies having Best's rating of A/VII or better, licensed or approved to transact business in the State of Texas, and shall obtain such insurance of the following types and minimum limits:

22.2.1 Workers' Compensation insurance. Substitutes to genuine Workers' Compensation Insurance will not be allowed.

22.2.2 Employers' Liability insurance with limits of not less than $1,000,000 per injury by accident, $1,000,000 per injury by disease, and $1,000,000 per bodily injury by disease.

22.2.3 Commercial general liability insurance with a limit of not less than $1,000,000 each occurrence and $2,000,000 in the annual aggregate. Policy shall cover liability for bodily injury, personal injury, and property damage and products/completed operations arising out of the business operations of the policyholder.

22.2.4 Business Automobile Liability coverage with a combined Bodily Injury/Property Damage limit of not less than $1,000,000 each accident. The policy shall cover liability arising from the operation of licensed vehicles by policyholder.

22.3 County and the members of Commissioners Court shall be named as additional insured to all required coverage except for Workers' Compensation and Professional Liability (if required). All Liability policies including Workers' Compensation written on behalf of contractor, excluding Professional Liability, shall contain a waiver of subrogation in favor of County and members of Commissioners Court.

22.4 If required coverage is written on a claims-made basis, contractor warrants that any retroactive date applicable to coverage under the policy precedes the effective date of the contract; and that continuous coverage will be maintained or an extended discovery period will be exercised for a period of two (2) years beginning from the time that work under the agreement is completed.

22.5 Builder's Risk Insurance: Contractor is required to provide proof before a Purchase Order is issued for this project and keep in full force and effect until the Transfer Date, Builders Risk Insurance, subject to policy terms and conditions, of direct physical loss or damage to property, materials, equipment and supplies which are to become an integral part of the Project, whether owned by Contractor, or subcontractors of every tier, and in which one or more of same has an insurable interest, while in transit, while at the Construction Site awaiting construction, during construction, and until the Transfer Date. Such insurance shall be maintained to cover, as nearly as practicable, the insurable value of such property, materials, equipment and supplies at risk, and shall contain a waiver of subrogation in favor of Contractor, Architect, subcontractors of any tier and Owner for loss or damage occurring during the Work and shall name Contractor as the named insured and Owner as additional insureds. All Builder's Risk Insurance proceeds shall be paid directly to the Contractor.

23.0 INDEMNIFICATION:

Respondent shall save harmless County from and against all claims, liability, and expenses, including reasonable attorney's fees, arising from activities of Respondent, its agents, servants or employees, performed under this agreement that result from the negligent act, error, or omission of Respondent or any of Respondent's agents, servants or employees.

23.1 Respondent shall timely report all such matters to Fort Bend County and shall, upon the receipt of any such claim, demand, suit, action, proceeding, lien or judgment, not later than the fifteenth day of each month; provide Fort Bend County with a written report on each such matter, setting forth the status of each matter, the schedule or planned proceedings with respect to each matter and the cooperation or assistance, if any, of Fort Bend County required by Respondent in the defense of each matter.

23.2 Respondent's duty to defend, indemnify and hold Fort Bend County harmless shall be absolute. It shall not abate or end by reason of the expiration or termination of any contract unless otherwise agreed by Fort Bend County in writing. The provisions of this section shall survive the termination of the contract and shall remain in full force and effect with respect to all such matters no matter when they arise.

23.3 In the event of any dispute between the parties as to whether a claim, demand, suit, action, proceeding, lien or judgment appears to have been caused by or appears to have arisen out of or in connection with acts or omissions of Respondent, Respondent shall never-the-less fully defend such claim, demand, suit, action, proceeding, lien or judgment until and unless there is a determination by a court of competent jurisdiction that the acts and omissions of Respondent are not at issue in the matter.

23.4 Respondent's indemnification shall cover, and Respondent agrees to indemnify Fort Bend County, in the event Fort Bend County is found to have been negligent for having selected Respondent to perform the work described in this request.

23.5 The provision by Respondent of insurance shall not limit the liability of Respondent under an agreement.

23.6 Respondent shall cause all trade contractors and any other contractor who may have a contract to perform construction or installation work in the area where work will be performed under this request, to agree to indemnify Fort Bend County and to hold it harmless from all claims for bodily injury and property damage that arise may from said Respondent's operations. Such provisions shall be in form satisfactory to Fort Bend County.

23.7 Loss Deduction Clause - Fort Bend County shall be exempt from, and in no way liable for, any sums of money which may represent a deductible in any insurance policy. The payment of deductibles shall be the sole responsibility of Respondent

and/or trade contractor providing such insurance.

24.0 PREVAILING WAGES:

This project is subject to the prevailing wage rate requirements of Chapter 2258 of the Government Code. All persons employed by Contractor shall be compensated at not less than the rates shown below. Contractor shall keep detailed records of each of its workers and said records shall be made available to County for inspection at all reasonable times. The Contractor shall pay Fort Bend County sixty dollars ($60.00) for each worker employed by the Contractor for the provision of services described herein for each calendar day or part of the day that the worker is paid less than the below stated rates. Contractors may also visit www.wdol.gov/dba.aspx.

General Decision Number: TX20240247 01/05/2024
Superseded General Decision Number: TX20230247

State: Texas
Construction Type: Building

County: Fort Bend County in Texas.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022: Executive Order 14026 generally applies to the contract. The contractor must pay all covered workers at least $17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.

If the contract was awarded on|or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January|30, 2022: Executive Order 13658 generally applies to the contract. The contractor must pay all covered workers at least $12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/05/2024

	Rates	Fringes
ASBE0022-009 07/03/2023		
ASBESTOS WORKER/HEAT & FROST INSULATOR (Duct, Pipe and Mechanical System Insulation)	$ 28.35	16.02
BOIL0074-003 07/01/2023		
BOILERMAKER	$ 37.00	24.64
CARP0551-008 04/01/2021		
CARPENTER (Excludes Acoustical Ceiling Installation, Drywall Hanging, Form Work and Metal Stud Installation)	$ 25.86	9.08
ELEC0716-005 08/29/2023		
ELECTRICIAN (Excludes Low Voltage Wiring and Installation of Alarms)	$ 34.50	10.41
ELEV0031-003 01/01/2023		
ELEVATOR MECHANIC	$ 49.15	37.335+a+b

FOOTNOTES:

A. 6% under 5 years based on regular hourly rate for all hours worked. 8% over 5 years based on regular hourly rate for all hours worked.

B. Holidays: New Year's Day; Memorial Day; Independence Day; Labor Day; Thanksgiving Day; Friday after Thanksgiving Day; Christmas Day; and Veterans Day.

ENGI0450-002 04/01/2014		
POWER EQUIPMENT OPERATOR		
Cranes	$ 34.85	9.85
IRON0084-002 06/01/2023		

IRONWORKER (ORNAMENTAL AND STRUCTURAL)	$ 27.51	8.13
PLAS0783-001 04/01/2023		
PLASTERER	$ 31.34	10.30
PLUM0068-002 10/01/2023		
PLUMBER	$ 34.86	11.68
PLUM0211-010 10/01/2023		
PIPEFITTER (Including HVAC Pipe Installation)	$ 38.31	12.61
SHEE0054-003 04/01/2020		
SHEET METAL WORKER (Excludes HVAC Duct and Unit Installation)	$ 29.70	13.85
SUTX2014-023 07/21/2014		
ACOUSTICAL CEILING MECHANIC	$ 16.41 **	3.98
BRICKLAYER	$ 19.86	0.00
CAULKER	$ 15.36 **	0.00
CEMENT MASON/CONCRETE FINISHER	$ 13.82 **	0.00
DRYWALL FINISHER/TAPER	$ 16.30 **	3.71
DRYWALL HANGER AND METAL STUD INSTALLER	$ 17.45	3.96
ELECTRICIAN (Alarm Installation Only)	$ 17.97	3.37
ELECTRICIAN (Low Voltage Wiring Only)	$ 18.00	1.68
FLOOR LAYER: Carpet	$ 20.00	0.00
FORM WORKER	$ 11.87 **	0.00
GLAZIER	$ 19.12	4.41
INSULATOR – BATT	$ 14.87 **	0.73
IRONWORKER, REINFORCING	$ 12.10 **	0.00

LABORER: Common or General	$ 10.79 **	0.00
LABORER: Mason Tender – Brick	$ 13.37 **	0.00
LABORER: Mason Tender - Cement/Concrete	$ 10.50 **	0.00
LABORER: Pipelayer	$ 12.94 **	0.00
LABORER: Roof Tearoff	$ 11.28 **	0.00
LABORER: Landscape and Irrigation	$ 9.49 **	0.00
LATHER	$ 19.73	0.00
OPERATOR: Backhoe/Excavator/Trackhoe	$ 14.10 **	0.00
OPERATOR: Bobcat/Skid Steer/Skid Loader	$ 13.93 **	0.00
OPERATOR: Bulldozer	$ 20.77	0.00
OPERATOR: Drill	$ 16.22 **	0.34
OPERATOR: Forklift	$ 15.64 **	0.00
OPERATOR: Grader/Blade	$ 13.37 **	0.00
OPERATOR: Loader	$ 13.55 **	0.94
OPERATOR: Mechanic	$ 17.52	3.33
OPERATOR: Paver (Asphalt, Aggregate, and Concrete)	$ 16.03 **	0.00
OPERATOR: Roller	$ 16.00 **	0.00
PAINTER (Brush, Roller and Spray), Excludes Drywall Finishing/Taping	$ 16.77 **	4.51
ROOFER	$ 15.40 **	0.00
SHEET METAL WORKER (HVAC Duct Installation Only)	$ 17.81	2.64
SHEET METAL WORKER (HVAC Unit Installation Only)	$ 16.00 **	1.61
SPRINKLER FITTER (Fire Sprinklers)	$ 22.17	9.70

TILE FINISHER	$ 12.00 **	0.00
TILE SETTER	$ 16.17 **	0.00
TRUCK DRIVER: 1/Single Axle Truck	$ 14.95 **	5.23
TRUCK DRIVER: Dump Truck	$ 12.39 **	1.18
TRUCK DRIVER: Flatbed Truck	$ 19.65	8.57
TRUCK DRIVER: Semi-Trailer Truck	$ 12.50 **	0.00
TRUCK DRIVER: Water Truck	$ 12.00 **	4.11
WATERPROOFER	$ 14.39 **	0.00

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($17.20) or 13658 ($12.90). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate

whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.
Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:
* an existing published wage determination

* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

25.0 PERMITS:

It shall be the sole responsibility of the successful Respondent to obtain any required permits in the name of Fort Bend County.

26.0 TAX EXEMPT:

Fort Bend County is exempt from state and local sales and use taxes under Section 151.309 of the Texas Tax Code. This project will be deemed a separate project for Texas tax purposes, and as such, Fort Bend County hereby issues its Texas Exemption for the purchase of any items qualifying for exemption under this project. Respondent is to issue its Texas Resale Certificate to vendors and subcontractors for such items qualifying for this exemption, and further, Respondent should state these items at cost.

27.0 NAME BRANDS:

Name Brands: Specifications may reference name brands and model numbers. It is not the intent of Fort Bend County to restrict these bids in such cases, but to establish a desired quality level of merchandise or to meet a pre-established standard due to like existing items. Bidders may offer items of equal stature and the burden of proof of such stature rests with them. Fort Bend County shall act as sole judge in determining equality and acceptability of products offered.

28.0 EVALUATION CRITERIA:

In order to facilitate the analysis of responses to this Proposal, Respondents are required to prepare their proposals in accordance with the instructions outlined in this part. Proposals should be prepared as simply as possible and provide a straightforward, concise description of the Respondent's capabilities to satisfy the requirements of the Proposal. Emphasis should be concentrated on accuracy, completeness, and clarity of content. All parts, pages, figures, and tables should be numbered and clearly labeled.

28.1 Respondents are required to follow the outline below when preparing their proposals:

Tab	Title
	Title Page
	Letter of Transmittal
	Table of Contents
	Executive Summary
1	Cost
2	Understanding Scope of Work
3	Firm's Experience
4	Staff Experience
5	Proposed Schedule
6	Overall Completeness of Proposal

28.2 Any exceptions to the Proposal requirements shall be identified in the applicable section.

28.3 Executive Summary - This part of the response to the Proposal should be limited to a brief narrative highlighting the Respondent's proposal. This section should not include cost quotations. Note that the executive summary should identify the primary contacts for the Respondent.

28.4 Respondents will be evaluated utilizing the factors, as weighted below:

Tab 1

Cost (weight factor = 45%)

- Complete Exhibit I.

Tab 2

Understanding Scope of Work (weight factor = 15%)

- Respondents must express, in detail, their understanding of this specific project. In addition, describe how the project requested will be provided and managed. Describe the approach your firm will take to the required collaboration, scheduling and coordination required for this project.

Tab 3

Firm's Experience (weight factor = 15%)

- Firm Experience with Projects of Similar Size and Complexity: Such experience must be in the form of providing general contracting services for similar facilities. List a minimum of three (3) similar projects completed within the last ten (10) years; provide the name and location of each project, detailed description of project, completion date, final cost, the client, and a contact person and phone number.

Tab 4

Staff Experience (weight factor = 10%)

- Staff Experience with Projects of Similar Size and Complexity: Such experience must be in the form of providing project management and construction services for similar facilities. List a minimum of three (3) similar projects completed within the last ten (10) years; provide the name and location of each project, the client, and a contact person and phone number and completion date. In addition, provide resumes for project superintendent and project manager who will be assigned to this project.

Tab 5

Proposed Schedule (weight factor = 10%)

- Provide project schedule.

Tab 6

Overall Completeness of Proposal (weight factor = 5%)

- Required Proof of Insurance
- Completed Respondent forms
- Completed W9 form
- Completed debt form
- Completed Contractor Acknowledgement of Stormwater Management Program form

29.0 AWARD:

The County will select the respondent whose proposal is the highest evaluated and responsible for the County. Contractual commitments are contingent upon the availability of funds, as evidenced by the issuance of a purchase order. All contracts are subject to the approval of the County's legal counsel and Commissioners' Court, prior to execution. Once awarded, the contract will be the final expression of the agreement between the parties and may not be altered, changed, or amended except by mutual agreement, in writing.

30.0 RETAINAGE:

Within thirty (30) days after receipt of each uncontested Application for Payment together with the supporting materials required, County shall advance to Contractor the uncontested amount requested in such uncontested Application for Payment, except *five* percent (5%) of the amount requested (hereinafter "Retainage") in each Application for Payment by County. The Retainage withheld shall be released upon final completion of the entire Project and verification of satisfactory work performed, unless grounds exist for withholding payment on account of other defaults by Contractor, including services provided by its sub-contractors.

31.0 LIQUIDATED DAMAGES:

If the Services are not substantially completed within the time for performance or within such additional time as may be extended by County, County will deduct from the final payment as liquidated damages and not as a penalty the sum of two hundred and fifty ($250.00) per calendar day that the Services are not substantially complete. Such sum is agreed upon as a reasonable and proper measure of the damages County will sustain.

32. STATE LAW REQUIREMENTS FOR CONTRACTS:

The contents of this section are required by Texas Law and are included by County regardless of content.

32.1 Agreement to Not Boycott Israel Chapter 2271 Texas Government Code: Contractor verifies that if Contractor employs ten (10) or more full-time employees and this Agreement has a value of $100,000 or more, Contractor does not boycott Israel and will not boycott Israel during the term of this Agreement.

32.2 Texas Government Code Section 2251.152 Acknowledgment: By signature on vendor form, Contractor represents pursuant to Section 2252.152 of the Texas Government Code, that Contractor is not listed on the website of the Comptroller of the State of Texas concerning the listing of companies that are identified under Section 806.051, Section 807.051 or Section 2253.153.

33.0 HUMAN TRAFFICKING:

By acceptance of this contract, Contractor acknowledges that Fort Bend County is opposed to human trafficking and that no County funds will be used in support of services or activities that violate human trafficking laws.

34.0 REQUIRED FORMS:

All respondents submitting are required to complete the attached and return with submission:

34.1 Vendor Form

34.2 W9 Form

34.3 Tax Form/Debt/Residence Certification

34.4 Contractor Acknowledgement of Stormwater Management Program

35.0 EXHIBIT:

Exhibit I: Pricing

Exhibit II: Project Manual

Exhibit III: Plans

Form **W-9**
(Rev. December 2014)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

Give Form to the requester. Do not send to the IRS.

Print or type
See **Specific Instructions** on page 2.

1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.

2 Business name/disregarded entity name, if different from above

3 Check appropriate box for federal tax classification; check only **one** of the following seven boxes:

☐ Individual/sole proprietor or single-member LLC ☐ C Corporation ☐ S Corporation ☐ Partnership ☐ Trust/estate

☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=partnership) ▶ _____

Note. For a single-member LLC that is disregarded, do not check LLC; check the appropriate box in the line above for the tax classification of the single-member owner.

☐ Other (see instructions) ▶

4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3):

Exempt payee code (if any) _____

Exemption from FATCA reporting code (if any) _____

(Applies to accounts maintained outside the U.S.)

5 Address (number, street, and apt. or suite no.)

Requester's name and address (optional)

6 City, state, and ZIP code

7 List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the Part I instructions on page 3. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN* on page 3.

Note. If the account is in more than one name, see the instructions for line 1 and the chart on page 4 for guidelines on whose number to enter.

Social security number

			–		–				

or

Employer identification number

		–							

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and
3. I am a U.S. citizen or other U.S. person (defined below); and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions on page 3.

Sign Here	**Signature of U.S. person ▶**	**Date ▶**

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. Information about developments affecting Form W-9 (such as legislation enacted after we release it) is at *www.irs.gov/fw9*.

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following:

- Form 1099-INT (interest earned or paid)
- Form 1099-DIV (dividends, including those from stocks or mutual funds)
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
- Form 1099-S (proceeds from real estate transactions)
- Form 1099-K (merchant card and third party network transactions)
- Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
- Form 1099-C (canceled debt)
- Form 1099-A (acquisition or abandonment of secured property)

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.

If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See *What is backup withholding?* on page 2.

By signing the filled-out form, you:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),
2. Certify that you are not subject to backup withholding, or
3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income, and
4. Certify that FATCA code(s) entered on this form (if any) indicating that you are exempt from the FATCA reporting, is correct. See *What is FATCA reporting?* on page 2 for further information.

Note. If you are a U.S. person and a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

- An individual who is a U.S. citizen or U.S. resident alien;
- A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States;
- An estate (other than a foreign estate); or
- A domestic trust (as defined in Regulations section 301.7701-7).

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax under section 1446 on any foreign partners' share of effectively connected taxable income from such business. Further, in certain cases where a Form W-9 has not been received, the rules under section 1446 require a partnership to presume that a partner is a foreign person, and pay the section 1446 withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid section 1446 withholding on your share of partnership income.

In the cases below, the following person must give Form W-9 to the partnership for purposes of establishing its U.S. status and avoiding withholding on its allocable share of net income from the partnership conducting a trade or business in the United States:

- In the case of a disregarded entity with a U.S. owner, the U.S. owner of the disregarded entity and not the entity;
- In the case of a grantor trust with a U.S. grantor or other U.S. owner, generally, the U.S. grantor or other U.S. owner of the grantor trust and not the trust; and
- In the case of a U.S. trust (other than a grantor trust), the U.S. trust (other than a grantor trust) and not the beneficiaries of the trust.

Foreign person. If you are a foreign person or the U.S. branch of a foreign bank that has elected to be treated as a U.S. person, do not use Form W-9. Instead, use the appropriate Form W-8 or Form 8233 (see Publication 515, Withholding of Tax on Nonresident Aliens and Foreign Entities).

Nonresident alien who becomes a resident alien. Generally, only a nonresident alien individual may use the terms of a tax treaty to reduce or eliminate U.S. tax on certain types of income. However, most tax treaties contain a provision known as a "saving clause." Exceptions specified in the saving clause may permit an exemption from tax to continue for certain types of income even after the payee has otherwise become a U.S. resident alien for tax purposes.

If you are a U.S. resident alien who is relying on an exception contained in the saving clause of a tax treaty to claim an exemption from U.S. tax on certain types of income, you must attach a statement to Form W-9 that specifies the following five items:

1. The treaty country. Generally, this must be the same treaty under which you claimed exemption from tax as a nonresident alien.

2. The treaty article addressing the income.

3. The article number (or location) in the tax treaty that contains the saving clause and its exceptions.

4. The type and amount of income that qualifies for the exemption from tax.

5. Sufficient facts to justify the exemption from tax under the terms of the treaty article.

Example. Article 20 of the U.S.-China income tax treaty allows an exemption from tax for scholarship income received by a Chinese student temporarily present in the United States. Under U.S. law, this student will become a resident alien for tax purposes if his or her stay in the United States exceeds 5 calendar years. However, paragraph 2 of the first Protocol to the U.S.-China treaty (dated April 30, 1984) allows the provisions of Article 20 to continue to apply even after the Chinese student becomes a resident alien of the United States. A Chinese student who qualifies for this exception (under paragraph 2 of the first protocol) and is relying on this exception to claim an exemption from tax on his or her scholarship or fellowship income would attach to Form W-9 a statement that includes the information described above to support that exemption.

If you are a nonresident alien or a foreign entity, give the requester the appropriate completed Form W-8 or Form 8233.

Backup Withholding

What is backup withholding? Persons making certain payments to you must under certain conditions withhold and pay to the IRS 28% of such payments. This is called "backup withholding." Payments that may be subject to backup withholding include interest, tax-exempt interest, dividends, broker and barter exchange transactions, rents, royalties, nonemployee pay, payments made in settlement of payment card and third party network transactions, and certain payments from fishing boat operators. Real estate transactions are not subject to backup withholding.

You will not be subject to backup withholding on payments you receive if you give the requester your correct TIN, make the proper certifications, and report all your taxable interest and dividends on your tax return.

Payments you receive will be subject to backup withholding if:

1. You do not furnish your TIN to the requester,

2. You do not certify your TIN when required (see the Part II instructions on page 3 for details),

3. The IRS tells the requester that you furnished an incorrect TIN,

4. The IRS tells you that you are subject to backup withholding because you did not report all your interest and dividends on your tax return (for reportable interest and dividends only), or

5. You do not certify to the requester that you are not subject to backup withholding under 4 above (for reportable interest and dividend accounts opened after 1983 only).

Certain payees and payments are exempt from backup withholding. See *Exempt payee code* on page 3 and the separate Instructions for the Requester of Form W-9 for more information.

Also see *Special rules for partnerships* above.

What is FATCA reporting?

The Foreign Account Tax Compliance Act (FATCA) requires a participating foreign financial institution to report all United States account holders that are specified United States persons. Certain payees are exempt from FATCA reporting. See *Exemption from FATCA reporting code* on page 3 and the Instructions for the Requester of Form W-9 for more information.

Updating Your Information

You must provide updated information to any person to whom you claimed to be an exempt payee if you are no longer an exempt payee and anticipate receiving reportable payments in the future from this person. For example, you may need to provide updated information if you are a C corporation that elects to be an S corporation, or if you no longer are tax exempt. In addition, you must furnish a new Form W-9 if the name or TIN changes for the account; for example, if the grantor of a grantor trust dies.

Penalties

Failure to furnish TIN. If you fail to furnish your correct TIN to a requester, you are subject to a penalty of $50 for each such failure unless your failure is due to reasonable cause and not to willful neglect.

Civil penalty for false information with respect to withholding. If you make a false statement with no reasonable basis that results in no backup withholding, you are subject to a $500 penalty.

Criminal penalty for falsifying information. Willfully falsifying certifications or affirmations may subject you to criminal penalties including fines and/or imprisonment.

Misuse of TINs. If the requester discloses or uses TINs in violation of federal law, the requester may be subject to civil and criminal penalties.

Specific Instructions

Line 1

You must enter one of the following on this line; **do not** leave this line blank. The name should match the name on your tax return.

If this Form W-9 is for a joint account, list first, and then circle, the name of the person or entity whose number you entered in Part I of Form W-9.

a. **Individual.** Generally, enter the name shown on your tax return. If you have changed your last name without informing the Social Security Administration (SSA) of the name change, enter your first name, the last name as shown on your social security card, and your new last name.

Note. ITIN applicant: Enter your individual name as it was entered on your Form W-7 application, line 1a. This should also be the same as the name you entered on the Form 1040/1040A/1040EZ you filed with your application.

b. **Sole proprietor or single-member LLC.** Enter your individual name as shown on your 1040/1040A/1040EZ on line 1. You may enter your business, trade, or "doing business as" (DBA) name on line 2.

c. **Partnership, LLC that is not a single-member LLC, C Corporation, or S Corporation.** Enter the entity's name as shown on the entity's tax return on line 1 and any business, trade, or DBA name on line 2.

d. **Other entities.** Enter your name as shown on required U.S. federal tax documents on line 1. This name should match the name shown on the charter or other legal document creating the entity. You may enter any business, trade, or DBA name on line 2.

e. **Disregarded entity.** For U.S. federal tax purposes, an entity that is disregarded as an entity separate from its owner is treated as a "disregarded entity." See Regulations section 301.7701-2(c)(2)(iii). Enter the owner's name on line 1. The name of the entity entered on line 1 should never be a disregarded entity. The name on line 1 should be the name shown on the income tax return on which the income should be reported. For example, if a foreign LLC that is treated as a disregarded entity for U.S. federal tax purposes has a single owner that is a U.S. person, the U.S. owner's name is required to be provided on line 1. If the direct owner of the entity is also a disregarded entity, enter the first owner that is not disregarded for federal tax purposes. Enter the disregarded entity's name on line 2, "Business name/disregarded entity name." If the owner of the disregarded entity is a foreign person, the owner must complete an appropriate Form W-8 instead of a Form W-9. This is the case even if the foreign person has a U.S. TIN.

Line 2

If you have a business name, trade name, DBA name, or disregarded entity name, you may enter it on line 2.

Line 3

Check the appropriate box in line 3 for the U.S. federal tax classification of the person whose name is entered on line 1. Check only one box in line 3.

Limited Liability Company (LLC). If the name on line 1 is an LLC treated as a partnership for U.S. federal tax purposes, check the "Limited Liability Company" box and enter "P" in the space provided. If the LLC has filed Form 8832 or 2553 to be taxed as a corporation, check the "Limited Liability Company" box and in the space provided enter "C" for C corporation or "S" for S corporation. If it is a single-member LLC that is a disregarded entity, do not check the "Limited Liability Company" box; instead check the first box in line 3 "Individual/sole proprietor or single-member LLC."

Line 4, Exemptions

If you are exempt from backup withholding and/or FATCA reporting, enter in the appropriate space in line 4 any code(s) that may apply to you.

Exempt payee code.

- Generally, individuals (including sole proprietors) are not exempt from backup withholding.
- Except as provided below, corporations are exempt from backup withholding for certain payments, including interest and dividends.
- Corporations are not exempt from backup withholding for payments made in settlement of payment card or third party network transactions.
- Corporations are not exempt from backup withholding with respect to attorneys' fees or gross proceeds paid to attorneys, and corporations that provide medical or health care services are not exempt with respect to payments reportable on Form 1099-MISC.

The following codes identify payees that are exempt from backup withholding. Enter the appropriate code in the space in line 4.

1—An organization exempt from tax under section 501(a), any IRA, or a custodial account under section 403(b)(7) if the account satisfies the requirements of section 401(f)(2)

2—The United States or any of its agencies or instrumentalities

3—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities

4—A foreign government or any of its political subdivisions, agencies, or instrumentalities

5—A corporation

6—A dealer in securities or commodities required to register in the United States, the District of Columbia, or a U.S. commonwealth or possession

7—A futures commission merchant registered with the Commodity Futures Trading Commission

8—A real estate investment trust

9—An entity registered at all times during the tax year under the Investment Company Act of 1940

10—A common trust fund operated by a bank under section 584(a)

11—A financial institution

12—A middleman known in the investment community as a nominee or custodian

13—A trust exempt from tax under section 664 or described in section 4947

The following chart shows types of payments that may be exempt from backup withholding. The chart applies to the exempt payees listed above, 1 through 13.

IF the payment is for . . .	THEN the payment is exempt for . . .
Interest and dividend payments	All exempt payees except for 7
Broker transactions	Exempt payees 1 through 4 and 6 through 11 and all C corporations. S corporations must not enter an exempt payee code because they are exempt only for sales of noncovered securities acquired prior to 2012.
Barter exchange transactions and patronage dividends	Exempt payees 1 through 4
Payments over $600 required to be reported and direct sales over $5,000[1]	Generally, exempt payees 1 through 5[2]
Payments made in settlement of payment card or third party network transactions	Exempt payees 1 through 4

[1] See Form 1099-MISC, Miscellaneous Income, and its instructions.

[2] However, the following payments made to a corporation and reportable on Form 1099-MISC are not exempt from backup withholding: medical and health care payments, attorneys' fees, gross proceeds paid to an attorney reportable under section 6045(f), and payments for services paid by a federal executive agency.

Exemption from FATCA reporting code. The following codes identify payees that are exempt from reporting under FATCA. These codes apply to persons submitting this form for accounts maintained outside of the United States by certain foreign financial institutions. Therefore, if you are only submitting this form for an account you hold in the United States, you may leave this field blank. Consult with the person requesting this form if you are uncertain if the financial institution is subject to these requirements. A requester may indicate that a code is not required by providing you with a Form W-9 with "Not Applicable" (or any similar indication) written or printed on the line for a FATCA exemption code.

A—An organization exempt from tax under section 501(a) or any individual retirement plan as defined in section 7701(a)(37)

B—The United States or any of its agencies or instrumentalities

C—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities

D—A corporation the stock of which is regularly traded on one or more established securities markets, as described in Regulations section 1.1472-1(c)(1)(i)

E—A corporation that is a member of the same expanded affiliated group as a corporation described in Regulations section 1.1472-1(c)(1)(i)

F—A dealer in securities, commodities, or derivative financial instruments (including notional principal contracts, futures, forwards, and options) that is registered as such under the laws of the United States or any state

G—A real estate investment trust

H—A regulated investment company as defined in section 851 or an entity registered at all times during the tax year under the Investment Company Act of 1940

I—A common trust fund as defined in section 584(a)

J—A bank as defined in section 581

K—A broker

L—A trust exempt from tax under section 664 or described in section 4947(a)(1)

M—A tax exempt trust under a section 403(b) plan or section 457(g) plan

Note. You may wish to consult with the financial institution requesting this form to determine whether the FATCA code and/or exempt payee code should be completed.

Line 5

Enter your address (number, street, and apartment or suite number). This is where the requester of this Form W-9 will mail your information returns.

Line 6

Enter your city, state, and ZIP code.

Part I. Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. If you are a resident alien and you do not have and are not eligible to get an SSN, your TIN is your IRS individual taxpayer identification number (ITIN). Enter it in the social security number box. If you do not have an ITIN, see *How to get a TIN* below.

If you are a sole proprietor and you have an EIN, you may enter either your SSN or EIN. However, the IRS prefers that you use your SSN.

If you are a single-member LLC that is disregarded as an entity separate from its owner (see *Limited Liability Company (LLC)* on this page), enter the owner's SSN (or EIN, if the owner has one). Do not enter the disregarded entity's EIN. If the LLC is classified as a corporation or partnership, enter the entity's EIN.

Note. See the chart on page 4 for further clarification of name and TIN combinations.

How to get a TIN. If you do not have a TIN, apply for one immediately. To apply for an SSN, get Form SS-5, Application for a Social Security Card, from your local SSA office or get this form online at *www.ssa.gov*. You may also get this form by calling 1-800-772-1213. Use Form W-7, Application for IRS Individual Taxpayer Identification Number, to apply for an ITIN, or Form SS-4, Application for Employer Identification Number, to apply for an EIN. You can apply for an EIN online by accessing the IRS website at *www.irs.gov/businesses* and clicking on Employer Identification Number (EIN) under Starting a Business. You can get Forms W-7 and SS-4 from the IRS by visiting IRS.gov or by calling 1-800-TAX-FORM (1-800-829-3676).

If you are asked to complete Form W-9 but do not have a TIN, apply for a TIN and write "Applied For" in the space for the TIN, sign and date the form, and give it to the requester. For interest and dividend payments, and certain payments made with respect to readily tradable instruments, generally you will have 60 days to get a TIN and give it to the requester before you are subject to backup withholding on payments. The 60-day rule does not apply to other types of payments. You will be subject to backup withholding on all such payments until you provide your TIN to the requester.

Note. Entering "Applied For" means that you have already applied for a TIN or that you intend to apply for one soon.

Caution: *A disregarded U.S. entity that has a foreign owner must use the appropriate Form W-8.*

Part II. Certification

To establish to the withholding agent that you are a U.S. person, or resident alien, sign Form W-9. You may be requested to sign by the withholding agent even if items 1, 4, or 5 below indicate otherwise.

For a joint account, only the person whose TIN is shown in Part I should sign (when required). In the case of a disregarded entity, the person identified on line 1 must sign. Exempt payees, see *Exempt payee code* earlier.

Signature requirements. Complete the certification as indicated in items 1 through 5 below.

1. Interest, dividend, and barter exchange accounts opened before 1984 and broker accounts considered active during 1983. You must give your correct TIN, but you do not have to sign the certification.

2. Interest, dividend, broker, and barter exchange accounts opened after 1983 and broker accounts considered inactive during 1983. You must sign the certification or backup withholding will apply. If you are subject to backup withholding and you are merely providing your correct TIN to the requester, you must cross out item 2 in the certification before signing the form.

3. Real estate transactions. You must sign the certification. You may cross out item 2 of the certification.

4. Other payments. You must give your correct TIN, but you do not have to sign the certification unless you have been notified that you have previously given an incorrect TIN. "Other payments" include payments made in the course of the requester's trade or business for rents, royalties, goods (other than bills for merchandise), medical and health care services (including payments to corporations), payments to a nonemployee for services, payments made in settlement of payment card and third party network transactions, payments to certain fishing boat crew members and fishermen, and gross proceeds paid to attorneys (including payments to corporations).

5. Mortgage interest paid by you, acquisition or abandonment of secured property, cancellation of debt, qualified tuition program payments (under section 529), IRA, Coverdell ESA, Archer MSA or HSA contributions or distributions, and pension distributions. You must give your correct TIN, but you do not have to sign the certification.

What Name and Number To Give the Requester

For this type of account:	Give name and SSN of:
1. Individual	The individual
2. Two or more individuals (joint account)	The actual owner of the account or, if combined funds, the first individual on the account[1]
3. Custodian account of a minor (Uniform Gift to Minors Act)	The minor[2]
4. a. The usual revocable savings trust (grantor is also trustee) b. So-called trust account that is not a legal or valid trust under state law	The grantor-trustee[1] The actual owner[1]
5. Sole proprietorship or disregarded entity owned by an individual	The owner[3]
6. Grantor trust filing under Optional Form 1099 Filing Method 1 (see Regulations section 1.671-4(b)(2)(i)(A))	The grantor*
For this type of account:	**Give name and EIN of:**
7. Disregarded entity not owned by an individual	The owner
8. A valid trust, estate, or pension trust	Legal entity[4]
9. Corporation or LLC electing corporate status on Form 8832 or Form 2553	The corporation
10. Association, club, religious, charitable, educational, or other tax-exempt organization	The organization
11. Partnership or multi-member LLC	The partnership
12. A broker or registered nominee	The broker or nominee
13. Account with the Department of Agriculture in the name of a public entity (such as a state or local government, school district, or prison) that receives agricultural program payments	The public entity
14. Grantor trust filing under the Form 1041 Filing Method or the Optional Form 1099 Filing Method 2 (see Regulations section 1.671-4(b)(2)(i)(B))	The trust

[1] List first and circle the name of the person whose number you furnish. If only one person on a joint account has an SSN, that person's number must be furnished.

[2] Circle the minor's name and furnish the minor's SSN.

[3] You must show your individual name and you may also enter your business or DBA name on the "Business name/disregarded entity" name line. You may use either your SSN or EIN (if you have one), but the IRS encourages you to use your SSN.

[4] List first and circle the name of the trust, estate, or pension trust. (Do not furnish the TIN of the personal representative or trustee unless the legal entity itself is not designated in the account title.) Also see *Special rules for partnerships* on page 2.

***Note.** Grantor also must provide a Form W-9 to trustee of trust.

Note. If no name is circled when more than one name is listed, the number will be considered to be that of the first name listed.

Secure Your Tax Records from Identity Theft

Identity theft occurs when someone uses your personal information such as your name, SSN, or other identifying information, without your permission, to commit fraud or other crimes. An identity thief may use your SSN to get a job or may file a tax return using your SSN to receive a refund.

To reduce your risk:

- Protect your SSN,
- Ensure your employer is protecting your SSN, and
- Be careful when choosing a tax preparer.

If your tax records are affected by identity theft and you receive a notice from the IRS, respond right away to the name and phone number printed on the IRS notice or letter.

If your tax records are not currently affected by identity theft but you think you are at risk due to a lost or stolen purse or wallet, questionable credit card activity or credit report, contact the IRS Identity Theft Hotline at 1-800-908-4490 or submit Form 14039.

For more information, see Publication 4535, Identity Theft Prevention and Victim Assistance.

Victims of identity theft who are experiencing economic harm or a system problem, or are seeking help in resolving tax problems that have not been resolved through normal channels, may be eligible for Taxpayer Advocate Service (TAS) assistance. You can reach TAS by calling the TAS toll-free case intake line at 1-877-777-4778 or TTY/TDD 1-800-829-4059.

Protect yourself from suspicious emails or phishing schemes. Phishing is the creation and use of email and websites designed to mimic legitimate business emails and websites. The most common act is sending an email to a user falsely claiming to be an established legitimate enterprise in an attempt to scam the user into surrendering private information that will be used for identity theft.

The IRS does not initiate contacts with taxpayers via emails. Also, the IRS does not request personal detailed information through email or ask taxpayers for the PIN numbers, passwords, or similar secret access information for their credit card, bank, or other financial accounts.

If you receive an unsolicited email claiming to be from the IRS, forward this message to *phishing@irs.gov.* You may also report misuse of the IRS name, logo, or other IRS property to the Treasury Inspector General for Tax Administration (TIGTA) at 1-800-366-4484. You can forward suspicious emails to the Federal Trade Commission at: *spam@uce.gov* or contact them at *www.ftc.gov/idtheft* or 1-877-IDTHEFT (1-877-438-4338).

Visit IRS.gov to learn more about identity theft and how to reduce your risk.

Privacy Act Notice

Section 6109 of the Internal Revenue Code requires you to provide your correct TIN to persons (including federal agencies) who are required to file information returns with the IRS to report interest, dividends, or certain other income paid to you; mortgage interest you paid; the acquisition or abandonment of secured property; the cancellation of debt; or contributions you made to an IRA, Archer MSA, or HSA. The person collecting this form uses the information on the form to file information returns with the IRS, reporting the above information. Routine uses of this information include giving it to the Department of Justice for civil and criminal litigation and to cities, states, the District of Columbia, and U.S. commonwealths and possessions for use in administering their laws. The information also may be disclosed to other countries under a treaty, to federal and state agencies to enforce civil and criminal laws, or to federal law enforcement and intelligence agencies to combat terrorism. You must provide your TIN whether or not you are required to file a tax return. Under section 3406, payers must generally withhold a percentage of taxable interest, dividend, and certain other payments to a payee who does not give a TIN to the payer. Certain penalties may also apply for providing false or fraudulent information.

Job No.: _____

TAX FORM/DEBT/ RESIDENCE CERTIFICATION
(for Advertised Projects)

Taxpayer Identification Number (T.I.N.): _____

Company Name submitting Bid/Proposal: _____

Mailing Address: _____

Are you registered to do business in the State of Texas? Yes No

If you are an individual, list the names and addresses of any partnership of which you are a general partner or any assumed name(s) under which you operate your business

_____

_____

I. **Property:** List all taxable property in Fort Bend County owned by you or above partnerships as well as any d/b/a names. Include real and personal property as well as mineral interest accounts. (Use a second sheet of paper if necessary.)

Fort Bend County Tax Acct. No.*	Property address or location**
_____	_____
_____	_____
_____	_____
_____	_____

** This is the property account identification number assigned by the Fort Bend County Appraisal District.*

*** For real property, specify the property address or legal description. For business personal property, specify the address where the property is located. For example, office equipment will normally be at your office, but inventory may be stored at a warehouse or other location.*

II. **Fort Bend County Debt** - Do you owe any debts to Fort Bend County (taxes on properties listed in I above, tickets, fines, tolls, court judgments, etc.)?

Yes No If yes, attach a separate page explaining the debt.

III. **Residence Certification** - Pursuant to Texas Government Code §2252.001 *et seq.*, as amended, Fort Bend County requests Residence Certification. §2252.001 *et seq.* of the Government Code provides some restrictions on the awarding of governmental contracts; pertinent provisions of §2252.001 are stated below:

(3) "Nonresident bidder" refers to a person who is not a resident.

(4) "Resident bidder" refers to a person whose principal place of business is in this state, including a contractor whose ultimate parent company or majority owner has its principal place of business in this state.

I certify that _____ is a Resident Bidder of Texas as defined in Government Code
[Company Name]
§2252.001.

I certify that _____ is a Nonresident Bidder as defined in Government Code
[Company Name]
§2252.001 and our principal place of business is _____.
[City and State]

Mandatory Form

Contractor Acknowledgement of Storm Water Management Program

I hereby acknowledge that I am aware of the stormwater management program and standard operating procedures developed by Fort Bend County in compliance with the TPDES General Permit No. TXR040000. I agree to comply with all applicable best management practices and standard operating procedures while conducting my services for Fort Bend County. I agree to conduct all services in a manner that does not introduce illicit discharges of pollutants to streets, stormwater inlets, drainage ditches or any portion of the drainage system. The following materials and/or pollutant sources must not be discharged to the drainage system as a result of any services provided:

1. Grass clippings, leaves, mulch, rocks, sand, dirt or other waste materials resulting from landscaping activities, (except those materials resulting from ditch mowing or maintenance activities)
2. Herbicides, pesticides and/or fertilizers, (except those intended for aquatic use)
3. Detergents, fuels, solvents, oils and/or lubricants, other equipment and/or vehicle fluids,
4. Other hazardous materials including paints, thinners, chemicals or related waste materials,
5. Uncontrolled dewatering discharges, equipment and/or vehicle wash waters,
6. Sanitary waste, trash, debris, or other waste products
7. Wastewater from wet saw machinery,
8. Other pollutants that degrade water quality or pose a threat to human health or the environment.

Furthermore, I agree to notify Fort Bend County immediately of any issue caused by or identified by:

_____

(Company/Contractor)

that is believed to be an immediate threat to human health or the environment.

_____ _____

Contractor Signature Date

_____

Printed Name

_____

Title

RFP 24-045
Construction of Fresno Community Center

Exhibit I: Pricing

Total Bid

$_____

Calendar days for completion _____

Acknowledgement of Receipt of Addendum(s), if issued by Purchasing, to the Request for Proposal Document.

Addendum No 1 dated _____ Received _____

Addendum No 2 dated _____ Received _____

Addendum No 3 dated _____ Received _____

_____
Name of Respondent

_____
Signature of Authorized Representative

_____
Printed Name of Representative

FORT BEND BOYS AND GIRLS CLUB

PROJECT MANUAL AND SPECIFICATIONS

S&C PROJECT NO. N032023

February 29, 2024

Owner
Fort Bend County
301 Jackson Street
Richmond, TX 77469

Architect
Smith & Company Architects
720 N Post Oak
Suite 124
Houston, TX 77024
Phone: 713-524-4202

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DOCUMENT 003132 - GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.

B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.

C. A geotechnical investigation report for Project, prepared by Associated Testing Laboratories dated July 18, 2023 is available for viewing as appended to this Document.

1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.

END OF DOCUMENT 003132

3143 Yellowstone Blvd., Houston, Texas 77054 Tel: (713) 748-3717 Fax: (713) 748-3748

ATL Project # G23-161

Report
Geotechnical Investigation
Proposed Fort Bend County Fresno Community Center
Corner of W. Sycamore and S. Post Oak
Fort Bend County, Texas

Prepared For

Fort Bend County
Architect, Director of Facilities
Fort Bend County Texas

July 18, 2023

ASSOCIATED TESTING LABORATORIES

3143 Yellowstone Blvd., Houston, Texas 77054
Tel: (713) 748-3717 Fax: (713) 748-3748

July 18, 2023
Project No: G23-161

Mr. James Knight
Architect
Director Of Facilities
Fort Bend County, Texas

Reference: Geotechnical Investigation
Proposed Fort Bend County Fresno Community Center
Corner of W. Sycamore and S. Post Oak
Fort Bend County

Dear Mr. Knight:

Associated Testing Laboratories, Inc. is pleased to present our report for the above referenced project. This report summarizes our investigations, analyses and recommendations for design and construction of the project.

Once you are ready for construction, we will be pleased to assist you in field / laboratory testing of materials and construction inspection.

It has been a pleasure working with you on this project. If you have any question regarding this report, please contact us. We look forward to being of further assistance as construction begins.

Very truly yours,

ASSOCIATED TESTING LABORATORIES, INC.
(TBPE Firm Registration No. F-4560)

Nutan V. Palla

Nutan V Palla, Ph.D., P.E.
Director of Geotechnical Services

Nutan
7-18-23

ASSOCIATED TESTING LABORATORIES

3143 Yellowstone Blvd., Houston, Texas 77054
Tel: (713) 748-3717 Fax: (713) 748-3748

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Introduction

General

This report presents the results of a geotechnical investigation performed by Associated Testing Laboratories, Inc. (ATL) for Fort Bend County. The location of the project site is shown in Figure 1. This report includes ATL's Investigations and geotechnical recommendations for the design and construction of this project.

Project Description

Information for this project was provided by Mr. James Knight, Architect, Director of Facilities, Fort bend County. The proposed Fort Bend County Fresno Community Center building and parking lots is located at Corner of W. Sycamore and S. Post Oak, Fort Bend County, Texas. The project site is currently an open lot with grass and some trees, relatively flat, with topographic variations of about 1 to 2 feet. The site layout is shown below:

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Scope of Work

The purpose of this geotechnical investigation is to explore and evaluate the subsurface conditions for developing geotechnical design and construction recommendations. ATL's scope of services included performing the following tasks:

- Review available geologic and geotechnical data pertinent to the project site.
- Investigate the subsurface conditions by drilling and sampling seven (7) geotechnical borings to depths of approximately 5-ft & 25-ft below the ground surface with a drill rig, in accordance with ASTM Standards.
- Perform geotechnical laboratory tests on selected soil samples obtained from the borings in accordance with ASTM Standards.
- Perform engineering analyses and geologic evaluation.
- Prepare this report containing ATL's investigations and recommendations, which includes following:
  a) Discussion of the surface and subsurface geotechnical conditions and site preparation.
  b) Recommendations for type and depth of foundations for structural support.
  c) Pavement Recommendations
  d) Construction monitoring.

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Field Exploration

The field exploration consisted of drilling and sampling of a total of seven (7), four (4) 25-ft- & three (3) 5-ft deep soil borings, 115 linear feet. The approximate boring locations are shown in Figure 1.

Improvements	Boring Numbers	Total No	Depth (ft)	Total Depth (ft)
Community Center	B-1 & B-4	4	25	100
Parking area	B-5 thru B-7	3	5	15
			Total Depth (ft)	115

The boreholes were drilled and sampled under the observations of our experienced geotechnical engineering technician and performed in accordance with ASTM Standards. The field drilling was performed with a truck-mounted drilling rig and was advanced using dry auger method to 20 feet or until groundwater is encountered. Groundwater levels were observed at the time of drilling.

Soil samples were obtained continuously to a depth of 20-ft. Undisturbed samples of cohesive soils were obtained from the borings by pushing 3.0-inch diameter thin-wall, seamless steel Shelby tube samplers according to ASTM D 1587 requirements.

The undisturbed samples of cohesive soils were extruded mechanically from the Shelby tubes in the field and wrapped in aluminum foil. All soil samples were inspected and classified and sealed in plastic bags to reduce moisture loss and disturbance. The samples were placed in core boxes and transported to the laboratory for further testing. Strength of the cohesive soils are estimated in the field using a hand penetrometer.

Standard Penetration Tests (SPT) were performed in low cohesion (sandy lean clays) and non-plastic (silty sand) soils according to ASTM D 1586 requirements. We recorded the driving resistance while performing the SPT. The samples were placed in sealed bags and delivered to our laboratory.

The boreholes were backfilled with cement-bentonite grout with tremie pipe upon completion of drilling. Subsurface information from the soil boring is presented in the Boring Log in **Appendix A**.

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Laboratory Testing

Laboratory testing were performed on selected representative soil samples collected during the field investigation to measure physical and engineering properties. The types of laboratory tests are shown in the following table.

Type of Test	Testing Method
Natural Water Content	ASTM D 2216
Atterberg Limits	ASTM D 4318
Sieve Analysis No. 200	ASTM D 1140
Unconfined Compression	ASTM D 2166
Soil Classification	ASTM D 2487

Description of the laboratory tests:

- ***Moisture Content of Soil –***. The moisture content of the soil (in percentage) is defined as the ratio of the mass of fluid to the mass of soil solid. The moisture content can provide an indication of cohesive soil plastic state of cohesive soils.

- ***Atterberg Limits (Liquid Limit, Plastic Limit and Plasticity Index).*** These tests are used for soil plasticity (high, low or non) and provide an indication of volume change potential when considered in conjunction with the natural moisture content. The liquid limit and plastic limit establish the boundaries of the consistency states of plastic soils. The difference between the liquid limit and the plastic limit is defined as plastic index.

- ***Sieve Analysis No. 200 (75-μm) Sieve –***. This test measures the total amount of material (in percentage) in soils finer than the No. 200 sieve.

- ***Unconfined Compressive Strength of Cohesive Soil –***. This test measures the unconfined compressive strength of cohesive soils in undisturbed or remolded condition, using strain-controlled deformation under load application. The undrained shear strength of a cohesive soil sample is one-half of the unconfined compressive strength.

The results of the laboratory tests are presented on the test boring logs and the test summary sheets and test reports in Appendix A.

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Subsurface and Site Conditions

Site Geology

The site is underlain by the Beaumont Formation of Pleistocene age. This formation consists of over consolidated clays, silts and sands with some shell calcium carbonate and iron oxides. These formations are quite strong and extend to an approximate depth of 100 feet. The surface materials are often weakened by the weathering process.

There are numerous faults and fault systems in Greater Houston and surrounding areas. The movement of many of these faults has been affected in recent history by area subsidence. The subsidence is caused by removal of oil and ground water. As much as nine feet of subsidence has taken place in the eastern part of Houston in the last seventy years, and more than five feet of that has taken place in the last decade as demand for oil and water has increased. Conversion to surface water usage and the limiting of oil production has greatly reduced the subsidence rate in the east of Houston. However, continued ground water withdrawal in the southwest Houston area makes subsidence and associated faulting a continuing problem in that area.

An investigative fault study is beyond the scope of this study. For a geologic fault risk evaluation of this project site, we recommend consulting a professional geologist knowledgeable in geological faults in the Harris and Montgomery County area.

Soil Shrink and Swell Potential

We performed laboratory tests to provide indications of the soil shrink and swell potential. The results of these tests are shown in Appendix A and summarized in the following table.

Boring	Depth (ft)	Free Swell (%)
B-5	2-4	30
B-6	4-6	20

The table below shows the typical degrees of soil expansion as predicted by the free swell test.

Free Swell (%)	Degree of Expansion
<50	Low
50 to 100	Medium
100 to 200	High
>200	Very high

Based on the laboratory test data, the clay soils below the upper 2 ft to 6 ft have a low potential to shrink and swell with changes in moisture content.

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Soil Chemical Tests

Soil pH, chloride and sulfate ion concentration and electrical resistivity tests were performed on the selected soil samples. The results of these tests are shown in Appendix A and summarized below.

Boring	Depth (ft)	Chloride (ppm)	Sulfate (ppm)	pH	Electrical Resistivity (ohm-cm)
B-5	2-4	57.7	22.3	8.9	4400
B-6	4-6	103	21.1	8.8	1740

It is generally accepted that corrosion of steel is most likely to occur in soils containing chloride ions even in low concentration, low pH and/or low electrical resistivity as presented in the table below.

Electrical Resistivity Measurement (ohm-cm)	Soil pH	Chloride Ion Concentration (ppm)	Corrosion Potential
0 - 1,000	0.0 - 4.5	-	Very High
1,000 - 2,000	4.5 - 5.5	> 500	High
2,000 - 5,000	5.5 - 6.5	< 500	Moderate
> 5,000	> 6.5	-	Mild

On the basis of the soil electric resistivity data, the shallow soils have **moderate to high** potential to attack unprotected steel.

The degradation of concrete is caused by chemical agents in the soil or groundwater that react with concrete to either dissolve the cement paste or precipitate larger compounds which cause cracking and flaking. The concentration of water-soluble sulfates in the soils is a good indicator of the potential for chemical attack of concrete as presented in the following table.

Sulfate Ion Concentration (ppm)	Aggressiveness
> 20,000	Very Severe
2,000 - 20,000	Severe
1,000 - 2,000	Moderate
< 1,000	Mild

Based on the sulfate ion concentration data, the soils have a **mild** potential for attacking concrete.

Site Class

A site class is assigned for seismic design based on the types of soils/rock present and their engineering properties. Site class requirements are provided by the International Building Code (IBC) and the American Society of Civil Engineers (ASCE) Minimum Design Loads for Buildings and Other Structures, ASCE Standard 7-10.

Six site class definitions are provided in Section 1613.5.2 of the 2009 IBC (Classes A through F). The site class definitions are based on the average soil/rock properties to a depth of 100 ft. The test borings and laboratory test data indicate soil characteristics of Site Class D.

Soil Conditions

Four (4) 25-ft & three (3) 5-ft deep borings were drilled within the proposed Community center Building Based on the soil borings drilled, the surface soils in the proposed area consist of a surface stratum of stiff to hard, high to very high plasticity, Fat Clay (CH) soil to a death about 18 feet. These Fat Clay (CH) soils are underlain by non-plastic silty sands to the bottom of boring depth 25 feet. A Sandy Lean Clay (CL) soil was encountered between the depth of 8 to 12 feet at Boring location B-5.

Clay soils with higher plasticity have a considerable shrink/swell potential due to seasonal moisture variations, and often contain slickensides as a result of the shrink/swell movements. A more detailed description of the subsurface soils and stratigraphy may be found on the boring logs in Appendix A.

Groundwater

The test borings were drilled using dry auger methods to obtain free water level measurements. The following table summarizes the depths where groundwater was observed while drilling and the depths after 15 minutes of observations.

Boring No	Boring Depth	Dry Auguring Depth	Ground water Depth		
			While Auguring	After 15 min	EOD Readings
B-1	5	5	Dry	Dry	Dry
B-2	5	5	Dry	Dry	Dry
B-3	25	25	Dry	Dry	Dry
B-4	25	25	Dry	Dry	Dry
B-5	25	25	Dry	Dry	Dry
B-6	25	25	Dry	Dry	Dry
B-7	5	5	Dry	Dry	Dry

Sands and silts, and clay stratum containing considerable lenses/seams/layers of more permeable soils such as silty/clayey sand or sandy silt, can become pathways for water infiltration during rain events

and form perched water. The rate of flow of groundwater produced by these layers will depend upon the weather conditions such as amount of precipitation and ambient temperature etc., at the time of construction. It should also be noted that the groundwater level is generally influenced by such factors as topography and surface drainage features.

It should be noted that a detailed hydro-geological investigation of the proposed project area is beyond the scope of this investigation. Groundwater depths measured during and at completion of drilling are shown on the respective boring logs.

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General Site Preparation Guidelines

Site Preparation

Areas to be cut or filled should be stripped to remove organic materials, and other deleterious materials to expose competent soils. Generally, the depth of stripping should be on the order of 4 in. The stripped materials should not be used as compacted fill. If encountered, loose or wet soils should be undercut and replaced with compacted backfill.

The ground surface should be appropriately graded throughout construction to prevent ponding of rainfall runoff and provide positive drainage.

Proof Rolling

The effective depth of proof rolling will depend on the vehicle weight and tire pressures. We recommend that proof rolling be performed using earthmoving equipment such as loaders and scrapers, compactors, or tracked vehicles.

Proof rolling should extend at least 5 ft beyond the construction limits and should include overlapping perpendicular passes in two directions. The proof rolling specifications should provide for the following acceptance criteria:

Rut depths less than 2 inches
No visual evidence of pumping

A geotechnical representative should be present to observe and document each proof rolling and to delineate areas of weak or compressible soils. Areas that are not in compliance with the proof rolling specifications could require remediation. Remedial options include disking and air drying, application of geogrid reinforcement, and chemical treatment.

Select Fill

For areas such as below floor slabs and below soil supported foundations such as spread footings, the select fill should meet the following specifications.

Item	Specification	Test Reference
soil fines	More than 60% passing No. 200 sieve and less than 85%	ASTM D 1140
plasticity index (PI)	10 to 20	ASTM D 4318
liquid limit	less than 40	ASTM D 4318
classification	CL	ASTM D 2487 & 2488
organic content	less than 4 percent	ASTM D 2974
Compaction	95% of max. Standard Proctor	ASTM D 698
Moisture Content	±2	ASTM D 2216

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The fill should be placed in uniform layers or lifts. Typically, a maximum 8 in. lift thickness (loose measure) is appropriate for most conventional compactors. The fill should be compacted to at least 95 percent of the maximum dry density determined by the Standard Proctor test (ASTM D 698). The water content should be at or above the optimum water content.

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Discussion

Based on our investigation, the soil conditions are considered suitable for supporting light to moderate loads (two story fire station and generator building). We understand that the typical foundation depths will be on the order of 4 ft below existing ground surface to bear on the underlying stiff clays. Foundation should not bear on the upper sands. Depending on the loading conditions (lateral, axial compression, tension, and settlement tolerances), it is anticipated that most equipment will be supported on spread foundations or drilled and underreamed cast-in-place concrete piers.

Foundation excavations should be backfilled with properly compacted on-site soil obtained from the on-site excavations. The backfill should be moisture conditioned at or above optimum moisture content and compacted to at least 95% of the maximum dry density per ASTM D 698 test procedures.

For all of the above systems, positive surface drainage is critical so that surface water does not accumulate adjacent to structures, slabs, or pavements. We recommend a minimum positive slope away from the improvement area of 6 in. in 50 ft for surface drainage. The area around buildings, and sensitive concrete slabs should have an impervious surface to facilitate surface drainage and minimize surface water infiltration.

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Foundation Recommendations

General

The project consists of constructing a new community center building on the project site location. Column and wall loads are not known at this time. ATL assumes that the first-floor elevation will be slightly above the existing grade. Concrete paving may be used for patios and driveways. Anticipated traffic loads will be light. The above criteria are our assumption. However, if there are any variations in the subsurface conditions, we should be notified for further analysis.

Foundation Considerations and Options

Based on Test Method TEX-124-E (1978), we computed a potential vertical rise (PVR) of the upper 10 ft of the existing soil is about 3.7 to 4.3-in. for respective "existing" and "dry" conditions. Possible design schemes to be considered for slab construction include (i) post tensioned concrete slab (ii) structural isolation (grade beams and drilled piers combination), or (iii) construction of the slab on a minimum 5-ft thick select (non-expansive) fill pad, listed in decreasing order of 1-in effectiveness.

Bearing Capacity Slab-On-Grade

A shallow foundation system consisting of an engineered post-tensioned foundation or conventional ribbed and reinforced slab with a perimeter footing and interior thickened sections (grade beams), should be designed according to Post-Tensioning Institute (P.T.I), 3rd edition, 2008. The grade beams should be placed at least 18 inches below the finish grade and designed for net allowable soil bearing pressure of 1500 psf. The net allowable bearing pressure can be increased by 1/3 for transient loads, if allowed by design code.

Post-Tensioned Slab-On-Grade Design (Option 1)

Post-tensioned slab design parameters are provided in the *Design and Construction of Post-Tensioned Slabs-on-Ground, 3rd Edition, with 2008 Supplement* by the Post-Tensioning Institute (PTI). Recommended PTI parameters are based on the predominant soil type, estimated percentage of clay mineral, type of clay mineral composing the soil, suction potential of the soil within the active zone and depth to constant suction for the subject area.

We used computer code VOLFLO 1.5 to estimate the required geotechnical parameters for structural design of post-tensioned slab-on-grade foundations. The soil input parameters required for structural design are presented below. Edge moisture variation distances using a Thornthwaite Moisture Index (I_m) of +18 are presented below.

The following design parameters are based on the recommended slab-on-grade subgrade preparation and 1-ft of compacted select fill in accordance with P.T.I:

Thornwaite Moisture Index	I_m	18
Constant Suction Value	pF	3.5
Moisture Variation, e_m (feet)	Center lift	9.0
	Edge lift	5.6
Estimated Differential Swell, Y_m (inch)	Center lift	1.2.
	Edge lift	1.0

Floor Slabs (Option 2)

This design approach is relatively low risk with regard to the active subgrade. This option involves structural support of the floor slab and grade beams on a drilled pier foundation system. The base of the drilled piers should be located at about 12-ft depth where moisture variation is minimal and shrink-swell movements are greatly reduced.

Structural Isolation: The floor slab is cast on void forms. Void space between the base of the structural slab and underlying graded soil should be at least 6-in.

Conventional: It is recommended to place at least 2-feet of compacted select fill below the building slab-on-grade to provide more uniform, stable and competent foundation support. The select fill stratum should extend at least 5 feet beyond the proposed building perimeter and 5 feet beyond the proposed pavement/parking areas.

Grade Beams

Grade beams used in conjunction with drilled piers should be designed to support the imposed loads and bear directly on the soil. We recommend that grade beams with a minimum depth of 18 in. be placed beneath all exterior and interior load-bearing walls. It is our experience that void boxes below grade beams can deteriorate and provide access for water that can cause soil swelling.

Drilled and Underreamed Cast-in-Place Concrete Piers

Drilled piers should be bottomed at a depth of twelve (12) feet below the existing grade. Drilled piers should be designed for net allowable bearing pressure of 4500 psf. The net allowable bearing pressure can be increased by 1/3 for transient loads, if allowed by design code.

We anticipate the foundation settlement of the drilled piers of the footing size (8-ft x 8-ft) or equivalent area with net sustained load will be less than ½ -in. We need to perform settlement analysis for the footing size larger than 8-ft by 8-ft.

The lateral response of the straight or underream piers will be function to the depth, dimension and shaft diameter, as well as, reinforcing steel and concrete compressive strength. The response will also

be a function of the head conditions (free and fixed) for the underream and the elevation where lateral loads are applied. once final size has be selected, we can perform lateral analysis, if needed.

The ultimate capacity of underreamed footings to resist uplift loads can be determined from the following equation provided the ratio of footing depth to bell diameter:

$$Qu = 5.8 * c * (D^2 - d^2)$$

Where:

Q_u	=	Ultimate uplift capacity, lbs
c	=	Average shear strength above the footing grade, pounds per square foot (Use c = 500 psf)
D	=	Underream diameter, feet
d	=	Shaft diameter, feet

We recommend a minimum factor of safety of 2.0 for uplift capacity in the final design. The depth of the surface crack can be taken as 3-ft if the area adjoining the structure is not paved. Surface cracking can be neglected if paving, or a permanent impervious cover, adjoins the entire structure periphery. A factor of safety of 3 should be used to calculate the allowable uplift resistance. The weight of the foundation can be added to the uplift resistance and can be calculated by using a unit weight of 150 pcf.

The drilled piers should be wide enough for cleaning and inspection purposes. Each pier should be provided with sufficient vertical steel reinforcement extending from the top to within six inches of the bottom of the piers to resist tension stresses created by lateral and uplift forces. To resist uplift forces the underreams should be at least one foot larger than the shaft to serve as an anchor. The drilled footings should be designed with an underream/shaft ratio of up to 3:1.

If material at the belling depth sloughs during underreaming, the problem can usually be alleviated by increasing the belling angle or by increasing the diameter of the shaft portion of the footing. If sloughing persists, it may become necessary to reduce underream to shaft ratio to 2:1 or use straight-sided shafts. For best results, any standing water should be pumped out and footings poured immediately after the excavation is competed.

Construction of Slab on Select Fill (Option 3)

Non expensive select imported fill can be used to provide a minimum 5-foot-thick non-expansive pad beneath and 5-ft beyond the slab. The select fill pad should extend as a minimum 12-in. above site grade for positive surface drainage. The select fill provides a zone that has a low potential for shrink/swell movements between the higher plasticity soils and the floor slab. It is important that moisture content in excess of the optimum moisture content of the cohesive soils be maintained during construction. We estimate the PVR will be on the order of about 1.0-in. with the placement of a minimum 5-foot thick select fill pad.

Utility lines that exit from below the slab should be sealed to prevent migration of moisture through trench excavations. Backfilling of the interior utility trenches with sand is not recommended.

Spread Footings

The individual spread footings should be founded in the stiff to very stiff Fat Clay with Sand (CH) soils at a depth of about 4-ft below the existing ground elevation. The depth of the stiff clays could vary.

The individual spread footings should be designed for an allowable bearing capacity of 3,000 psf total loads. This bearing capacity is based on a minimum safety factor of 3.0. If allowed by the design code, the net allowable bearing pressures can be increased by ⅓ for transient loads. The bearing pressures could be limited by settlement.

We expect the settlement of the footing size (8-ft x 8-ft) or equivalent area with net sustained load (2500 psf) will be about 1-in. We need to perform settlement analysis for the footing size larger than 8-ft by 8-ft.

For best results, the foundation soils after excavation should be tamped using a portable compactor and standing water (if any) should be pumped out and footings poured immediately after the excavation has been made.

The allowable capacity of an individual spread footing to resist net uplift loads can be determined from the following equations, the smaller value of Equation (1) or (2) shall governs:

$$Q_u = 5.8\ c\ (B * L) / FS1 + W_{ftg} / FS2 \quad (1)$$

$$W_{ftg + Soil} = [(B*L) + (B+Z)*(L+Z)] / 2 * Z * 100 / FS2 \quad (2)$$

Where:

	Q_u	=	Allowable uplift capacity, pounds
	C	=	Average shear strength above the footing grade, pounds per square foot. (use c = 250 PSF)
	B	=	Width of individual spread footing, feet.
	L	=	Length of individual spread footing, feet.
	FS1	=	Factor of safety, use 2.0
	W_{ftg}	=	Weight of spread footing, lbs.
	FS2	=	Factor of safety, use 1.1
	$W_{ftg + Soil}$	=	Weight of soil wedge above spread footing and the weight of footing, lbs.

Drilled Shaft Group Effects

Group Capacity: In situations where the design load is too high for a single drilled shaft/pile, drilled shaft/pile groups may be installed. The efficiency of a shaft/pile group is the ratio of the actual group capacity to the sum of the individual shaft axial capacities. The group efficiency factors are shown in Figure 5.

Groups of piles having a center-to-center spacing of less than three (3) diameters should be analyzed for axial group efficiency. We should be contacted to analyze group capacities and settlements once the final pile size, depth loads, and group configurations are selected.

Lateral Response - Pile Group

The single pile lateral capacity is impacted by group effects and reductions in single pile capacities will be necessary for group effects for pile spacing ranging up to approximately 6 diameters.

The lateral group efficiency factor (Ge) is approximately equal to the average value of the Pm values shown below for all piles in the group. For instance, for a 3 by 3 pile group with a center-to-center spacing of 3 diameters, the lateral group efficiency will be about 0.69 [-(0.82 + 0.68 + 0.58)/3].

Recommended Pm Values for Square & Rectangular Pile Layout Patterns

Pile Spacing (center-to-center)	Leading Row	1st Trailing Row	2nd Trailing Row	3rd and Subsequent Trailing Rows
3 Diameters	0.82	0.68	0.58	0.52
4 Diameters	0.90	0.78	0.72	0.68
5 Diameters	0.94	0.89	0.86	0.84
6 Diameters	1.0	1.0	1.0	1.0

When evaluating the lateral capacity of a pile group, the passive resistance and sliding friction against the pile cap can be considered in addition to the lateral capacity of the piling.

We can analyze lateral pile group response to the specific loading case, pile configuration and location using 2-dimensional (2D) routine of the program Group Version 2016 (Ensoft, 2016). The pile response interaction is modeled by the computer internally-generated axial (t-z and q-z) and lateral (p-y) curves based on the input soil parameters. The analysis is performed using internally-generated "cyclic" p-y curves. Lateral group effects are considered by internal routines based on the pile spacing and pile location within the group (i.e., "leading pile" and "trailing" piles). The effects of pile cap embedment are also evaluated.

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Concrete Paving

The pavement designs presented below based on the use of 4,000 PSI Portland cement concrete (PCC) with a Modules of Rupture of about 660 PSI. The following pavement subgrade preparation and stabilization sequence is recommended:

1. Remove existing vegetation and topsoil and excavate to the design grade and proof-roll the pavement subgrade as recommended in the "Site Preparation" section.

2. Once the pavement subgrade has been prepared and graded to the design grade, the top 8 inches of the subgrade soils and should be scarified and treated with about 6 to 8% lime (on weight basis) and compacted at a moisture content within +/- 2 percent of optimum to at least 95 percent of the maximum dry density of the Standard Proctor (ASTM D 698).

The following pavement sizes are recommended:

Light Vehicles	Medium Vehicles	Heavy Vehicles
6" PCC	7" PCC	8" PCC
8" Stabilized Subgrade	8" Stabilized Subgrade	8" Stabilized Subgrade

Note: Typical commercial type traffic is assumed. If high volume heavy truck traffic is anticipated, ATL shall be informed and a pavement design based on the forecast traffic loading and frequency shall be performed.

The pavement designs presented in this report are based on the following load classifications:

Design Loads	Gross Vehicle Weight
Light	6,000 pounds
Medium	10,000 pounds
Heavy	20,000 pounds

Pavement Maintenance

It is essential to maintain the pavement to prevent infiltration of water into the subgrade soils. Allowing water into the subgrade will accelerate pavement failure and maintenance requirements. Periodic maintenance must be performed on the pavement sections to seal any surface cracks and prevent infiltration of water.

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Foundation Construction

Placement of concrete should be accomplished as soon as possible to prevent changes in state of stress and caving of the foundation soils. Excavation/drilling of foundations should be inspected by an ATL representative or soil engineer to help assure the integrity of foundations.

Design Review

It is recommended that ATL be allowed to review the design and construction plans and specifications prior to release to make sure that the geotechnical recommendations and design criteria presented herein have been properly interpreted.

Limitations

Information in this report is based on data obtained from test borings at the locations shown in Figure 1, selected laboratory tests, and professional interpretation and evaluation of such data considering the project information furnished. A description of expansive soils is presented in Appendix B; this appendix also presents the recommendations to properly maintain the foundation.

If the soil conditions change significantly from those discussed in this report, our office should be notified immediately so that an evaluation and any necessary adjustments can be made. Also, if the scope of the project changes significantly, our office should be notified. Analyses of slope stability, bulkhead or any other features at this site are not within the scope of this investigation and, therefore, ATL is not responsible for any problems caused by these features. Also the recommendations given in this report may not be valid if conditions such as leakage of underground pipes, leaking of pools, standing of water occur at the site. ATL is not responsible for any problems caused by these features. This report also does not consider the effect of deep tree roots that may be present on the site.

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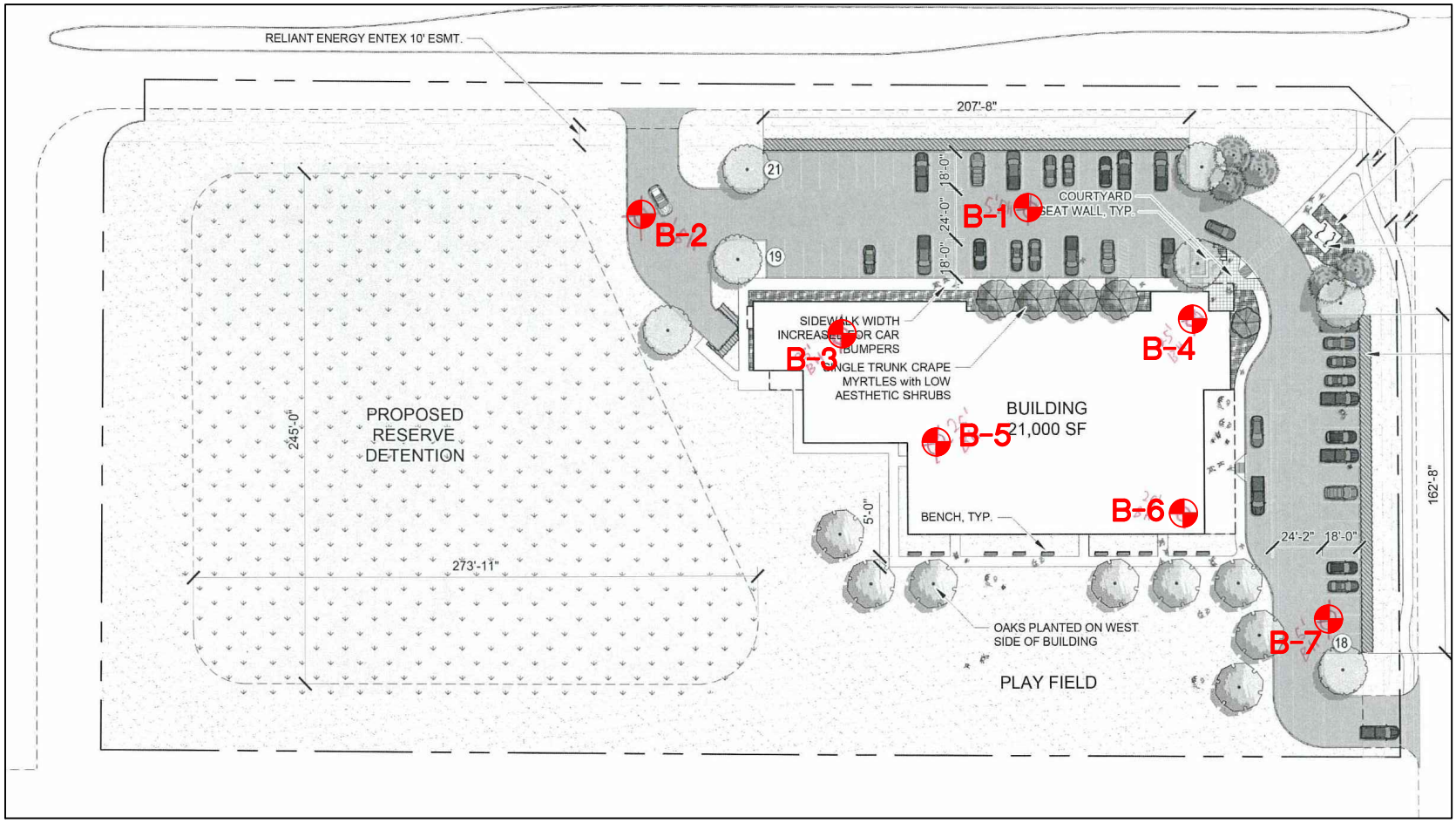
Figures



SITE PLAN

Proposed Fort bend County Fresno Community Center, Corner of W. Sycamore & S. Post Oak Fort Bend County, Texas

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SCALE: N.T.S.	*DRAWN BY: P.J*
PROJECT NO. G23-161	*FIGURE. 1*

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Appendix A

BORING LOG B-1

PROJECT	CLIENT	Project No:
Corner of W. Sycamore and S. Post Oak, Fort Bend County, Tx	Fort Bend County, Director of Facilities, Fort Bend Co, Texas	G23-161

COORDINATES	GROUND WATER		Boring Depth		Start Date/Finish	
ELEVATION	Init Dry	15 min Dry	0	5	7/13/23	07/13/23

Elevation (ft)	Depth	SAMPLE	Symbol	Description	Pocket Penetrometer (tsf)	SPT/THD	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Dry Density (pcf)	UC/UU Compression (tsf)	Failure Strain (%)	% Passing 200	Other Tests
	0			LEAN CLAY WITH SAND (CL), very stiff, high plasticity, dark brown	3.5		14.6	46	17	29				75.5	
				-tan and light gray below 2'	3.5		17.5				112	2.32	10.6		
				-with ferrous nodules below 4'	3.5		17.2	41	16	25	111	2.78	14.1	73.5	
	5														
	10														
	15														
	20														
	25														
	30														

Note:

Driller: Ace GeoDrilling

Logger: Manuel & Daniel

BORING LOG B-2

PROJECT	CLIENT	Project No:
Corner of W. Sycamore and S. Post Oak, Fort Bend County, Tx	Fort Bend County, Director of Facilities, Fort Bend Co, Texas	G23-161

COORDINATES	GROUND WATER		Boring Depth		Start Date/Finish	
ELEVATION	Init Dry	15 min Dry	0	5	7/13/23	07/13/23

Elevation (fT)	Depth	SAMPLE	Symbol	Description	Pocket Penetrometer (tsf)	SPT/THD	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Dry Density (pcf)	UC/UU Compression (tsf)	Failure Strain (%)	% Passing 200	Other Tests
	0			LEAN CLAY WITH SAND (CL), very stiff, high plasticity, light gray and tan	3.5		22.2	49	17	32				73.9	
				FAT CLAY WITH SAND (CH), stiff to very stiff, highplasticity, light gray and tan	3.5		21.4	57	19	38	106	1.84	15.0	73.6	
	5			-with ferrous nodules below 4'	3.5		21.8				105	2.24	14.4		
	10														
	15														
	20														
	25														
	30														

Note:

Driller: Ace GeoDrilling

Logger: Manuel & Daniel

BORING LOG B-3

PROJECT	CLIENT		
Corner of W. Sycamore and S. Post Oak, Fort Bend County, Tx	Fort Bend County, Director of Facilities, Fort Bend Co, Texas	Project No:	**G23-161**
COORDINATES	GROUND WATER	Boring Depth	Start Date/Finish
ELEVATION	Init: Dry / 15 min: Dry	0 / 25	7/13/23 / 07/13/23

Elevation (ft)	Depth	SAMPLE	Symbol	Description	Pocket Penetrometer (tsf)	SPT/THD	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Dry Density (pcf)	UC/UU Compression (tsf)	Failure Strain (%)	% Passing 200	Other Tests
	0			FA CLAY WITHSAND (CH), stiff to very stiff, high to very high plasticity, dark gray	3.5		19.9	69	19	50				73.7	
				-light gray and tan below 2'	3.5		21.3								
					3.5		22.4	78	18	60				82.0	
	5			-with ferrous nodules below 6'	3.5		19.0								
				-with calcareous nodules below 8'	3.5		19.0	57	18	39	104	2.45	15.0	82.9	
	10				2.0		20.5				107	2.62	11.4		
					3.5		20.3	60	19	41	104	2.21	7.6	82.6	
				-reddish brown below 14'	4.0		15.8				107	1.34	8.4		
	15				3.0		18.9	55	16	39					
	20			SILTY SAND (SM), medium dense, non plastic, light gray and tan		10/8/9	13.4							31.0	
						7/10/6	7.3								
	25														
	30														

Note:

Driller: Ace GeoDrilling

Logger: Manuel & Daniel

BORING LOG B-4

PROJECT	CLIENT	Project No:
Corner of W. Sycamore and S. Post Oak, Fort Bend County, Tx	Fort Bend County, Director of Facilities, Fort Bend Co, Texas	G23-161

COORDINATES	GROUND WATER		Boring Depth		Start Date/Finish	
ELEVATION	Init Dry	15 min Dry	0	25	7/13/23	07/13/23

Elevation (ft)	Depth	SAMPLE	Symbol	Description	Pocket Penetrometer (tsf)	SPT/THD	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Dry Density (pcf)	UC/UU Compression (tsf)	Failure Strain (%)	% Passing 200	Other Tests
	0			FAT CLAY (CH), firm to very stiff, high to very high plasticity, dark gray	4.5		22.8								
					2.5		27.2	71	22	49				85.1	
				-light gray and tan below 4'	2.5		27.9				98	1.38	14.9		
	5			-with ferrous nodules below 6'	4.0		26.6	76	23	53				85.8	
					4.0		26.6				94	1.31	15.0		
	10			-with calcareous nodules below 14'	4.0		25.4	78	22	56				86.1	
				-with slickensides layers below 12'	4.0		25.1				94	1.89	4.7		
				-reddish brown below 14'	4.0		28.2	54	19	35	95	0.96	6.9		
	15			SANDY LEAN CLAY (CL), very stiff, high plasticity, light gray with sand layers	3.0		13.6							53.8	
				SILTY SAND (SM), medium dense, non plastic, light gray and tan		8/8/10	14.0							23.8	
	20					5/6/6	7.3								
	25														
	30														

Note:

Driller: Ace GeoDrilling

Logger: Manuel & Daniel

BORING LOG B-5

PROJECT	CLIENT		
Corner of W. Sycamore and S. Post Oak, Fort Bend County, Tx	Fort Bend County, Director of Facilities, Fort Bend Co, Texas	Project No:	**G23-161**
COORDINATES	GROUND WATER	Boring Depth	Start Date/Finish
ELEVATION	Init: Dry / 15 min: Dry	0 / 25	7/13/23 / 07/13/23

Elevation (ft)	Depth	SAMPLE	Symbol	Description	Pocket Penetrometer (tsf)	SPT/THD	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Dry Density (pcf)	UC/UU Compression (tsf)	Failure Strain (%)	% Passing 200	Other Tests
	0			FAT CLAY WITH SAND (CH), very stiif to hard, high plasticity, dark gray	4.5		22.8	70	19	51				83.8	
					4.5		21.3				107	5.05	7.6		
	5			-light gray and tan below 4'	4.5		25.9	68	21	47				84.5	
				-with calcareous nodules below 6'	4.5		12.0								
				SANDY LEAN CLAY (CL), hard, high plasticity, light gray and tam	4.5		13.1	39	17	22	114	7.85	6.6	68.6	
	10				4.5		15.3				116	4.85	8.8		
				SANDY FAT CLAY (CH), very stiff, high plasticity, light gray and tan	4.5		15.8	65	17	48	113	2.47	15.0	66.3	
	15				4.5		18.4				110	2.38	15.1		
					3.5		18.9	54	17	37					
	20			SILTY SAND (SM), medium desne, non plastic, light gray and tan		9/7/13	15.4								
						6/5/4	6.8							49.2	
	25														
	30														

Note:

Driller: Ace GeoDrilling

Logger: Manuel & Daniel

BORING LOG B-6

PROJECT	CLIENT		
Corner of W. Sycamore and S. Post Oak, Fort Bend County, Tx	Fort Bend County, Director of Facilities, Fort Bend Co, Texas		Project No: **G23-161**
COORDINATES	GROUND WATER	Boring Depth	Start Date/Finish
ELEVATION	Init: Dry / 15 min: Dry	0 / 25	7/13/23 / 07/13/23

Elevation (fT)	Depth	SAMPLE	Symbol	Description	Pocket Penetrometer (tsf)	SPT/THD	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Dry Density (pcf)	UC/UU Compression (tsf)	Failure Strain (%)	% Passing 200	Other Tests
	0			FAT CLAY (CH), stiff to hard, high to very high plasticity, dark gray	4.5		20.9								
				-light gray and tan below 2'	4.5		23.0	66	27	39				85.4	
					4.5		22.3				104	4.15	7.6		
	5				4.5		28.7	78	29	49	92	2.00	7.1	87.0	
				-with ferrous nodules below 8' (slickensides)	4.0		32.5				90	1.27	3.0		
	10			-with calcareous nodules below 10'	3.0		33.8	78	29	49				93.5	
					4.0		24.1				100	2.83	3.1		
				-dark gray below 14'	4.0		23.6	67	21	46				85.1	
	15			-firm, with sand pockets below 16'	3.5		22.5	63	28	35	106	0.67	4.6		
				SILTY SAND (SM), medium desne, non plastic, light gray and tan		8/10/9	12.5							32.8	
	20					7/5/4	8.1								
	25														
	30														

Note:

Driller: Ace GeoDrilling

Logger: Manuel & Daniel

BORING LOG B-7

PROJECT	CLIENT		
Corner of W. Sycamore and S. Post Oak, Fort Bend County, Tx	Fort Bend County, Director of Facilities, Fort Bend Co, Texas		Project No: **G23-161**
COORDINATES	GROUND WATER	Boring Depth	Start Date/Finish
ELEVATION	Init Dry / 15 min Dry	0 / 5	7/13/23 / 07/13/23

Elevation (ft)	Depth	SAMPLE	Symbol	Description	Pocket Penetrometer (tsf)	SPT/THD	Natural Moisture (%)	Liquid Limit	Plastic Limit	Plasticity Index	Dry Density (pcf)	UC/UU Compression (tsf)	Failure Strain (%)	% Passing 200	Other Tests
	0			FAT CLAY WITH SAND (CH), stiff to very stiff, high to very high plasticity dark gray	3.5		21.9	63	21	42				73.7	
				-light gray and tan with ferrous nodules below 2'	3.5		25.7				95	1.98	5.0		
				-with calcareous nodules below 4'	3.5		17.2	52	19	33	115	3.35	7.6	71.0	
	5														
	10														
	15														
	20														
	25														
	30														

Note:

Driller: Ace GeoDrilling

Logger: Manuel & Daniel

KEY TO LOG TERMS AND SYMBOLS

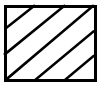
SOIL TYPE

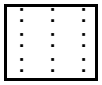

CONCRETE


ASPHALT


FILL

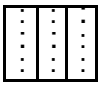

FAT CLAY (CH)


LEAN CLAY (CL)


Poorly Graded Sand (SP)


Silty Clayey Sand (SC-SM)

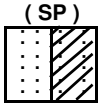

SILT (ML)

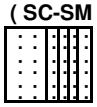

SILTY SAND (SM)


CLAYEY SAND (SC)


SILTY CLAY (CL-ML)


GRAVEL


Poorly Graded Sand with Clay (SP-SC)


Poorly Graded Sand with Silt (SP-SM)

SAMPLER TYPE


AUGER SAMPLE


SHELBY TUBE


SPLIT SPOON


NO RECOVERY


ROCK CORE


TCP / THD Value

UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D 2487

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS LESS THAN 50% PASSING No. 200 SIEVE	GRAVEL & GRAVELY SOILS LESS THAN 50% PASSING No.4 SIEVE	CLEAN GRAVELS LITTLE OR NO FINES	GW	WELL GRADEED GRAVELS,GRAVELSAND MIXTURES WITH LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS,GRAVEL SAND MIXTURES WITH LITTLE OR NO FINES
		W/ APPRECIATEBLE FINES	GM	SILTY GRAVELS,GRAVEL SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS,GRAVEL SAND-CLAY MIXTURES
	SANDS MORE THAN 50% PASSING No.4 SIEVE	CLEAN SANDS LITTLE FINES	SW	WELL GRADED SAND,GRAVELY SAND (LITTLE FINES)
			SP	POORLY GRADED SANDS,GRAVELY SAND(L. FINES)
		SANDS WITH APPREA. FINES	SM	SILTY SANDS,SAND-SILT MIXTURES
			SC	CLAYEY SANDS,SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS & VERY FINE SANDS,ROCK FLOUR SILTY OR CLAYEY FINE SANDS OR CLAYEY SILT W/PI
			CL	INORGANIC CLAY OF LOW TO MEDIUM PI LEAN CLAY, GRAVELY LEAN CLAYS,SANDY LEAN CLAYS,LEAN CLAYS WITH SAND
			OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PI
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS,MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY FAT CLAYS, FAT CLAYS WITH SAND, SANDY FAT CLAYS, FAT CLAYS WITH GRAVEL
			OH	ORGANIC CLAYS OF MED TO HIGH PI, ORGANIC SILT
HIGHLY ORGANIC SOIL			FT	PEAT AND OTHER HIGHLY ORGANIC SOILS
UNCLASSIFIED FILL MATERIALS			ARTIFICIALLY DEPOSITED AND OTHER UNCLASSIFIED SOILS FILL MATERIALS	

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNDRAINED SHEAR STRENGTH IN TSF	SPT N-VALUE
VERY SOFT	< 0.125	< 2
SOFT	0.125 TO 0.25	2 TO 4
FIRM	0.25 TO 0.5	4 TO 8
STIFF	0.5 TO 1.0	8 TO 16
VERY STIFF	1.0 TO 2.0	16 TO 32
HARD	> 2.0	> 32

RELATIVE DENSITY - GRANULAR SOILS

CONSISTENCY	SPT N-VALUE (BLOWS PER FT)
VERY LOOSE	< 4
LOOSE	5 - 10
MEDIUM DENSE	11 - 30
DENSE	31 - 50
VERY DENSE	> 50

Density (Cohesionless)	Consistency (Cohesive)	TCP-VALUES (BLOWS PER FT)
VERY LOOSE	VERY SOFT	0-8
LOOSE	SOFT	8-20
SLIGHTLY COMPACT	STIFF	20-40
COMPACT	VERY STIFF	40-80
DENSE	HARD	80-5"/100
VERY DENSE	VERY HARD	5"/100 - 0"/100

Note. U.S.S denotes undrained shear strength

DEGREE OF PLASTICITY OF COHESIVE SOILS

PLASTICITY INDEX	0-4	5 - 10	11 - 20	21 - 40	> 40
PLASTICITY CLASSIFICATION	NONE	SLIGHT	MEDIUM	HIGH	VERY HIGH

CLASSIFICATION OF GRANULAR SOILS

U.S.STANDARD SIEVE SIZE(S)

	6"	3"		3/4"	4	10		40	200		
BOULDERS	COBBLES	GRAVEL			SAND					SILT OR CLAY	CLAY
		COARSE		FINE	COARSE	MEDIUM		FINE			
	152	76.2		19.1	4.76	2.0		0.420	0.074		0.002

GRAIN SIZE IN MM

ASSOCIATED TESTING LABORATORIES

Project No: G2023-155
Project Name: Fulshear Simonton Firestation

Free Swell - Holtz and Gibbs (1957)

Sample ID: Boring B-5

Sample Depth: 2-4 ft

Sample Description: FAT CLAY (CH), Dark Brown

Dry Soil Wt : (Vo) 10 cc

Reading of dry soil in graduated cylinder (cc): (Vo) 10 cc

Changes in Hours:

Date: 07/17/23

1 hour-	11	Time: ___ 8:30	am
2 hour(s)-	12	Time: ___ 9:30	am
4 hour(s)-	12	Time: ___ 12:30	pm
8 hour(s)-(V)	12	Time: ___ 4:30	pm

Free Swell: [(V-Vo)/Vo] x 100 = 20%

Additional Comments: Moisture Conten 21.3

This test is performed by slowly pouring 10 cc of air-dried soil, passing the No. 40 sieve into a 100 cc graduate filled with water and noting the swelled volume of the soil after it comes to rest at the bottom.

Tested By: DP **Date:** 7/17/2023

Computed By: NP **Date:** 7/18/2023

Checked By: NP **Date:** 7/18/2023

ASSOCIATED TESTING LABORATORIES

Project No: G2023-161
Project Name: Fresno Community Center

Free Swell - Holtz and Gibbs (1957)

Sample ID: Boring B-6

Sample Depth: 4-6 ft

Sample Description: SANDY FAT CLAY (CH), Reddish Brown

Dry Soil Wt : (Vo) 10 cc

Reading of dry soil in graduated cylinder (cc): (Vo) 10 cc

Changes in Hours:

Date: 07/17/23

1 hour-	11	Time:	8:30 am
2 hour(s)-	12	Time:	9:30 am
4 hour(s)-	12	Time:	12:30 pm
8 hour(s)-(V)	13	Time:	4:30 pm

Free Swell: [(V-Vo)/Vo] x 100 = 30%

Additional Comments: Moisture Conten 22.3

This test is performed by slowly pouring 10 cc of air-dried soil, passing the No. 40 sieve into a 100 cc graduate filled with water and noting the swelled volume of the soil after it comes to rest at the bottom.

Tested By: DP **Date:** 7/17/2023

Computed By: NP **Date:** 7/18/2023

Checked By: NP **Date:** 7/18/2023

Laboratory Analysis Report

Total Number of Pages: 11

Job ID : 23071344

10100 East Freeway, Suite 100, Houston, TX 77029 tel: 713-453-6060, fax: 713-453-6091, http://www.ablabs.com

Client Project Name :
G23-161 / W. Sycamore and S Post Oak

Report To :	Client Name:	Associated Testing Lab	P.O.#.:
	Attn:	Jitu Shah	Sample Collected By:
	Client Address:	3143 Yellowstone Blvd.	Date Collected: 07/14/23
	City, State, Zip:	Houston, Texas, 77054	

A&B Labs has analyzed the following samples...

Client Sample ID	Matrix	A&B Sample ID
B-5 / 2'-4'	Solid	23071344.01
B-6 / 4'-6'	Solid	23071344.02

Released By: Ashley Arnett
Title: Project Manager
Date: 07/17/2023

This Laboratory is NELAP (T104704213-23-31) accredited. Effective: 04/13/2023; Expires: 3/31/2024
Scope: Non-Potable Water, Drinking Water, Air, Solid, Biological Tissue, Hazardous Waste

I am the laboratory manager, or his/her designee, and I am responsible for the release of this data package. This laboratory data package has been reviewed and is complete and technically compliant with the requirements of the methods used, except where noted in the attached exception reports. I affirm, to the best of my knowledge that all problems/anomalies observed by this laboratory (and if applicable, any and all laboratories subcontracted through this laboratory) that might affect the quality of the data, have been identified in the Laboratory Review Checklist, and that no information or data have been knowingly withheld that would affect the quality of the data.

ab-q210-0321

Date Received : 07/14/2023 13:15

Report Number: RPT230717109

LABORATORY TERM AND QUALIFIER DEFINITION REPORT

Job ID : 23071344

Date: 7/17/2023

General Term Definition

Back-Wt	Back Weight	Post-Wt	Post Weight
BRL	Below Reporting Limit	ppm	parts per million
cfu	colony-forming units	Pre-Wt	Previous Weight
Conc.	Concentration	Q	Qualifier
D.F.	Dilution Factor	RegLimit	Regulatory Limit
Front-Wt	Front Weight	RPD	Relative Percent Difference
LCS	Laboratory Check Standard	RptLimit	Reporting Limit
LCSD	Laboratory Check Standard Duplicate	SDL	Sample Detection Limit
MS	Matrix Spike	surr	Surrogate
MSD	Matrix Spike Duplicate	T	Time
MW	Molecular Weight	TNTC	Too numerous to count
J	Estimation. Below calibration range but above MDL	MQL	Minimum Quantitation Limit

Qualifier Definition

M1	Matrix Spike and/or Matrix Spike Duplicate recovery is above laboratory control limits due to matrix interference.

LABORATORY TEST RESULTS

Job ID : 23071344

Date 7/17/2023

Client Name:	Associated Testing Lab		Attn: Jitu Shah
Project Name:	G23-161 / W. Sycamore and S Post Oak		

Client Sample ID:	B-5 / 2'-4'	Job Sample ID:	23071344.01
Date Collected:	07/14/23	Sample Matrix	Solid
Time Collected:		% Moisture	
Other Information:			

Test Method	Parameter/Test Description	Result	Units	DF	Rpt Limit	Reg Limit	Q	Date Time	Analyst
EPA 120.1	Resistivity								
	Resistivity²	4400	ohm-cm	1				07/17/23 11:45	RR
SM 2540G	% Moisture								
	% Moisture	18.1	%	1	0.1			07/14/23 07:45	BR
EPA 300.0	Water Soluble Anions								
	Chloride*	57.7	mg/Kg	1.00	1.22			07/17/23 11:26	KPE
	Sulfate*	22.3	mg/Kg	1.00	1.22			07/17/23 11:26	KPE
SW-846 9045D	Corrosivity, pH								
	pH	8.9	s.u.					07/17/23 10:00	BR
	Temperature when read, °C²	24.1	s.u.					07/17/23 10:00	BR

ab-q212-0321

Soil results reported on dry weight basis

LABORATORY TEST RESULTS

Job ID : 23071344

Date 7/17/2023

Client Name:	Associated Testing Lab		Attn: Jitu Shah
Project Name:	G23-161 / W. Sycamore and S Post Oak		

Client Sample ID:	B-6 / 4'-6'	Job Sample ID:	23071344.02
Date Collected:	07/14/23	Sample Matrix	Solid
Time Collected:		% Moisture	
Other Information:			

Test Method	Parameter/Test Description	Result	Units	DF	Rpt Limit	Reg Limit	Q	Date Time	Analyst
EPA 120.1	Resistivity								
	Resistivity²	1740	ohm-cm	1				07/17/23 11:45	RR
SM 2540G	% Moisture								
	% Moisture	17.8	%	1	0.1			07/14/23 07:45	BR
EPA 300.0	Water Soluble Anions								
	Chloride*	103	mg/Kg	1.00	1.22			07/17/23 12:08	KPE
	Sulfate*	21.1	mg/Kg	1.00	1.22			07/17/23 12:08	KPE
SW-846 9045D	Corrosivity, pH								
	pH	8.8	s.u.					07/17/23 10:00	BR
	Temperature when read, °C²	24.1	s.u.					07/17/23 10:00	BR

ab-q212-0321

Soil results reported on dry weight basis

²-Parameter not available for accreditation.

*-Moisture Attached

QUALITY CONTROL CERTIFICATE

Job ID : 23071344 **Date :** 7/17/2023

Analysis : % Moisture **Method :** SM 2540G **Reporting Units :** %

QC Batch ID : Qb23071403 **Created Date :** 07/14/23 **Created By :** BRose

Samples in This QC Batch : 23071344.01,02

Sample Preparation : PB23071401 **Prep Method :** SM 2540G **Prep Date :** 07/14/23 07:29 **Prep By :** BRose

QC Type: Method Blank

Parameter	CAS #	Result	Units	D.F.	RptLimit		Qual
% Moisture		BRL	%	1	0.1		

QC Type: Duplicate

QC Sample ID: 23070968.09

Parameter	QCSample Result	Sample Result	Units	RPD	RPD CtrlLimit		Qual
% Moisture	29.8	29.9	%	0.3	20		

QUALITY CONTROL CERTIFICATE

Job ID : 23071344 **Date :** 7/17/2023

Analysis : Anions **Method :** EPA 300.0 **Reporting Units :** mg/Kg

QC Batch ID : Qb23071731 **Created Date :** 07/17/23 **Created By :** KPerera

Samples in This QC Batch : 23071344.01,02

Sample Preparation : PB23071714 **Prep Method :** EPA 300.0 **Prep Date :** 07/17/23 09:00 **Prep By :** KPerera

QC Type: Method Blank

Parameter	CAS #	Result	Units	D.F.	RptLimit		Qual
Chloride	16887-00-6	BRL	mg/Kg	1.00	1		
Sulfate	14808-79-8	BRL	mg/Kg	1.00	1		

QC Type: LCS and LCSD

Parameter	LCS Spk Added	LCS Result	LCS % Rec	LCSD Spk Added	LCSD Result	LCSD % Rec	RPD	RPD CtrlLimit	%Recovery CtrlLimit	Qual
Chloride	10	10.3	103	10	9.76	97.6	4.9	20	90-110	
Sulfate	10	10.7	107	10	10.1	101	5.5	20	90-110	

QC Type: MS and MSD
QC Sample ID: 23071344.01

Parameter	Sample Result	MS Spk Added	MS Result	MS % Rec	MSD Spk Added	MSD Result	MSD % Rec	RPD	RPD CtrlLimit	%Rec CtrlLimit	Qual
Chloride	47.2	10	61.3	141						80-120	M1
Sulfate	18.3	10	30.8	125						80-120	M1

QUALITY CONTROL CERTIFICATE

Job ID : 23071344 **Date :** 7/17/2023

Analysis : **Resistivity** **Method :** **EPA 120.1** **Reporting Units :** **ohm-cm**

QC Batch ID : Qb23071763 **Created Date :** 07/17/23 **Created By :** RRayford

Samples in This QC Batch : 23071344.01,02

QC Type: Method Blank

Parameter	CAS #	Result	Units	D.F.	RptLimit		Qual
Resistivity		BRL	ohm-cm	1			

QC Type: Duplicate

QC Sample ID: 23071344.01

Parameter	QCSample Result	Sample Result	Units	RPD	RPD CtrlLimit		Qual
Resistivity	4444	4405	ohm-cm	0.9	20		

QC Type: LCS and LCSD

Parameter	LCS Spk Added	LCS Result	LCS % Rec	LCSD Spk Added	LCSD Result	LCSD % Rec	RPD	RPD CtrlLimit	%Recovery CtrlLimit	Qual
Resistivity	10000	10020	100						80-120	

QUALITY CONTROL CERTIFICATE

Job ID : 23071344 **Date :** 7/17/2023

Analysis : **Corrosivity, pH** **Method :** **SW-846 9045D** **Reporting Units :** **s.u.**

QC Batch ID : Qb23071771 **Created Date :** 07/17/23 **Created By :** BRose

Samples in This QC Batch : 23071344.01

QC Type: Duplicate

QC Sample ID: 23071282.01

Parameter	QCSample Result	Sample Result	Units	RPD	RPD CtrlLimit		Qual
pH	9.4	9.4	s.u.	0	5		

QC Type: LCS and LCSD

Parameter	LCS Assigned	LCS Result		LCSD Assigned	LCSD Result		RPD	RPD CtrlLimit	Tolerance	Qual
pH	4.0	4.00							98.75-101.25	

QUALITY CONTROL CERTIFICATE

Job ID : 23071344 **Date :** 7/17/2023

Analysis : **Corrosivity, pH** **Method :** **SW-846 9045D** **Reporting Units :** **s.u.**

QC Batch ID : Qb23071772 **Created Date :** 07/17/23 **Created By :** BRose

Samples in This QC Batch : 23071344.02

QC Type: Duplicate

QC Sample ID: 23071344.02

Parameter	QCSample Result	Sample Result	Units	RPD	RPD CtrlLimit		Qual
pH	8.8	8.8	s.u.	0	5		

QC Type: LCS and LCSD

Parameter	LCS Assigned	LCS Result		LCSD Assigned	LCSD Result		RPD	RPD CtrlLimit	Tolerance	Qual
pH	4.0	4.00							98.75-101.25	

A & B Labs — *Chain of Custody*

The Chain of Custody is a Legal Document

Page _____ of _____

10100 East Fwy (I-10)
Suite 100
Houston, TX 77029
713-453-6060
1-877-478-6060 Toll Free
713-453-6091 Fax
ablabs.com

A&B JOB ID #

5. Project # G23-161

1. REPORT TO:
Company: Associated Testing Lab
Address: 3143 Yellowstone Blvd
Houston, Tx 77054
Contact: Jitu shah
Phone: 713-748-3717
Fax: ☐ 713-748-3748
E-mail: ☐ Jitu@associatedtesting.com

2. INVOICE TO:
Company:
Address:
Contact:
Phone:
Fax: ☐
E-mail: ☐

3. PO #
3a. A&B Quote #
4. Turnaround Time (Business Days)
☑ 1 Day* ☐ Other:
☐ 2 Days*
☐ 3 Days* *Surcharge applies
☐ 7 Days - Standard

6. Project Name/Location: W. Sycamore and S. Post oak

7. Reporting Requirement:
☐ TRRP Limits only ☐ TRRP Rpt. Package ☐ See Attached ☐ Standard Level II ☐ PST ☐ MDL ☐ EDD

8. Sampler's Name & Company (PLEASE PRINT) Sampler's Signature & Date

LAB USE ONLY	9. Sample ID and Description	10. Sampling Date	Time 24hr	11. Comp.	Grab	12. Matrix: Water	Soil	Sludge	Oil	Drinking Water	Air	Other	No. of Containers	Analyses/Methods: PH	Sulfates/Chlorides	Electric Resistivity	18. REMARKS
1A	B-5 2'-4'	7/14/23												✓	✓	✓	
2A	B-6 4'-6'	7/14/23												✓	✓	✓	

13. 14. Containers* / 15. Preservatives** / 16. PH-Lab Only / 17.

Job ID:23071344
07/14/2023 Associated Testing Lab ANA

19. RELINQUISHED BY	DATE	TIME	20. RECEIVED BY	DATE	TIME
1 James A. Talley Jr.	7/14/23	13:15		7/14/23	13:15
2					
3					

21. KNOWN HAZARDS/COMMENTS

Temperature: 4.0 °C
Thermometer ID IR5
Intact: Y or N Initials

*Containers: VOA - 40 ml vial; 4 oz/8 oz - glass wide mouth; A/G - Amber/Glass 1 Liter; P/O - Plastic/other _____

**Preservatives: C - Cool; OH - NaOH; H - HCl; T - $NA_2S_2O_3$; N - HNO_3; X - Other; S - H_2SO_4

METHOD OF SHIPMENT

BILL OF LADING/TRACKING #

A&B cannot accept verbal changes
Please FAX written changes to 713-453-6091

Samples will be disposed of after 30 days
A&B reserves the right to return samples

LAB USE ONLY SAMPLING _____ RENTAL _____ P/U _____ Supplies _____ Field Work _____

ab-s001-0516

Sample Condition Checklist

A&B JobID : **23071344**	Date Received : **07/14/2023**	Time Received : **1:15PM**
Client Name : **Associated Testing Lab**		
Temperature : **4.0°C**	Sample pH : **NA**	
Thermometer ID : **IR5**	pH Paper ID : **NA**	
Perservative :		

	Check Points	Yes	No	N/A
1.	**Cooler Seal present and signed.**		X	
2.	**Sample(s) in a cooler.**	X		
3.	**If yes, ice in cooler.**	X		
4.	**Sample(s) received with chain-of-custody.**	X		
5.	**C-O-C signed and dated.**	X		
6.	**Sample(s) received with signed sample custody seal.**		X	
7.	**Sample containers arrived intact. (If No comment)**	X		
8.	**Matrix:** Water ☐ Soil ☑ Liquid ☐ Sludge ☐ Solid ☐ Cassette ☐ Tube ☐ Bulk ☐ Badge ☐ Food ☐ Other ☐			
9.	**Samples were received in appropriate container(s)**	X		
10.	**Sample(s) were received with Proper preservative**			X
11.	**All samples were tagged or labeled.**	X		
12.	**Sample ID labels match C-O-C ID's.**	X		
13.	**Bottle count on C-O-C matches bottles found.**	X		
14.	**Sample volume is sufficient for analyses requested.**	X		
15.	**Samples were received with in the hold time.**	X		
16.	**VOA vials completely filled.**			X
17.	**Sample accepted.**	X		
18.	**Has client been contacted about sub-out**			X

Comments : Include actions taken to resolve discrepancies/problem:

Samples received in 4oz containers. ~EV 7/14/2023

Received by : EValdez

Check in by/date : EValdez / 07/14/2023

ab-s005-0321

ASSOCIATED TESTING LABORATORIES

3143 Yellowstone Blvd., Houston, Texas 77054
Tel: (713) 748-3717 Fax: (713) 748-3748

Appendix B

ASSOCIATED TESTING LABORATORIES

3143 Yellowstone Blvd., Houston, Texas 77054
Tel: (713) 748-3717 Fax: (713) 748-3748

EXPANSIVE SOILS

The high plasticity clays at this site may experience volume changes with changes in moisture content. During hot, dry periods the soil loses moisture and shrinks. Conversely, during extended wet weather cycles, the soil gains moisture and swells. This seasonal movement can exert considerable stresses on structures supported by these soils.

Under normal conditions, water evaporates from the surface of the soil, and it replaced by water drawn upward by capillary action from below. When a floor slab and vapor barrier are placed on the surface, this evaporation is mitigated. Moisture continues to be drawn upward until a balanced condition is developed. During wet season, the soils near the edge of the slab receive more moisture than the soils at the center of the slab. During dry season, the soils near the edge of the slab dries out more than the soils at the center of the slab. These conditions may cause differential movement and cracking of the slab.

Several preventive measures are available to reduce the effects of volume changes in these soils. One is to use deep grade beams to provide a barrier to evaporation of water from below the slab. Another is to place a paved strip around the perimeter of the building. This strip acts as a buffer zone, with most of the differential movement taking place in this area. A minimum width of 5 feet is normally recommended. Residences or other structures may use a mulch bed around the perimeter to help keep moisture from evaporating. Lime stabilization of a 5-foot-wide strip outside the building line will also help prevent moisture loss.

Trees can also contribute to the soil shrink/swell movement in highly plastic soils. During extended periods of dry weather, trees remove water from the soil and cause shrinkage. This shrinkage causes movement of the soils downward and toward the tree and can seriously damage nearby structures. This condition can normally be neutralized by removing the trees or by placing the structure on foundations bearing below the affected soil. Existing trees absorb water from the soil through the roots. This leads to the formation of isolated pockets of dry soils near the tree roots. When the trees are removed and the building constructed on top of it, the isolated pockets of dry soil when exposed to moisture will swell more than the surrounding soils. This will lead to differential swelling. Although, the tree roots are generally found in the top few feet, there may be cases where tree roots may be present at deeper depths. In this event, the foundation is designed based on the potential vertical rise (PVR) of deeper soils, permeability of soils and probability of moisture changes in soils at deeper depths.

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Contractor's use of site and premises.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and Drawing conventions.
7. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 017300 "Execution" for coordination of Owner-installed products.

1.3 DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.4 PROJECT INFORMATION

A. Project Identification: Fresno Boys and Girls Club and N32023.

1. Project Location: 1031 W Sycamore Rd. Fresno, TX 77545.

B. Owner: Fort Bend County, 301 Jackson Street, Richmond, TX 77469.

1. Owner's Representative: James Knight

C. Architect: Smith & Company Architects, 720 N Post Oak Rd. Ste. 124, Houston, TX 77024.

1. Architect's Representative: Kirk Paul, 713-524-4202, Kpaul@sc-arch.com.

D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. Structural Engineer: STANLEY SPURLING & HAMILTON INC.
Representative: Tim Tedford, 713-778-9433, ttedford@sshinc.net

2. Civil Engineer: LJA ENGINEERING
Representative: Amanda Barbier, P.E., 713-953-5054, abarbier@lja.com

3. Landscape Architect: STUDIO AVID
Representative: Kolby Davidson, PLA, 281-796-508, kdavidson@studio-avid.com

4. MEP Engineer: INFRASTRUCTURE
Representative: Sevak Kalantarian, PE, 713-622-0120 ext. 102, sk1@iahouston.com

5. Technology Consultant: TRUE NORTH CONSULTANT GROUP
Representative: Rob Larsen, Sr. Technology Consultant, 832-948-0250, rob.laren@tncg.com

E. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.

1. See Section 013100 "Project Management and Coordination." for requirements for using web-based Project software.

1.5 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. A 22,022 S.F. Boys and Girls Club Facility to serve the communities of Teal Run and Andover Farms, in Fresno Texas. Occupancy classification is Mixed occupancy, and construction type IIB (601) for a gym, 4 offices, Conference room, Warming Kitchen, Game room, Teen room, Kid’s café and 4 Classrooms. Parking for 50 with 3 ADA spaces, including a playing field in the rear as indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.6 CONTRACTOR'S USE OF SITE AND PREMISES

A. Limits on Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.7 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to between 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

1. Weekend Hours: 7:00 a.m. to 12:00 p.m.
2. Early Morning Hours: Reference Chapter 22 Article III Section 22.52 restrictions on noisy work violations.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property is not permitted.

E. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

F. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

END OF SECTION 011000

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, Including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Requested substitution provides sustainable design characteristics that specified product provided.
c. Substitution request is fully documented and properly submitted.
d. Requested substitution will not adversely affect Contractor's construction schedule.
e. Requested substitution has received necessary approvals of authorities having jurisdiction.
f. Requested substitution is compatible with other portions of the Work.
g. Requested substitution has been coordinated with other portions of the Work.
h. Requested substitution provides specified warranty.
i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

    a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
    b. Requested substitution does not require extensive revisions to the Contract Documents.
    c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    d. Requested substitution provides sustainable design characteristics that specified product provided.
    e. Substitution request is fully documented and properly submitted.
    f. Requested substitution will not adversely affect Contractor's construction schedule.
    g. Requested substitution has received necessary approvals of authorities having jurisdiction.
    h. Requested substitution is compatible with other portions of the Work.
    i. Requested substitution has been coordinated with other portions of the Work.
    j. Requested substitution provides specified warranty.
    k. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
2. Section 013100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710.

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.

d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
e. Quotation Form: Use forms acceptable to Architect.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule

1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Owner's name.

c. Owner's Project number.
d. Name of Architect.
e. Architect's Project number.
f. Contractor's name and address.
g. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:

   a. Related Specification Section or division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.

      1) Labor.
      2) Materials.
      3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

   a. Differentiate between items stored on-site and items stored off-site.

6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
7. Purchase Contracts: Provide a separate line item in the schedule of values for each Purchase contract. Show line-item value of Purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
8. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
9. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
10. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.

11. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
12. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and paid for by Owner.

B. Payment Application Times: Submit Application for Payment to Architect by the last day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

H. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
1. When an application shows completion of an item, submit conditional final or full waivers.
2. Owner reserves the right to designate which entities involved in the Work must submit waivers.
3. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Sustainable design action plans, including preliminary project materials cost data.
7. Schedule of unit prices.
8. Submittal schedule (preliminary if not final).
9. List of Contractor's staff assignments.
10. List of Contractor's principal consultants.
11. Copies of building permits.
12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.

13. Initial progress report.
14. Report of preconstruction conference.
15. Certificates of insurance and insurance policies.
16. Performance and payment bonds.
17. Data needed to acquire Owner's insurance.

J. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

    a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."

2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. AIA Document G706.
6. AIA Document G706A.
7. AIA Document G707.
8. Evidence that claims have been settled.
9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
10. Final liquidated damages settlement statement.
11. Proof that taxes, fees, and similar obligations are paid.
12. Waivers and releases.

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.
4. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities, list addresses and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, in web-based Project software directory, and in prominent location in each built facility. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its own operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance

requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts, and electrical distribution equipment.
    c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

    a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    c. Panel board, switch board, switchgear, transformer, busway, generator, and motor-control center locations.
    d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:

    a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Architect will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being

prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.

10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."

11. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
12. File Submittal Format: Submit or post coordination drawing files using PDF format.

1.7 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716.

1. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for approval of Contractor's means and methods.
    d. Requests for coordination information already indicated in the Contract Documents.
    e. Requests for adjustments in the Contract Time or the Contract Sum.
    f. Requests for interpretation of Architect's actions on submittals.
    g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly software. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Architect's Data Files Not Available: Architect will not provide Architect's BIM model digital data files for Contractor's use during construction.

B. Web-Based Project Software: Provide, administer, and use web-based Project software site for purposes of hosting and managing Project communication and documentation until Final Completion.

1. Web-based Project software site includes, at a minimum, the following features:

a. Compilation of Project data, including Contractor, subcontractors, Architect, architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
c. Document workflow planning, allowing customization of workflow between project entities.
d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
e. Track status of each Project communication in real time, and log time and date when responses are provided.
f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
g. Processing and tracking of payment applications.
h. Processing and tracking of contract modifications.
i. Creating and distributing meeting minutes.
j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
k. Management of construction progress photographs.
l. Mobile device compatibility, including smartphones and tablets.

2. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.9 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 10 working days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

a. Responsibilities and personnel assignments.
b. Tentative construction schedule.
c. Phasing.
d. Critical work sequencing and long lead items.
e. Designation of key personnel and their duties.
f. Lines of communications.
g. Use of web-based Project software.
h. Procedures for processing field decisions and Change Orders.
i. Procedures for RFIs.
j. Procedures for testing and inspecting.
k. Procedures for processing Applications for Payment.
l. Distribution of the Contract Documents.
m. Submittal procedures.
n. Sustainable design requirements.
o. Preparation of Record Documents.
p. Use of the premises.
q. Work restrictions.
r. Working hours.
s. Owner's occupancy requirements.
t. Responsibility for temporary facilities and controls.
u. Procedures for moisture and mold control.
v. Procedures for disruptions and shutdowns.
w. Construction waste management and recycling.
x. Parking availability.
y. Office, work, and storage areas.

z. Equipment deliveries and priorities.
aa. First aid.
bb. Security.
cc. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Sustainable design requirements.
i. Review of mockups.
j. Possible conflicts.
k. Compatibility requirements.
l. Time schedules.
m. Weather limitations.
n. Manufacturer's written instructions.
o. Warranty requirements.
p. Compatibility of materials.
q. Acceptability of substrates.
r. Temporary facilities and controls.
s. Space and access limitations.
t. Regulations of authorities having jurisdiction.
u. Testing and inspecting requirements.
v. Installation procedures.
w. Coordination with other work.
x. Required performance results.
y. Protection of adjacent work.
z. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

    a. Preparation of Record Documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Procedures for completing and archiving web-based Project software site data files.
    d. Submittal of written warranties.
    e. Requirements for completing sustainable design documentation.
    f. Requirements for preparing operations and maintenance data.
    g. Requirements for delivery of material samples, attic stock, and spare parts.
    h. Requirements for demonstration and training.
    i. Preparation of Contractor's punch list.
    j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    k. Submittal procedures.
    l. Coordination of separate contracts.
    m. Owner's partial occupancy requirements.
    n. Installation of Owner's furniture, fixtures, and equipment.
    o. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at biweekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

        1) Review schedule for next period.

    b. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Resolution of BIM component conflicts.
        4) Status of submittals.
        5) Status of sustainable design documentation.
        6) Deliveries.
        7) Off-site fabrication.
        8) Access.
        9) Site use.
        10) Temporary facilities and controls.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Status of correction of deficient items.
        14) Field observations.
        15) Status of RFIs.
        16) Status of Proposal Requests.
        17) Pending changes.
        18) Status of Change Orders.
        19) Pending claims and disputes.
        20) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

END OF SECTION 013100

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Periodic construction photographs.
2. Final Completion construction photographs.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
2. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.

1. Submit photos by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in web-based Project management software site:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architecr.
d. Name of Contractor.
e. Date photograph was taken.
f. Description of location, vantage point, and direction.
g. Unique sequential identifier keyed to accompanying key plan.

1.4 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.5 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. Metadata: Record accurate date and time from camera.

D. File Names: Name media files with date and sequential numbering suffix.

1.6 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs with maximum depth of field and in focus.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:

1. Underground utilities.
2. Underslab services.
3. Piping.
4. Electrical conduit.
5. Waterproofing and weather-resistant barriers.

D. Periodic Construction Photographs: Take 20 photographs monthly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

E. Final Completion Construction Photographs: Take 20 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

F. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.

1. Three days' notice will be given, where feasible.
2. In emergency situations, take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following:

    a. Special events planned at Project site.
    b. Immediate follow-up when on-site events result in construction damage or losses.
    c. Photographs shall be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
    d. Substantial Completion of a major phase or component of the Work.
    e. Extra record photographs at time of final acceptance.
    f. Owner's request for special publicity photographs.

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 013233 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and final completion construction photographs.
5. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
6. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
7. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
8. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
9. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled date of fabrication.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.5 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Construction Manager.
5. Name of Contractor.

6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Paper Submittals:

1. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
4. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
5. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
6. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using AIA Document G810 transmittal form.

E. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

F. Submittals for Web-Based Project Software: Prepare submittals as PDF files, or another format indicated by Project software website.

1.6 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.

a. Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

2. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
3. Paper: Prepare submittals in paper form, deliver to Architect.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15

days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.7 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams that show factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm)

a. Two opaque (bond) copies of each submittal. Architect will return one copy(ies).

C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

a. Project name and submittal number.
b. Generic description of Sample.
c. Product name and name of manufacturer.
d. Sample source.
e. Number and title of applicable Specification Section.
f. Specification paragraph number and generic name of each item.

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
4. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
5. Paper Transmittal: Include paper transmittal including complete submittal information indicated.
6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

7. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.

8. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of

assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

a. Name of evaluation organization.
b. Date of evaluation.
c. Time period when report is in effect.
d. Product and manufacturers' names.
e. Description of product.
f. Test procedures and results.
g. Limitations of use.

1.8 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.9 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S AND CONSTRUCTION MANAGER'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required.

1. PDF Submittals: Architect and Construction Manager will indicate, via markup on each submittal, the appropriate action.
2. Paper Submittals: Architect and Construction Manager will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
3. Submittals by Web-Based Project Software: Architect will indicate, on Project software website, the appropriate action.

    a. Actions taken by indication on Project software website have the following meanings:

B. Informational Submittals: Architect will review each submittal and will not return it or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect will discard submittals received from sources other than Contractor.
F. Submittals not required by the Contract Documents will be returned by Architect without action.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections include the following:

1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
2. Division 01 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
3. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and

completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

J. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

    a. Provide test specimens representative of proposed products and construction.
    b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.

3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.

5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Reference Requirements.
B. Governing Regulations and Authorities.
C. Definitions

1.2 REFERENCE REQUIREMENTS:

A. Materials, equipment and operations specified by reference to published standards and specifications of a technical society, trade association, or other agency standard, shall comply with the requirements of the current edition of the listed document that is in effect on the issue date of the Specifications or Addendum page making reference thereto, unless otherwise specified. Make copies of referenced documents available at site, as the ODR or A/E may request.

B. No provision of a reference standard, specification, manual, or code shall change the duties and responsibilities of the Owner, the Contractor, the A/E and their consultants, their agents and employees from those duties and responsibilities set forth in the Contract Documents.

C. Acronyms for names of technical societies, associations, and agencies referenced in the Contract Documents shall be interpreted as follows:

AA Aluminum Association
900 19th St., NW, Suite 300; Washington, DC 20006;
202-862-5100
www.aluminum.org

AABC Associated Air Balance Council
1518 K Street, NW, Suite 503; Washington, DC 20005
202-737-0202
www.aabchq.com

AAMA American Architectural Manufacturers Association
1827 Walden Office Square, Ste 550; Schaumburg, IL 60173-4268
847-303-5664
www.aamanet.org

ANLA American Nursery & Landscape Association
1000 Vermont Ave., NW, Ste 300; Washington, DC 20005-4914
202-789-2900
www.anla.org

ACI American Concrete Institute

38800 Country Club Drive; Farmington Hills, MI, 48331;
248-848-3700
www.concrete.org

ACIL American Council of Independent Laboratories
1629 K Street, NW, Suite 400; Washington, DC 20006-1633
202-887-5872
www.acil.org

ADC Air Diffusion Council
1000 E. Woodfield Road, Suite 102; Schaumburg, IL 60173-5921
847-706-6750
www.flexibleduct.org

AGC Associated General Contractors of America
333 John Carlyle Street, Suite 200; Alexandria, VA 22314
703-548-3118
www.agc.org

AIA America Institute of Architects
1735 New York Avenue, NW; Washington DC 20006
202-626-7300
www.aia.org

AIC American Institute of Constructors
466 94th Avenue North; St. Petersburg, FL 33702
727-578-0317
www.aicnet.org

AISC American Institute of Steel Construction, Inc.
One East Wacker Drive, Suite 3100; Chicago, IL 60601-2001
312-670-2400
www.aisc.org

AISI American Iron and Steel Institute
1140 Connecticut Avenue, Suite 705; Washington, DC 20036
202-452-7100
www.steel.org

AMCA Air Movement and Control Association
30 West University Drive; Arlington Heights, IL 60004-1893
847-394-0150
www.amca.org

ANSI American National Standards Institute
1819 L. Street, NW, 6th Floor; Washington, DC 20036
202-293-8020
www.ansi.org

APA American Plywood Association
P.O. Box 11700; Tacoma, WA 98411-0700
253-565-6600
www.apawood.org

ARI Air Conditioning and Refrigeration Institute
4100 North Fairfax Drive, Suite 200; Arlington, VA 22203
703-524-8800
www.ari.org

ASHRAE American Society of Heating, Refrigerating &
Air Conditioning Engineers, Inc.
1791 Tullie Circle, NE; Atlanta, GA 30329
404-636-8400
www.ashrae.org

ASME American Society of Mechanical Engineers
3 Park Avenue; New York, NY 10016
212-591-7000
www.asme.org

ASTM American Society for Testing and Materials
100 Barr Harbor Drive; West Conshohocken, PA 19428-2959
610-832-9500
www.astm.org

AWI Architectural Woodwork Institute
1952 Isaac Newton Square West; Reston, VA 20190
703-733-0600
www.awinet.org

AWPA American Wood Preservers' Association
P.O. Box 388; Selma, Alabama 36702-0388
www.awpa.com

AWS American Welding Society, Inc.
550 Le Jeune Road, NW; Miami, FL 33126
305-443-9353
www.aws.org

AWWA American Water Works Association
6666 West Quincy Avenue; Denver, CO 80235
303-794-7711
www.awwa.org

BHMA Builders' Hardware Manufacturers Association
355 Lexington Ave., 17th Floor; New York, NY 10017

212-297-2122
www.buildershardware.com

BIA — Brick Institute of America
11490 Commerce Park Drive, Suite 300; Reston, VA 20191
703-620-0010
www.bia.org

BICSI — Building Industry Consulting Services International
8610 Hidden River Parkway; Tampa, FL 33637
800-242-7405
www.bicsi.org

CPA — Composite Panel Association
18922 Premiere Court; Gaithersburg, MD 20879
301-670-0604
www.pbmdf.com

CPSC — Consumer Product Safety Commission
National Injury Information Clearinghouse
4330 East-West Hwy.; Bethesda, MD 20814-4408
301-504-6816
www.cpsc.gov

CRSI — Concrete Reinforcing Steel Institute
933 Plum Grove Road; Schaumburg, IL 60173-4758
847-517-1200
www.crsi.org

DHI — Door and Hardware Institute
14150 Newbrook Drive, Suite 200; Chantilly, VA 20151-2223
703-222-2010
www.dhi.org

FM — Factory Mutual Engineering and Research Organization
1151 Boston-Providence Turnpike; Norwood, MA 02062-5001
781-762-4300

FS — Federal Specification (General Services Administration) Specifications Unit (WFSIS)

GA — Gypsum Association
810 First Street, NE, Suite 510; Washington, DC 20002
202-289-5440
www.gypsum.org

IEEE — Institute of Electrical and Electronics Engineers
445 Hoes Lane; Piscataway, NJ 08854

732-981-0660
www.ieee.org

IESNA Illuminating Engineering Society of North America
120 Wall Street, Floor 17; New York, NY 10005
212-248-5000
www.iesna.org

IGCC Insulating Glass Certification Council
c/o ETL Testing Labs, P.O. Box 9, Henderson Harbor, NY 13651
315-646-2234
www.igcc.org

ILI Indiana Limestone Institute of America
400 Stone City Bank Building, Bedford, IN 47421
812-275-4426
www.iliai.com

LPI Lightning Protection Institute
3335 N. Arlington Hts. Road, Suite E; Arlington Hts., IL 60004
847-577-7200
www.lightning.org

MIL Military Standardization Documents (U.S. Dept. of Defense)

MSS Manufacturers Standardization Society of the Valve and Fittings Industry
127 Park Street, NE; Vienna, VA 22180-4602
703-281-6613
www.mss-hq.com

NAAMM National Association of Architectural Metal Manufacturers
8 South Michigan Avenue, Suite 1000; Chicago, IL 60603
312-332-0405
www.naamm.org

NCMA National Concrete Masonry Association
13750 Sunrise Valley Drive; Herndon, VA 20171-4662
703-713-1900
www.ncma.org

NEC National Electric Code (by NFPA)

NEI National Elevator Industry, Inc.
1677 County Route 64, P.O. Box 838; Salem, NY 12865-0838
518-854-3100
www.neii.org

NEMA National Electrical Manufacturers Association

1300 North 17th Street; Rosslyn, VA 22209
703-841-3200
www.nema.org

NFPA — National Fire Protection Association
One Batterymarch Park; Quincy, MA 02269-9101
617-770-3000
www.nfpa.org

NIST — National Institute of Standards and Technology
(formerly National Bureau of Standards; U.S. Dept. of Commerce)
Gaithersburg, MD 20899-3460
301-975-6478
www.nist.gov

NPCA — National Paint and Coatings Association
1500 Rhode Island Ave., NW; Washington, DC 20005
202-462-6272
www.paint.org

NRCA — National Roofing Contractors Association
10255 W. Higgins Road, Suite 600; Rosemont, IL 60018-5607
847-299-9070
www.nrca.net

NSF — National Sanitation Foundation
P.O. Box 130140, 789 N. Dixboro Rd; Ann Arbor, MI 48113-0140
734-769-8010
www.nsf.org

NTMA — The National Terrazzo and Mosaic Association, Inc.
201 N. Maple Avenue, Suite 208; Purcelville, VA 20132
800-323-9736
www.ntma.com

NWWDA — National Wood Window and Door Association (formerly NWMA)
1400 E. Touhy Avenue #G54; Des Plaines, IL 60018
708-299-1286
www.nwwda.org

OSHA — Occupational Safety & Health Administration
200 Constitution Avenue, NW; Washington, DC 20210
www.osha.gov

PCA — Portland Cement Association
5420 Old Orchard Road; Skokie, IL 60077
847-966-6200
www.portcement.org

PCI Precast/Prestressed Concrete Institute
209 W. Jackson Blvd, Suite 500.; Chicago, IL 60606-6938
312-786-0300
www.pci.org

PS Product Standard of NBS (U.S. Department of Commerce)

RFCI Resilient Floor Covering Institute
401 E. Jefferson Street, Suite 102; Rockville, MD 20850
301-340-8580
www.rfci.com

RIS Redwood Inspection Service (Grading Rules)
405 Enfrente Drive, Suite 200; Novato, CA 94949
415-382-0662

SDI Steel Deck Institute
P.O. Box 25; Fox River Grove, IL 60021
847-458-4647
www.sdi.org

SDI Steel Door Institute
30200 Detroit Road; Cleveland, OH 44145-1967
440-899-0010
www.steeldoor.org

SIGMA Sealed Insulating Glass Manufacturers Association
401 N. Michigan Avenue, Suite 2400; Chicago, IL 60611
312-644-6610

SMACNA Sheet Metal & Air Conditioning Contractors National Association, Inc.
4201 Lafayette Center Drive; Chantilly, VA 20151-1209
703-803-2980
www.smacna.org

SPIB Southern Pine Inspection Bureau (Grading Rules)
4709 Scenic Highway, Pensacola, FL 32504-9094
850-434-2611
www.spib.org

SSPC The Society for Protective Coatings
40 24th Street, 6th Floor; Pittsburgh, PA 15222-4656
877-281-7772
www.sspc.org

TCA Tile Council of America, Inc.
100 Clemson Research Blvd.; Anderson, SC 29625

864-646-8453
www.tileusa.com

TIA/EIA Telecommunications Industry Association/Electronic Industries Alliance
2500 Wilson Blvd., Suite 300; Arlington, VA 22201
703-907-7700
www.tiaonline.org

UL Underwriter's Laboratories
333 Pfingsten Road; Northbrook, IL 60062
847-272-8800
www.ul.com

WCLIB West Coast Lumber Inspection Bureau (Grading Rules)
P.O. Box 23145; Portland, OR 97281
503-639-0651
www.wclib.com

WWPA Western Wood Products Association
522 SW 5th Avenue, Suite 500; Portland, OR 97204-2122
503-224-3930
www.wwpa.org

1.3 GOVERNING REGULATIONS/AUTHORITIES:

A. The A/E has contacted the appropriate authorities having jurisdiction for the listed regulations and codes to obtain information for preparation of the Contract Documents. The Contractor may contact authorities having jurisdiction directly for information and decisions having bearing on the Work.

1. Life Safety Code, NFPA 101, 2006 edition, and all referenced codes.
2. International Building Code, 2006 edition, International Code Council, Inc., (for all items not covered by Life Safety Code).
3. Other applicable National Fire Codes, NFPA.
4. State Energy Conservation Design Standard (ASHRAE 90.1-2004 Energy Standard).
5. State Energy Conservation Office (SECO) Suggested Water Efficiency Guidelines for Buildings and Equipment at Texas State Facilities.
6. Other applicable ASHRAE Standards
7. International Plumbing Code and International Mechanical Code, 2006 edition, International Code Council, Inc.
8. Building Service Piping, ASME/ANSI B31.9.
9. Applicable ANSI, ASTM and ASME codes and standards
10. Applicable OSHA, EPA and Texas Commission on Environmental Quality (TCEQ) regulations
11. Texas Accessibility Standards (TAS), Texas Department of Licensing and Regulations, Architectural Barriers Act, Ch. 469, Government Code.
12. Americans with Disabilities Act, Public Law 101-336, enacted July 26, 1990
13. Safety Code for Elevators and Escalators, ASME A17.1 & A17.3.

14. TIA/EIA Standards.
15. FM Global Standards for Roof Systems and Fire Protection Systems

1.4 DEFINITIONS:

A. Require and Similar Words: As needed to complete the Work and as directed by A/E, unless stated otherwise.

B. Perform: Contractor, at its expense, shall perform operations necessary to complete the Work, including furnishing of necessary labor, tools and equipment, and further including furnishing and installing of materials indicated, specified or required to complete such performance.

C. Provide: Contractor, at its expense, shall furnish and install the Work complete in place and ready for use, including furnishing of necessary labor, materials, tools, equipment and transportation. Definitions apply same to future, present and past tenses, except word "provide" may mean "contingent upon" where such is context.

D. Other Acceptable Manufacture, Equal, Or Equal, Equivalent and Words of Similar Import: It shall be understood such words are followed by expression "in opinion of A/E" unless stated otherwise.

E. Acceptable, Acceptance or Words of Similar Import: Acceptance or similar import of A/E is intended unless stated otherwise.

F. At No Extra Cost to Owner, With No Extra Compensation to Contractor, at Contractor's Expense or Terms of Similar Import: Such terms shall be understood to mean that Contractor shall perform or provide specified products, materials or operations of the Work at no increase to Contract Sum stated in executed Contract.

G. NIC: Work which is not being performed or provided as part of Contract; term shall mean "Not In This Contract" or "Not a Part of the Work to be Performed or Provided by Contractor." "NIC" work is indicated as an aid to Contractor in scheduling the amount of time and materials necessary for completion of Contract.

H. Indicated: The term "indicated" is a cross-reference to graphics, notes or schedules on Drawings, to other paragraphs or schedules in the Specifications, and to similar means of recording requirements in Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for purpose of helping reader locate cross-reference, and no limitation of location is intended except as specifically noted.

I. Directed, Requested or Similar Words: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by the ODR, A/E," "requested by the ODR, A/E," and similar directions by the ODR and A/E. However, no such implied meaning will be interpreted to extend Owner’s and A/E's responsibility into Contractor's area of construction supervision.

J. Approve: Where used in conjunction with Owner's and A/E's response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of the term "approved" will be held to limitations of Owner's and A/E's responsibilities and duties specified in General Conditions. In no case will "approval" by Owner and/or A/E be interpreted as a release of Contractor from responsibilities to fulfill requirements of Contract Documents.

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: General Contractor will pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: General Contractor will pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: General Contractor will Pay electric-power-service use charges for electricity used by all entities for construction operations.

E. Water and Sewer Service from Existing System: Water from Fort Bend County Municipal Utility District 23’s existing water system is available for use with metering from the existing fire hydrant located at the northwest corner of the property. Provide connections and extensions of services and metering as required for construction operations. Ensure extensions do not interfere with construction of the detention pond on the western portion of the tract.

F. Electric Power Service from Existing System: Electric power from CenterPoint Electric's existing system is available for use with metering. Provide connections and extensions of services and metering as required for construction operations.

G. Sewer, Water, and Electric Power Service: Use charges are specified in Section 011200 "Multiple Contract Summary."

1.4 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts.

B. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

2.2 TEMPORARY FACILITIES

A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, Construction Manager, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
3. Drinking water and private toilet.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures."

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Sewer service will be extended to the site during construction process by Fort Bend County MUD 23. Once available connect temporary sewers to municipal system as directed by authorities having jurisdiction. Prior to availability of municipal system contractor shall provide portable toilets and use storage tanks for sewage generated on site. Contractor shall ensure waste effluent is pumped and removed from the site in a lawful manner.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Water Service: Connect to Fort Bend County Municipal Utility District 23 existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.

F. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

G. Electric Power Service: Connect to Centerpoint Electric’s existing electric power service. Maintain equipment in a condition acceptable to Owner.

H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.
2. Connect temporary service to CenterPoint's existing power source via temporary pole, as directed by CenterPoint.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

J. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install Wi-Fi cell phone access equipment and one 1 land-based telephone line for each field office.

1. At each telephone, post a list of important telephone numbers.
   a. Police and fire departments.
   b. Ambulance service.
   c. Contractor's home office.
   d. Contractor's emergency after-hours telephone number.
   e. Architect's office.
   f. Engineers' offices.
   g. Owner's office.
   h. Principal subcontractors' field and home offices.

K. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

L. Project Computer: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:

1. Processor: Intel Core i5 or i7.
2. Memory: 16 gigabyte.
3. Disk Storage: 1 -terabyte hard-disk drive and combination DVD-RW/CD-RW drive.
4. Display: 24-inch (610-mm) LCD monitor with 256-Mb dedicated video RAM.
5. Full-size keyboard and mouse.
6. Network Connectivity: 10/100BaseT Ethernet.
7. Operating System: Microsoft Windows 10 Professional.
8. Productivity Software:

   a. Microsoft Office Professional, 2013 or higher, including Word, Excel, and Outlook.
   b. Adobe Reader DC.
   c. WinZip 10.0 or higher.

1. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
2. Internet Service: Broadband modem, router, and ISP, equipped with hardware firewall, providing minimum 10.0-Mbps upload and 15-Mbps download speeds at each computer.
3. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
4. Backup: External hard drive, minimum 2 terabytes, with automated backup software providing daily backups.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
2. Utilize designated area within existing building for temporary field offices.
3. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Section 312000 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proof rolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course

pavement before installation of final course in accordance with Section 321216 "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Provide temporary offsite parking areas for construction personnel.

F. Storage and Staging: Use designated areas of Project site for storage and staging needs.

G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

H. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
    a. Provide temporary, directional signs for construction personnel and visitors.
3. Maintain and touch up signs, so they are legible at all times.

I. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

J. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 011000 "Summary."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

G. Site Enclosure Fence: Before construction operations begin, furnish, and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting the number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.

5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
   a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
   b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
   c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:

1. Division 01 Section "References" for applicable industry standards for products specified.
2. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
3. Divisions 02 through 49 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

a. Specification Section number and title.
b. Generic name used in the Contract Documents.
c. Proprietary name, model number, and similar designations.
d. Manufacturer's name and address.
e. Supplier's name and address.
f. Installer's name and address.
g. Projected delivery date or time span of delivery period.
h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified material or product cannot be provided.
    b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
    g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
    i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
    j. Cost information, including a proposal of change, if any, in the Contract Sum.
    k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
    l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

    a. Form of Acceptance: Change Order.
    b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
    b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.

3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.

9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.

10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

A. Conditions: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner's portion of the Work.
6. Coordination of Owner-installed products.
7. Progress cleaning.
8. Starting and adjusting.
9. Protection of installed construction.

B. Related Requirements:

1. Section 011000 "Summary" for coordination of Owner's separate contracts, and limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.4 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at Project site.

1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:

    a. Contractor's superintendent.
    b. Trade supervisor responsible for cutting operations.
    c. Trade supervisor(s) responsible for patching of each type of substrate.
    d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.

2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.6 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Professional Engineer Qualifications: Refer to Section 014000 "Quality Requirements."

C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Plumbing piping systems.
    f. Mechanical systems piping and ducts.
    g. Control systems.
    h. Communication systems.
    i. Fire-detection and -alarm systems.
    j. Conveying systems.
    k. Electrical wiring systems.
    l. Operating systems of special construction.

3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

B. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb, and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

J. Repair or remove and replace damaged, defective, or nonconforming Work.

1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.4 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.5 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's construction personnel and Owner's separate contractors.

1. Refer to Section 011000 "Summary" for other requirements for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel and Owner's separate contractors.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel and Owner's separate contractors at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.6 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

I. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.8 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

D. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:
1. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.
2. Section 017419 – Construction Waste Management
3. Section 017839 – Project record documents.
4. Section 017500 – Operation and maintenance data.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at final completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.

5. Submit testing, adjusting, and balancing records.
6. Submit sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.

5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit final completion photographic documentation.
6.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

C. When contractor considers work complete, submit written certification that:
1. Contract documents have been reviewed.
2. Work has been inspected for compliance with contract documents.
3. Equipment and systems have been tested, adjusted and balanced, and are fully operational.
4. Operation of systems has been demonstrated to Owner's personnel.
5. Work is complete and ready for final inspection.

D. Should Architect/Engineer's or Project Manager's inspection find work incomplete, he will promptly notify contractor in writing, listing observed deficiencies.

E. Contractor shall remedy deficiencies and send a second certification of final completion.

F. When Architect/Engineer and Project Manager find work is complete, they will consider closeout submittals.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Submit list of incomplete items in the following format:
a. PDF electronic file. Architect will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. For items of work delayed beyond date of substantial completion, provide updated submittal listing date of acceptance as start of warranty period.

D. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

E. Execute and assemble documents from subcontractors, suppliers and manufacturers.

F. Submit prior to final application for payment.

G. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit on digital media acceptable to Architect.

H. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.

d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

    1) Clean HVAC system and provide written report on completion of cleaning.

p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be

repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit three paper copies. Architect will return two copies.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and prior to commencing demonstration and training.

E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of

contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.

7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.

4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed and identify color coding where required for identification.

1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance

service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

    a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

1.11 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:
1. Section 017700 "Closeout Procedures" for general closeout procedures.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Individual Specifications Sections: Manufacturer’s certificates and certificates of inspection.

1.3 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. In addition to requirements in General Conditions, Maintain at the site for Owner one record copy of:
1. Contract Drawings.
2. Specifications.
3. Addenda.
4. Reviewed shop drawings, product data, and samples.

B. Store Record Documents and samples in Field Office apart from documents used for construction. Provide files, and secure storage for Record Documents and samples.

C. Label and file record Documents and samples in accordance with Section number listings in Table of Contents of this Project Manual. Label each document “PROJECT RECORD” in neat, large, printed letters.

D. Maintain Record Documents in a clean, dry and legible condition. Do not use Records Documents for construction purposes.

E. Keep Record Documents and samples available for inspection by Architect/Engineer.

1.4 RECORDING

A. Record information on a set of black line opaque drawings, and in a copy of a Project Manual.

B. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.

C. Construction Drawings and Shop Drawings: Legibly mark each item to record actual construction, including:
1. Measured depths of elements of foundation in relation to finish first floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction.
4. Field changes of dimension and detail.
5. Details not on original Contract Drawings.

D. Other Documents: Maintain manufacturer's certifications, inspection certifications, and field test records, required by individual Specifications sections.

1.5 CLOSEOUT SUBMITTALS

A. At Contract closeout, deliver Record Documents and samples under provisions of Section 017710

B. Record Drawings: Comply with the following:

1. Number of Copies: Submit one PDF set of marked-up record prints.
2. Transmit, listing:
   a. Date.
   b. Project title and number.
   c. Contractor's name, address, and telephone number.
   d. Number and title of each Record Document.
   e. Signature of Contractor or authorized representative.
3. Number of Copies: Submit copies of record Drawings as follows:

   a. Final Submittal:
      1) Submit PDF electronic files of record drawings. Provide each drawing, whether or not changes and additional information were recorded.

C. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

D. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

E. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

F. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.6 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Construction Work Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.
    n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

1.7 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file.

1.8 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

C. Format: Submit record Product Data as annotated PDF electronic file.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.9 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.10 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

B. Allowances: Furnish demonstration and training instruction time under the demonstration and training allowance as specified in Section 012100 "Allowances."

C. Unit Price for Instruction Time: Length of instruction time will be measured by actual time spent performing demonstration and training in required location. No payment will be made for time spent assembling educational materials, setting up, or cleaning up. See requirements in Section 012200 "Unit Prices."

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Architect.
d. Name of Construction Manager.
e. Name of Contractor.
f. Date of video recording.

2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.5 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.7 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Systems and equipment operation manuals.
    c. Systems and equipment maintenance manuals.
    d. Product maintenance manuals.
    e. Project Record Documents.
    f. Identification systems.
    g. Warranties and bonds.
    h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.

b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.

c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.8 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.9 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
1. Owner will furish an instructor to describe Owner's operational philosophy.
2. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral or a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of at least 12 megapixels and capable of recording in full HD mode

1. Submit video recordings on CD-ROM or thumb drive.
2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:

    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. Email address.

B. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

    1. Furnish additional portable lighting as required.

C. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

D. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

SECTION 03200 CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Concrete reinforcing, including materials, fabrication, placement and quality assurance of bars, ties, supports and welded wire fabric for reinforced concrete elements.

B. Related Sections:

1. Section 03300 “Cast-In-Place Concrete” for concrete materials and placement.

1.3 REFERENCES

A. Standards referenced in this Section are:

1. ACI 315, Details and Detailing of Concrete Reinforcement.
2. ACI 318, Building Code Requirements for Structural Concrete.
3. ACI 350, Code Requirements for Environmental Engineering Concrete Structures.
4. ANSI/AWS D1.4, Structural Welding Code - Reinforcing Steel.
5. ASTM A82, Specification for Steel Wire, Plain, for Concrete Reinforcement.
6. ASTM A185, Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
7. ASTM A615, Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
8. ASTM A706, Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
9. ASTM E329, Specification for Agencies Engaged in Construction Inspection and/or Testing.

10. Concrete Reinforcing Steel Institute (CRSI), CRSI 1MSP, Manual of Standard Practice.

11. ICC Evaluation Service (ES) AC 308, Acceptance Criteria for Post-Installed Anchors in Concrete Elements.

1.4 ACTION SUBMITTALS

A. Shop Drawings:

1. Drawings for fabricating, bending, and placing concrete reinforcing. Comply with ACI 315, Parts A and B.

2. For walls, show elevations at minimum scale of 1/4-inch to one foot.

   a. Elevations shall show all openings and reference details that identify additional reinforcing required around each opening.

   b. Elevations shall denote each wall intersection and reference a detail that identifies additional reinforcing required at wall intersection. As an alternate to providing separate details for each wall intersection, provide overall plan detailing only the additional wall intersection reinforcing for each wall intersection.

3. For slabs and mats, show top and bottom reinforcing on separate plan views.

   a. Plans shall show all openings and shall reference details that identify additional reinforcing around each opening.

4. Show bar schedules, stirrup spacing, diagrams of bent bars, location of bar splices, length of lap splices, arrangements, and assemblies, as required for fabricating and placing concrete reinforcing unless otherwise noted.

5. Provide plans and elevations detailing location, spacing, and lengths of masonry wall dowels, where masonry is required. Coordinate location of dowels with masonry openings and with standard modular spacing. Submit masonry wall dowels with reinforcing submittal for element into which masonry dowel will be embedded. Coordinate with Section 04201, Unit Masonry Construction.

6. Splices shall be kept to a minimum. Avoid, when possible, splices in regions of maximum tensile stresses.

7. Drawings detailing location of all construction and expansion joints, as required under Section 03251, Concrete Joints, shall be submitted and approved before Shop Drawings for reinforcing are submitted.

8. Drawings detailing location, spacing, edge distance, and embedment depth of adhesive dowels. Adhesive system shall be submitted and approved before Shop Drawings with adhesive dowels are submitted.

B. Product Data:

1. Manufacturer's product data for adhesive, if not submitted under other Sections.

2. Adhesive manufacturer's test data and ICC ES report to verify specified capacity of adhesive dowels.

1.5 INFORMATION SUBMITTALS

A. Certificates:

1. Steel manufacturer's certificates of mill analysis, tensile, and bend tests for reinforcing steel.

2. Certification of welders and weld procedures for splices.

3. Adhesive manufacturer's certification verifying that installer is qualified and using proper installation procedures.

a. If anchors are being installed vertically, upwardly inclined or horizontally to support sustained tension, installer shall be certified in accordance with the ACI/CRSI Adhesive Anchor Installer Certification program.

B. Manufacturer's Instructions:

1. Installation instructions for adhesive systems.

C. Field Quality Control Submittals:

1. Reports of all field quality control testing, where applicable.

2. Results of required inspection of welded splices of reinforcing bars.

3. Results of required tensile testing of adhesive dowels. Include size and location of bars tested.

D. Special Procedure Submittals:

1. Description of reinforcing weld locations and weld procedures.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Testing Laboratory Qualifications: Shall meet requirements of ASTM E329 and shall have experience in the testing welded splices of reinforcing steel and tension testing of reinforcing bars set in adhesive in hardened concrete.

2. Installer of Adhesive Dowels Qualifications: Shall be experienced and certified by manufacturer of adhesive as possessing necessary training for installing manufacturer's products. Distributors or manufacturer's representatives shall not provide product training unless qualified as certified trainers by anchor manufacturer.

B. Certifications

1. Weld Procedures: For types of splices and grades of reinforcing used in the Work, weld procedures for welded reinforcing steel splices shall be certified in accordance with ANSI/AWS D1.4.

2. Welders: For types of splices and grades of reinforcing used in the Work, welders shall be certified for welding reinforcing steel splices in accordance with ANSI/AWS D1.4.

1.7 DELIVERY, HANDLING, AND STORAGE

A. Deliver concrete reinforcing products to Site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings on approved Shop Drawings.

B. Store concrete reinforcing products to prevent damage and accumulation of dirt and excessive rust. Store on heavy wood blocking so that reinforcing does not come into contact with the ground.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing Bars: Shall be in accordance with ASTM A615, and as follows:

1. Provide Grade 60 for all bars, unless indicated otherwise.

2. At beams and columns forming frames and wall boundary elements, where shown on the Drawings, provide ASTM A706 or ASTM A615, Grade 60, with tested actual maximum yield stress of 78,000 psi and ratio of actual tested

B. Mechanical Couplers: Reinforcement bars may be spliced with mechanical connection. Connection shall be full mechanical connection that shall develop in tension or compression, as required, at least 125 percent of specified yield strength (fy) of bar in accordance with ACI 318 and ACI 350. Where splices at the face of wall are shown or approved by Architect, form saver-type mechanical couplers may be used. Form-saver couplers shall have integral plates designed to positively connect coupler to formwork.

C. Steel Wire: Shall be in accordance with ASTM A82.

D. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting and fastening reinforcing in place.

1. Use wire bar type supports complying with CRSI 1 MSP recommendations, except as specified in this Section. Do not use wood, brick, or other unacceptable materials.

E. Adhesive Dowels:

1. Dowels:

a. Dowel reinforcing bars shall conform to ASTM A615, Grade 60.

2. Adhesive:

a. Hilti HIT-HY 200-R V3 or as shown on drawings.

2.2 FABRICATION

A. General: Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI 1 MSP. In case of fabricating errors, do not re-bend or straighten reinforcing in manner that injures or weakens material.

B. Unacceptable Materials: Reinforcing with one or more of the following defects is not allowed:

1. Bar lengths, bends, and other dimensions exceeding specified fabrication tolerances.

2. Bends or kinks not shown on approved Shop Drawings.

3. Bars that do not meet or exceed their ASTM specification requirements when hand-wire-brushed, with respect to cross section, nominal weight, or average height of deformations.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the substrate and conditions under which concrete reinforcing is to be placed and notify Architect in writing of unsatisfactory conditions. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with applicable recommendations of Laws and Regulations, applicable standards, and CRSI 1 MSP for details and methods of reinforcing placement and supports.

B. Clean reinforcing to remove loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Position, support, and secure reinforcing against displacement during formwork construction and concrete placing. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

1. Place reinforcing to obtain minimum concrete coverages specified in ACI 318, AC I 350, and the Contract Documents. Arrange, space, and securely tie bars and bar supports together with 16-gage wire to hold reinforcing accurately in position during concrete placing. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.

2. Prior to placing concrete, using surveyor’s level or string line, demonstrate to Architect that specified cover of reinforcing has been attained.

3. Do not secure reinforcing steel to forms with wire, nails, or other ferrous metal. Metal supports subject to corrosion shall not touch formed or exposed concrete surfaces.

D. Allowable Placing Tolerances: Comply with ACI 318, Chapter 7 - Details of Reinforcement, and ACI 350, Chapter 7 - Details of Reinforcement, except as specified in this Section:

1. Concrete surfaces in contact with liquid shall have minimum of two inches of concrete over reinforcing steel.

E. Provide sufficient number of supports of strength required to carry reinforcing. Do not place reinforcing bars more than two inches beyond last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

F. Lap Splices:

1. Provide standard reinforcing splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements shown for minimum lap of spliced bars as shown on the Drawings.

G. Mechanical Couplers:

1. Mechanical butt splices shall be in accordance with recommendations of mechanical splicing device manufacturer. Butt splices shall develop 125 percent of specified minimum yield tensile strength of spliced bars or of smaller bar in transition splices. Bars shall be flame-dried before butt splicing. Provide adequate jigs and clamps or other devices to support, align, and hold longitudinal centerline of bars being butt spliced in straight line.

H. Welded Splices:

1. When field welding of reinforcing is required on the Drawings or allowed by Architect in writing, welding of reinforcing bars shall conform to ANSI/AWS D1.4. Preheating and rate of cooling requirements shall be based on bar steel chemistry and ANSI/AWS D1.4. Welded splices shall be sized and constructed to transfer minimum of 125 percent of specified minimum yield tensile strength of spliced bars or of smaller bar in transition splices. Unless otherwise allowed by Architect in writing, welding of crossing bars (tack welding) for assembly of reinforcement is prohibited.

2. Welding of wire to wire, and of wire or welded wire fabric to reinforcing bars or structural steels, shall conform to applicable provisions of ANSI/AWS D1.4 and Architect's requirements for the particular application.

3. After completing welding on coated reinforcing bars, repair coating damage as specified in this Section. Welds and steel splice members, when used to splice bars, shall be coated with same material used for repair of coating damage.

I. Adhesive Dowels:

1. Adhesive dowels shall be reinforcing bar dowels set in an adhesive in hole drilled into hardened concrete. Comply with manufacturer's printed installation instructions regarding hole diameter, drilling method, embedment depth required to fully develop required tensile strength, and hole cleaning and preparation instructions.

2. Unless more-stringent standards are required by adhesive system manufacturer, comply with the following:

a. Drill holes to adhesive system manufacturer's recommended diameter and depth to develop required tensile strength. Holes shall not be more than 1/4-inch greater than nominal bar diameter, and hole depth shall not be less than twelve times nominal bar diameter. Hammer-drill holes. Cored holes are not allowed.

b. Embedment depths shall be based on compressive strength of 2,000 psi when embedded in existing concrete, and 4,000 psi when embedded in new concrete.

c. Determine location of existing reinforcing steel in vicinity of proposed holes prior to drilling. Adjust location of holes to be drilled to avoid drilling through or damaging existing reinforcing bars only when approved by Architect.

d. Before setting adhesive dowel, hole shall be made free of dust and debris by method recommended by adhesive system manufacturer. Hole shall be brushed, with manufacturer-approved brush and blown clean with clean, dry, oil-free compressed air to remove all dust and loose particles. Hole shall be dry as defined by adhesive system manufacturer.

e. Inject adhesive into hole through injection system mixing nozzle and necessary extension tubes, placed to bottom of hole. Withdraw discharge end as adhesive is placed, but keep end of tube immersed to prevent forming air pockets. Fill hole to depth that ensures that excess material is expelled from hole during dowel placement.

f. Twist dowels during insertion into partially filled hole to guarantee full wetting of bar surface with adhesive. Insert bar slowly to avoid developing air pockets.

3.3 FIELD QUALITY CONTROL

A. Site Inspections and Tests:

1. Do not place concrete until reinforcing is inspected and permission for placing concrete is granted by Architect. Concrete placed in violation of this provision will be rejected.

2. Do not close up formwork for walls and other vertical members until reinforcing is inspected and permission for placing concrete is granted by Architect. Concrete placed in violation of this provision will be rejected.

3. Testing of Adhesive Dowels: Employ testing agency to perform field quality control testing of drilled dowel installations. After manufacturer's recommended curing period and prior to placing connecting reinforcing, proof-test for pullout ten percent of adhesive dowels installed. Adhesive dowels shall be tensioned to 60 percent of specified yield strength. Where dowels are located less than six bar diameters from edge of concrete, Architect will determine tensile load required for test. If one or more dowels fail, retest all dowels installed for the Work. Dowels that fail shall be reinstalled and retested at CONTRACTOR's expense.

4. Inspection of Welded Splices: Employ testing agency to perform field quality control testing of welded splices. All welded splices shall be visually inspected. Radiographically

test minimum of five percent of butt splice welds. Repair defective welds to be completely sound.

B. Manufacturer's Services:

1. Provide qualified adhesive manufacturer's representative at the Site during initial installation of adhesive dowel systems to train installing personnel in proper selection and installation procedures. Manufacturer's representative shall observe to verify that installer demonstrates proper installation procedures for adhesive dowels and adhesive material. Each installer shall be certified in writing by manufacturer as qualified to install adhesive anchors.

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Sections:

1. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

2. Section 312000 "Earth Moving" for drainage fill under slabs-on-ground.

3. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.

2. Fly ash.

3. Slag cement.

4. Blended hydraulic cement.

5. Silica fume.

6. Performance-based hydraulic cement

7. Aggregates.

8. Admixtures:

   a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

9. Vapor retarders.

10. Floor and slab treatments.

11. Liquid floor treatments.

12. Curing materials.

13. Joint fillers.

14. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.

2. Minimum 28-day compressive strength.

3. Durability exposure class.

4. Maximum w/cm.

5. Slump limit.

6. Air content.

7. Nominal maximum aggregate size.

8. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.

9. Intended placement method.

10. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

a. Location of construction joints is subject to approval of the Architect.

D. Samples: For vapor retarder.

E. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.

2. Location within Project.

3. Exposure Class designation.

4. Formed Surface Finish designation and final finish.

5. Final finish for floors.

6. Curing process.

7. Floor treatment if any.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.

2. Ready-mixed concrete manufacturer.

3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.

2. Admixtures.

3. Curing compounds.

4. Floor and slab treatments.

5. Bonding agents.

6. Adhesives.

7. Vapor retarders.

8. Semirigid joint filler.

9. Joint-filler strips.

10. Repair materials.

C. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

D. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.

2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.

E. Preconstruction Test Reports: For each mix design.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician with experience installing and finishing concrete.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency

laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Field Quality Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CPP 610.1 or an equivalent certification program.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.8 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301

3. Do not use frozen materials or materials containing ice or snow.

4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.

5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.9 ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

A. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials".

B. ACI 301, "Specifications for Structural Concrete".

C. ACI 318, “Building Code Requirements for Structural Concrete”

D. ASTM C94/C94M, “Standard Specification for Ready-Mixed Concrete”.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.

2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.

3. Obtain aggregate from single source.

4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I, Type II, or Type I/II.

2. Fly Ash: ASTM C618, Class F.

3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

4. Silica Fume: ASTM C1240 amorphous silica.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:

a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.

b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.

c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.

2. Maximum Coarse-Aggregate Size: 3/4-inch nominal.

3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.

2. Retarding Admixture: ASTM C494/C494M, Type B.

3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.

5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.

6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water and Water Used to Make Ice: ASTM C94/C94M, complying with ASTM C1602/C1602M, including all limits listed in Table 2 and the requirements of paragraph 5.4.

2.2 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.3 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F: Black.

b. Ambient Temperature between 50 deg F and 85 deg F: Any color.

c. Ambient Temperature Above 85 deg F: White.

D. Curing Paper: Eight-feet- wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.

E. Water: Potable or complying with ASTM C1602/C1602M.

2.4 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, aromatic polyuria with a Type A shore durometer hardness range of 90 to 95 in accordance with ASTM D2240.

C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Floor Slab Protective Covering: Eight-feet- wide cellulose fabric.

2.5 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 4000 psi at 28 days when tested in accordance with ASTM C109/C109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.

4. Compressive Strength: Not less than 4000 psi at 28 days when tested in accordance with ASTM C109/C109M.

2.6 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.7 CONCRETE MIXTURES

A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.

1. Exposure Class: ACI 318 F1 C1.

2. Minimum Compressive Strength: 4000 psi at 28 days.

3. Maximum w/cm: 0.55

4. Slump Limit: 4 inches, plus or minus 1 inch or 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches, plus or minus 1 1/2 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.

5. Air Content:

a. Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size or 4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size.

6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

B. Class B: Normal-weight concrete used for interior slabs-on-ground.

1. Exposure Class: ACI 318 W1 CO.

2. Minimum Compressive Strength: 4000 psi at 28 days.

3. Maximum w/cm: 0.50.

4. Minimum Cementitious Materials Content: 540 lb/cu. yd..

5. Slump Limit: 4 inches, plus or minus 1 inch or 8 inches, plus or minus 1 1/2 inch for concrete with verified slump of 3 inches, plus or minus 1 inch, before adding high-range water-reducing admixture or plasticizing admixture at Project site.

6. Air Content:

a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

7. Limit water-soluble, chloride-ion content in hardened concrete to 1 percent by weight of cement.

C. Class C: Normal weight concrete used for concrete toppings on steel deck inside the building envelope.

1. Exposure Class: ACI 318 C0.

2. Minimum Compressive Strength: 4000 psi at 28 days.

3. Minimum Cementitious Materials Content: 470 lb/cu. Yd.

4. Maximum Size Aggregate: 1/2 inch.

5. Slump Limit: 3 inches, plus 1 inch or minus 2 inches.

6. Air Content: 0 percent, plus or minus 0.5 percent at point of delivery

7. Limit water-soluble, chloride-ion content in hardened concrete to 1 percent by weight of cement.

8. Retarding Admixture: Not allowed.

9. Accelerating Admixture: Not allowed.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and furnish batch ticket information.

B. Project-Site Mixing: Not allowed except for prepackaged repair materials. Mix prepackaged repair materials in strict accordance with manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.

2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.

2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.

4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.

2. Face laps away from exposed direction of concrete pour.

3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.

4. Lap joints 6 inches and seal with manufacturer's recommended tape.

5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.

6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.

7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

3.5 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.

2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.

    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Space vertical joints in walls **as** indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.

4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.

2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.

2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.

2. Deposit concrete to avoid segregation.

3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.

4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

a. Do not use vibrators to transport concrete inside forms.

b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.

c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.

d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete slabs in a checkerboard sequence.

2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Maintain reinforcement in position on chairs during concrete placement.

4. Screed slab surfaces with a straightedge and strike off to correct elevations.

5. Level concrete, cut high areas, and fill low areas.

6. Slope surfaces uniformly to drains where required.

7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.

8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-3.0:

a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.

b. Remove projections larger than 1/8 inch.

c. Patch tie holes.

d. Surface Tolerance: ACI 117 Class A.

e. Locations: Apply to concrete surfaces to receive a rubbed finish.

B. Rubbed Finish: Apply the following to as cast grade beam surface finishes:

1. Smooth-Rubbed Finish:

a. Perform no later than one day after form removal.

b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.

c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.

3.8 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.

2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.

3. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.

2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.

3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

4. Do not add water to concrete surface.

5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.

6. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

    a. Slabs on Ground:

        1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch and also no more than 1/16 inch in 2 feet.

7. Coordinate required final finish with Architect before application.

8. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.

2. Mix, place, and cure concrete, as specified, to blend with in-place construction.

3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.

2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.

3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces.

2. If forms remain during curing period, moist cure after loosening forms.

3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.

    b. Continuous Sprinkling: Maintain concrete surface continuously wet.

    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.

    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.

    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

        1) Recoat areas subject to heavy rainfall within three hours after initial application.

        2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.

2. Interior Concrete Floors:

    a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
            a) Lap edges and ends of absorptive cover not less than 12-inches.
            b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

        2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
            a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
            b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
   a) Water.
   b) Continuous water-fog spray.

b. Floors to Receive Polished Finish: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

   a) Lap edges and ends of absorptive cover not less than 12 inches.

   b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

   a) Water.

   b) Continuous water-fog spray.

c. Floors to Receive Chemical Stain:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.

2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.

3) Butt sides of curing paper tight; do not overlap sides of curing paper.

4) Leave curing paper in place for duration of curing period, but not less than 28 days.

d. Floors to Receive Urethane Flooring:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.

3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.

4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

3.11 TOLERANCES

A. Conform to ACI 117.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least two months.

2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Architect.

2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

a. Limit cut depth to 3/4 inch.

b. Make edges of cuts perpendicular to concrete surface.

c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.

d. Fill and compact with patching mortar before bonding agent has dried.

e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.

b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

a. Correct low and high areas.

b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

3. After concrete has cured at least 14 days, correct high areas by grinding.

4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.

a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.

a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with repair topping.

a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.

b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.

a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.

b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.

c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.

d. Place, compact, and finish to blend with adjacent finished concrete.

e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.

b. Dampen cleaned concrete surfaces and apply bonding agent.

c. Place patching mortar before bonding agent has dried.

d. Compact patching mortar and finish to match adjacent concrete.

e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.

2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.

3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

1) Project name.

2) Name of testing agency.

3) Names and certification numbers of field and laboratory technicians performing inspections and testing.

4) Name of concrete manufacturer.

5) Date and time of inspection, sampling, and field testing.

6) Date and time of concrete placement.

7) Location in Work of concrete represented by samples.

8) Date and time sample was obtained.

9) Truck and batch ticket numbers.

10) Design compressive strength at 28 days.

11) Concrete mixture designation, proportions, and materials.

12) Field test results.

13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.

14) Type of fracture and compressive break strengths at seven days and 28 days.

B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

C. Inspections:

1. Headed bolts and studs.

2. Verification of use of required design mixture.

3. Concrete placement, including conveying and depositing.

4. Curing procedures and maintenance of curing temperature.

5. Verification of concrete strength before removal of shores and forms from beams and slabs.

6. Batch Plant Inspections: On a random basis, as determined by Architect.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.

b. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;

a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:

a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C31/C31M:

a. Cast and laboratory cure two sets of three 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C39/C39M.

a. Test one set of three laboratory-cured specimens at seven days and one set of three specimens at 28 days.

b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is less than or equal to 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.

8. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

9. Additional Tests:

a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

1) Acceptance criteria for concrete strength shall be in accordance with ACI 301, section 1.6.6.3.

10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

11. Correct deficiencies in the Work as directed by the Architect that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 24 hours of completion of floor finishing and promptly report test results to Architect.

3.15 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.

2. Diaper hydraulic equipment used over concrete surfaces.

3. Prohibit vehicles from interior concrete slabs.

4. Prohibit use of pipe-cutting machinery over concrete surfaces.

5. Prohibit placement of steel items on concrete surfaces.

6. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION 033000

SECTION 033543 - POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polished concrete finishing, including staining.
2. Concrete for polished concrete, including concrete materials, mixture design, placement procedures, initial finishing, and curing is specified in Section 033000 "Cast-in-Place Concrete."

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete not designated as polished concrete.

1.2 DEFINITIONS

A. Abrasive Impregnated Pad: Resembling typical floor maintenance burnishing pads containing industrial grade diamonds with capacity to refine concrete surfaces on a microscopic level.

B. Abrasive Tooling: Containing industrial grade abrasives in a bonded matrix (such as metallic, resinous, ceramic) attached to rotating heads to refine concrete substrates.

C. Gloss-Enhancing Treatment: Water- or solvent-based film-forming materials that penetrate or adhere to polished and densified concrete surfaces, leaving a clear, durable, high-gloss finish.

D. Grinding: Process achieved using coarse abrasives to remove slab surfaces without creating a uniform finish.

E. Haze Index: Reflection haze measurements defined in accordance with ASTM D4039; expressed as numerical differences between 60 and 20-degree specular-gloss readings.

F. Honing: Process achieved using bonded-abrasive tooling to give surfaces smooth, matte finishes.

G. Mockup: Sample of completed polished Work to be reviewed in accordance with accepted levels of craftsmanship.

H. Mohs Hardness Scale: Scalar measurement of relative hardness of minerals by their resistance to scratching.

I. Polishing: Using bonded abrasive tooling to give surfaces smooth finishes that complies with measurable specified aesthetic requirements. Higher sheens are achieved using incrementally finer abrasives in the polishing process.

J. Polishing Process: Steps required to transform concrete substrates to the specified finished gloss. These steps may include a sequence of bonded-abrasives grits spanning the grinding, honing, and polishing stages.

K. Stain Prevention Film: Removable floor surface barrier that prevents surface staining and shadowing from joint filler overfill or repair material overfill, or both.

L. Stain-Resistant, Gloss-Enhancing Treatment: Water-based, film-forming material that penetrates polished and densified concrete surfaces leaving a clear, durable, high-gloss, and stain-resistant surface finish.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with polished concrete to attend, including the following:

    a. Contractor's superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Cast-in-place concrete subcontractor.
    e. Polished concrete finishing Subcontractor.
    f. Concrete finishing system manufacturer's field representative.

2. Advise Architect/Engineer, Contractor, and Owner or Owner's representative a minimum seven days in advance of conference.
3. Review cold- and hot-weather concreting procedures, curing procedures, construction joints, concrete repair procedures, concrete finishing, and protection of polished concrete.
4. Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending within seven days, but prior to placement of slabs to be polished.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product include manufacturer's written technical literature, data, application instructions, and recommendations.

B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints. Include sequencing Work details of coordination with other trades' interior construction, weather protection, and necessity of protection, if other construction activities may damage in-place polished Work.

C. Repair Data: Submit manufacturer's written instructions for each repair product. Include manufacturer's technical data, application instructions, and recommendations.

D. Surface Defect Repairs: Submit plan locating and identifying surface defects. Reference surface defect locations to building column lines.

E. Samples for Initial Selection: For each type of product requiring color selection.

F. Samples for Verification: For each type of exposed color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Quality control plan.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Stain materials.
2. Liquid floor treatments.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in performing polished concrete finishing with a minimum five previous projects similar in material, design, and extent to that indicated for this Project, whose work has resulted in applications with a record of successful in-service performance over the last three years, and that employs workers trained and certified by manufacturer of penetrating liquid floor treatments and stain materials.

B. Source Limitations for Polished Concrete Finishing Materials: Obtain concrete floor liquid treatment products, joint fillers, and sealant from one manufacturer with resources to provide products of consistent quality in physical properties and resulting appearance.

1.7 MOCKUPS

A. During or after casting concrete, build concrete finish mockups 10 by 10 ft. (3.05 by 3.05 m) to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Concrete mockup area to be minimum 28-days old prior to review.
3. Provide mockup area lighting similar in illumination, lumen output, color temperature, and both height and distance from surface as that of final areas to receive polished concrete finishing.

4. Use same personnel, equipment, tools, and methods as to be used for remaining interior floor slabs.
5. Mockup to demonstrate each color, pattern, liquid floor treatment, each different joint treatment, inside wall edge treatments, and any protective sealers.
6. Prior to starting grind and polish operations mockup, verify surface hardness with Mohs hardness testing kit.
7. Demonstrate curing, finishing, and protecting of polished concrete.
8. Provide simulated repairs to demonstrate acceptable repair procedures for acceptable color and texture matching.
9. Do not begin full-scale product applications or floor-polishing operations; or deliver major materials until Architect has approved mockup.
10. Protect mockup from physical damage or staining; retain mockups until final acceptance of polished concrete.
11. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 FIELD CONDITIONS

A. Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation and other conditions affecting chemical performance.

B. Verify building shell keeps out wind, rain, snow, and other adverse weather effects that could damage polishing Work.

C. Do Not Begin Work Until:

1. Water, power, lighting, and ventilation comply with manufacturer's written instructions.
2. Slab Substrate Temperature: 50 deg F (10 deg C) minimum.
3. Lighting Measured at Slab Surface: 40 fc (lx) minimum.
4. Area is broom clean with minimal construction materials and debris.

D. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 STAIN MATERIALS

A. Penetrating Acetone Stain: Prepackaged blends of concentrated powdered metallic pigments formulated specifically for dilution with acetone.

1. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
   a. Aquatint by Direct Colors.

2. Color: To be selected from manufacturer's list of standard colors.

2.2 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

1. Basis-of-Design Product: Subject to compliance with requirements, provide
   Euclid Chemical Company (The); Storm Grey Vibrance Dye by Direct Color.
   or comparable product.

B. Stain Resistant Gloss Enhancing Treatment: Water based polymeric sealer, minimum 20 percent solids, containing stain resistant additive, and densifying characteristics of lithium silicate.

2.3 RELATED MATERIALS

A. Joint Sealants: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Elastomeric Joint Sealant: Single-Component Polyurethane: Provide the following:

1. Hybrid-Urethane, S, NS, 35, T, NT: Single-component, nonsag, plus 35 percent and minus 35 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 35, Uses NT, M, A, and O.

   a. Color: To be chosen from manufacturers list of standard colors.

2.4 FIELD GRINDING AND POLISHING EQUIPMENT

A. Walk-behind or ride-on equipment with multiple balanced, planetary, same direction or counter- rotating heads designed for grinding and polishing.

B. Equipment to use one of the following methods for controlling dust:

1. Integrated water-delivery system that continuously feeds water to the grinding surface.
2. Port for connection to dust collection system appropriately sized for dust generated.

C. Edge Grinding and Polishing Equipment:

1. Stand-up or hand-held edger capable of producing similar grinding and polishing results as field grinding and polishing equipment. Equipment designed for use within 1/4 inch (6 mm) of vertical surfaces.
2. Equip handheld grinders with shroud and dust collection system.

D. High-Speed Burnishing Equipment:

1. Walk-behind or ride-on equipment with a variable-speed, single or multiple rotating head spinning an abrasive impregnated pad, with or without bonded abrasives. Equipment to have dust collection system or integrated water-control system.

E. Dust Collection System:

1. Vacuum system with HEPA filtration attached to polishing equipment; capable of limiting dust to comply with OSHA-defined respirable crystalline-silica exposure limits.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for polished concrete finishing, and other conditions affecting performance of the Work.

1. Concrete slab surface cured in accordance with manufacturer's written instructions.
2. Concrete slab surface flatness and levelness comply with ASTM E1155M and manufacturer's written instructions prior to beginning polishing Work.
3. Concrete slab compressive strength in compliance.
4. Concrete slab hardness is 4 or greater in accordance with Mohs Hardness test.
5. Installation surface profile tolerances to achieve specified aggregate exposure levels.
6. Substrate deficiencies include, but are not limited to, curling, stains, cracking, trowel marks, or other surface defects that may adversely affect achieving specified polished slab finish.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Beginning polishing application indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Allow concrete to cure minimum 28 days prior to commencing polishing operations.

B. Protect surrounding surfaces that can be damaged during surface preparation.

C. Surface Preparation and Cleaning:

1. Utilizing nonpowered, handheld tools and only mild cleaning chemicals that will not damage or mar concrete surface, remove remaining laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, saw-cut residue, form glue, texture overspray, paint drippings, and other contaminants on floor surfaces.
2. Power-sweep floor area with dust-free equipment.

3. Treat oil spots with oil emulsifier and oil-absorbent materials to remove oils from below concrete surface. Scrub oil spot areas and remove liquids with vacuum.
4. Scrub floor with automatic scrubber capable of a minimum of 80 lb (32.3 kg) head pressure, each head to be equipped with cleaning combo or light grit brushes and a neutral pH cleaning detergent that is compatible with the liquid densifier/sealer. Remove liquid as floor is scrubbed. Scrub floor a second and final time with clean water only and remove liquid as floor is scrubbed. Allow slab to air dry.

D. Prior to commencement of polished concrete finishing, test floors to receive polished concrete finishing for moisture vapor emission in accordance with ASTM F1869. Rate not to exceed 5 lb per 1000 sq. ft. (24.4 kg per 1000 sq. m) in 24 hours prior to commencement.

E. Joint Preparation and Cleaning:

1. Prior to applying joint sealant, remove dust and dirt from joints and cracks according to ASTM D4258. Joint surfaces are to be structurally sound, clean, dry, free of dust, dirt, paint, efflorescence, laitance and other contaminants that prevent proper adhesion.
2. For final step in cleaning, wipe joint with solvent to remove residue.
3. Substrates are to be completely dry at time of sealant application.

3.3 SURFACE FINISH REQUIREMENTS

A. Aggregate Exposure: Provide aggregate exposure class Insert aggregate exposure Class A and in conformance with approved mockup(s).

B. Appearance: Provide level of DOI gloss Level 3 and in conformance with ASTM D5767 and approved mockup(s). Take measurements prior to application of stain resistant, gloss-enhancing, surface treatments.

C. Haze Index: 10 or less in conformance with ASTM D4039 and approved mockup(s). Take measurements prior to application of stain resistant, gloss-enhancing, surface treatments.

D. Color: as indicated on drawings, and conformance with approved mockup(s)

3.4 COLORED STAIN

A. Apply stain solution by methods and techniques required by manufacturer's written instructions to produce finish matching approved mockup.

B. Maintain wet edge, working newly applied stain solution into edges of adjacent wet edges of previously treated surfaces.

C. Maintain consistent saturation throughout application.

D. Avoid splashing, dripping, or puddling of stain solution on adjacent substrates.

3.5 GRINDING AND POLISHING

A. Polishing Process Timing: Allow concrete floor slab to cure minimum of 28 days prior to commencing polished concrete finishing.

B. Grinding and polishing shall proceed in same manner used to achieve approved mockup.

C. Grinding:

1. Begin initial grinding with equipment sized and abrasive tooling in compliance with aggregate exposure class.
2. Perform sequential grinding passes with each pass perpendicular to previous pass.
3. Overlap adjacent grinding passes to achieve even aggregate exposure without creating striping.
4. Progressively grind edges to match field (main) surface area.
5. Thoroughly scrub and rinse slab surface with clean water and cleaning surfactant to lift surface salts and laitance; vacuum up with auto scrubber between grinding passes. Dispose of waste solution in compliance with all local, state, and federal guidelines and regulations for disposal.

D. Reactive Densifier Application:

1. Ensure slab surface is clean, dry, and water-absorbent at time of densifier application.
2. Apply densifier to point of surface saturation in accordance with manufacturer's written instructions.
3. Apply reactive surface densifier in accordance with manufacturer's written instructions, ensuring application is applied to point of rejection. Continue progressively polishing with appropriate resin tooling.

E. Honing:

1. Progressively hone edges along walls and around each abutment.
2. Progressively hone slab with 100-, 200-, 400-, hybrid-, or resin-bonded tooling.
3. Sequential progression of bonded abrasive tooling required and limited to no more than double grit value of previous tooling used.
4. Between honing passes, thoroughly scrub and rinse slab surface with clean water and vacuum up with auto scrubber.
5. Perform each honing pass perpendicular to previous pass.

F. Polishing:

1. Progressively polish edges along walls and around each abutment.
2. Progressively polish slab with resin-bonded tooling.
3. Use tooling in a sequential progression, to achieve surface refinement for each grit.
4. Between polishing passes, thoroughly scrub and rinse slab surface with clean water and vacuum up with auto scrubber.
5. Perform each polishing pass perpendicular to previous pass.
6. Clean surface thoroughly between grit levels.

G. Control and legally dispose of waste products produced by grinding and polishing operations.

H. Neutralize and clean polished floor surfaces.

I. Stain Resistant Gloss Enhancing Treatment:

1. Apply stain resistant gloss enhancing treatment using manufacturer's written instructions for sprayer and tip. Immediately spread with a microfiber pad. Ensure sprayer tip is clean and in good working condition for each day's Work.
2. Use new microfiber pad for each coat, pre-wetted with surface treatment product, to pull material out to create a thin film prior to drying.
3. Remove product completely from areas of over-application, as evidenced by surface streaking, and replace with unused surface treatment product.

J. High-Speed Burnish

1. Burnish surface per manufacturer's written instructions and when applied surface treatment product has experienced the proper dry time.
2. Burnish at slow movement pace using a high-speed machine with abrasive impregnated or natural hair burnishing pads.
3. Burnish with several passes. Make each progressive pass perpendicular to previous pass.

3.6 SEMI-RIGID JOINT FILLER

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, laitance, curing compounds, sealers, and other foreign materials from joints. Leave contact faces of joints clean and dry.

C. Apply joint filler stain prevention film in accordance with manufacturer's written instructions to prevent staining or shadowing of slab from overfill of joint filler.

1. Protect interior of joint from run-off and overspray.
2. Allow joint filler stain prevention film to dry completely prior to application of joint filler.
3. Remove joint filler stain prevention film immediately after joints are filled and shaved. Do not leave on surface for extended periods of time as it's difficult to remove the longer it's left on surfaces.

D. Clean inner joint walls mechanically using dustless dry-cut saw, or similar tool, to full depth of saw cuts and 2-inch (50-mm) minimum depth in construction joints to remove form release agents, curing compounds, sealer residues, and other surface contaminations that may interfere with bond of the specified joint filler material. Then clean dust and debris from mechanically prepared joints by vacuuming joint.

E. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening. Concave joints are not acceptable.

1. Mix and install sealant and filler in accordance with manufacturer's written instructions.
2. Use primer if recommended for specific application.
3. Install semirigid joint filler full depth in saw-cut joints.
4. Construction Joints Through Slab: Fill by one of the following methods:

a. Fill joint with dry-bagged silica sand to within 2 inches (50 mm) of slab surface.
b. Use of backer rod is unacceptable.

F. Overfill joint and trim joint filler flush with top of joint after hardening.

3.7 ELASTOMERIC JOINT SEALANT

A. Apply primer liberally with a clean brush or roller. Do not allow primer to puddle or pond. Use with adequate ventilation. Polyurethane Hybrid Joint Sealant must be applied within 8 hours after primer application.]

B. Place manufacturer's backer rod or bond breaker tape in joints and ensure they're secure.

C. Using standard caulking guns, install sealant in joints in accordance with manufacturer's written instructions. Once joint is full, tool sealant using a rounded spatula to create concave surface.

D. Width to Depth Ratios:

1. Equal depth and width for joints 1/4 to 1/2 inch (6 to 13 mm) wide.
2. 1/2 width for joints 1/2 to 1 inch (13 to 25 mm) wide.
3. 1/2 inch (13 mm) is the maximum allowable sealant depth.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer each failure of Work to comply with Contract Documents.
2. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

a. Test reports to include reporting requirements of ASTM D523, ASTM D5767, and ASTM D4039, including the following items as applicable to each test and inspection:

1) Project name.
2) Name of testing agency.

3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
4) Name of polished concrete finish manufacturer.
5) Date and time of inspection, sampling, and field testing.
6) Date and time of polished concrete finishing.
7) Location in Work of polished concrete finish represented by samples.
8) Date and time sample was obtained.
9) Field test results.
10) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.

B. Testing:

1. Specular Gloss: Test in accordance with ASTM D523; measuring at three locations for areas up to 1000 sq. ft. (465 sq. m) with one additional test for each 1000 sq. ft. (465 sq. m) or fraction thereof. Select test locations randomly in each test area; distributed across entire polished floor.
2. Distinctness of Image (DOI): Test in accordance with ASTM D5767; measuring at three locations for areas up to 1000 sq. ft. (465 sq. m) with one additional test for each 1000 sq. ft. (465 sq. m) or fraction thereof. Select test locations randomly in each test area; distributed across entire polished floor.
3. Haze: Test in accordance with ASTM D4039; measuring at three locations for areas up to 1000 sq. ft. (465 sq. m) with one additional test for each 1000 sq. ft. (465 sq. m) or fraction thereof. Select test locations randomly in each test area; distributed across entire polished floor.

3.9 REPAIRS, PROTECTION, AND CLEANING

A. Repair damaged finished surfaces of polished cast-in-place architectural concrete. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.

1. Remove and replace unrepairable polished cast-in-place architectural concrete to Architect's approval.

B. Protect polished cast-in-place architectural concrete from staining, laitance, and contamination for remainder of construction.

C. Protect surfaces of polished cast-in-place architectural concrete from contamination by oil, grease, hydraulic fluid, paint, adhesives, flux, and other contaminants.

1. Prohibit vehicle and pedestrian traffic on unprotected polished concrete slab.
2. Prohibit stocking construction materials, storing equipment, or tools on unprotected polished concrete slab.
3. Prohibit parking vehicles on unprotected polished concrete slab.
4. For construction equipment on polished concrete slab, use non-marring tires and diaper components that might drip oil, hydraulic fluid, or other liquids.

5. Prohibit tire embedments (rocks, nails, screws) that will scratch or pit polished concrete slab.
6. Conduct regular inspections for tire embedment's and leaks to avoid damage to the polished concrete slab.
7. Prohibit use of pipe cutting or threading machinery on polished concrete slab.
8. Control food and drink that can stain or damage unprotected polished concrete slab.
9. Prohibit temporary placement or storage of steel on polished concrete slab.
10. Prevent acids and acidic detergents from contacting polished concrete slab.
11. Cover polished concrete slab with breathable drop cloths during painting. If paint is spilled on concrete floor, remove paint promptly.
12. Protect polished concrete slab from standing moisture for 72 hours after completion to prevent re-emulsification of surface treatment(s) prior to cure.
13. Promptly remove mortar splatter, spilled liquids, oil, grease, paint, coatings, and other surface contaminants that adversely affect completed polished concrete slab finish. Clean up using soap, water, and rinse method.
14. Maintain liquid barrier at sill plates and floor penetrations to protect both polished concrete slab and adjacent flooring from liquid intrusion.

END OF SECTION 033543

SECTION 042113 - BRICK MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Face brick.
2. Mortar and grout.
3. Ties and anchors.
4. Embedded flashing.
5. Miscellaneous masonry accessories.

B. Related Sections:

1. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
2. Section 055000 "Metal Fabrications" for furnishing steel lintels and shelf angles for brick masonry.
3. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Face brick**,** in the form of straps of five or more bricks.
2. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:

1. Face brick, in the form of straps of five or more bricks.
2. Weep holes and vents.
3. Accessories embedded in masonry.

1.4 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties.
b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include test report for efflorescence according to ASTM C 67.
d. For surface-coated brick, include test report for durability of surface appearance after 50-cycles of freezing and thawing per ASTM C 67 or a list of addresses of buildings in Project's area where proposed brick has been used successfully and with a history of durability.

2. Cementitious materials. Include brand, type, and name of manufacturer.
3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
4. Grout mixes. Include description of type and proportions of ingredients.
5. Anchors, ties, and metal accessories.

C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 QUALITY ASSURANCE

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups for each type of exposed unit masonry construction in sizes approximately 60 inches (1500 mm long by 72 inches (1800 mm) high by full thickness, including accessories.

    a. Include a sealant-filled joint at least 16 inches (400 mm) long in mockup.
    b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.
    c. Include through-wall flashing installed for a 24-inch (600-mm) length in corner of exterior wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12-inch (300-mm) length of flashing left exposed to view (omit masonry above half of flashing).
    d. Include metal studs, sheathing, sheathing joint-and-penetration treatment, air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in mockup.
2. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
3. Protect accepted mockups from the elements with weather-resistant membrane.
4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

    a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

2.2 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units.

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: Facing brick complying with ASTM C 216.
1. Application: Use where brick is exposed unless otherwise indicated.

2.3 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or II.

B. Masonry Cement: ASTM C 91.

C. Hydrated Lime: ASTM C 207, Type S.

D. Aggregate for Mortar: ASTM C 144.

E. Aggregate for Grout: ASTM C 404.

F. Water: Potable.

G. Motor Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in motor mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Davis Colors: True Tone Mortar Colors.
2. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
3. Solomon Colors, Inc; SGS Mortar Colors.

H. Colored Cement Product: Packaged blend made from Portland cement and hydrated lime masonry cement or mortar cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:
   a. Products: Subject to compliance with requirements.
   1. Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
   2. Holcim (US) Inc; Rainbow Mortamix Custom Color Cement / Lime.
   3. Lafarge North America Inc; Eaglebond Portland & amp; amp; Lime.
   4. Lehigh Cement Company; Lehigh Custom Color Portland/ Lime Cement.

2.4 REINFORCEMENT

A. Steel Reinforcing Bars: Material and grade as follows:

1. Billet steel complying with ASTM A 615 (ASTM A 615M), Grade 60.

B. Deformed Reinforcing Wire: ASTM A 496, with ASTM A 153, Class B-2 zinc coating.

2.5 JOINT REINFORCEMENT

A. General: Provide joint reinforcement formed from the following:

1. 1. 2-#3 Continuous horizontal Bars

   a. ASTM A615 Grade 60

B. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet (3 m), with prefabricated corner and tee units, and complying with requirements indicated below:\

2.6 TIES AND ANCHORS, GENERAL

A. General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of this Article, unless otherwise indicated.

B. Steel Sheet: As follows:

1. Galvanized Steel Sheet: ASTM A 366 (ASTM A 366M) (commercial quality) coldrolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153, Class B-2 or B-3, as applicable, for sheet-metal ties and anchors.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Type 2, Class Grade 1; compressible up to 35 percent.

2.8 MORTAR AND GROUT MIXES MORTAR AND GROUT MIXES

A. Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, waterrepellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for job-mixed mortar; and ASTM C 1142 for ready-mixed mortar; Type S.

2.9 WEEPS

A. Weep holes shall be 3/4-inch diameter nylon tubing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected

3.2 INSTALLATION, GENERAL

A. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction.

Use full-size units without cutting, where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

B. Wetting of Brick: Wet brick prior to laying if the initial rate of absorption exceeds 30 g/30 sq. in. (g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb the water so they are damp but not wet at the time of laying.

3.3 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in stacked bond pattern.

3.4 MORTAR BEDDING AND JOINTING

A. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not furrow bed joints or slush head joints.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.5 REINFORCEMENT

A. Unless otherwise shown on the plans, the minimum vertical reinforcement for all masonry walls shall be one #5 bar at 16” on center and one #5 bar in cell at each corner in two full grouted cells. Bars shall be lapped a minimum of 27” with a #5 dowel embedded in the foundation.

B. Unless otherwise shown on the plans, the minimum horizontal reinforcement for lintels shall be two #6 bars continuous in full grouted cells

C. Unless otherwise shown on the plans, the minimum spacing for horizontal joint reinforcement in masonry walls shall be 16” on center.

3.6 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point-up joints, including corners, openings, and adjacent

construction, to provide a neat, uniform appearance. Prepare joints for application of sealants.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Protect adjacent non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
3. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
4. Clean brick by bucket and brush hand-cleaning method described in BIA Technical Note
5. No. 20 Revised, using the following masonry cleaner:

    a. Job-mixed detergent solution.
    b. Proprietary acidic cleaner, applied in compliance with directions of acidic cleaner manufacturer.

END OF SECTION 042113

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior non-load-bearing wall framing.
2. Soffit framing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.
2. Exterior non-load-bearing wall framing.
3. Drift clips.
4. Soffit framing.
5. Post-installed anchors.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.

1. Expansion anchors.
2. Mechanical fasteners.
3. Miscellaneous structural clips and accessories.

E. Research Reports:

1. For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings.

2. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

a. Upward and downward movement of 1/2 inch (13 mm).

4. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Wall Studs: AISI S211.
2. Headers: AISI S212.
3. Lateral Design: AISI S213.

2.2 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance.
2. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZM150), or GF30 (ZGF90).

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0677 inch (1.72 mm).
2. Flange Width: 2 inches (51 mm).

2.4 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
2. Flange Width: 1-5/8 inches (41 mm).

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, [Grade 36] [Grade 55], threaded carbon-steel [hex-headed bolts,] [headless, hooked bolts,] [headless bolts, with encased end threaded,] carbon-steel nuts, and flat, hardened-steel washers; zinc coated by [hot-dip process according to ASTM A153/A153M, Class C] [mechanically deposition according to ASTM B695, Class 50].

C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

E. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M.

B. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

2.8 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.3 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

E. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Wood blocking, cants, and nailers.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater size but less than 5 inches nominal (114 mm actual) size in least dimension.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   2. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5664.

1.5 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:
   1. Fire-retardant-treated wood.
   2. Power-driven fasteners.
   3. Post-installed anchors.
   4. Metal framing anchors.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Regional Materials: Dimension lumber shall be manufactured within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site.

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Dress lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less, 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of

significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 ft. (3.2 m) beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested in accordance with ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
3. Design Value Adjustment Factors: Treated lumber shall be tested in accordance with ASTM D5664, and design value adjustment factors shall be calculated in accordance with ASTM D6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. Application: Treat all miscellaneous carpentry unless otherwise indicated.

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:

1. Mixed southern pine or southern pine, No. 2 grade; SPIB.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

D. Do not splice structural members between supports unless otherwise indicated.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

H. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish

materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILER

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved to ensure blocking meets thickness of insulation or similar surrounding materials as indicated on the drawings.

B. Stagger joints in blocking 12 inches minimum between blocking layers. Ensure a minimum of 1/8 inch joint spacing between nailers.

C. Fasteners used to secure wood to wood should be stainless steel.

D. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

E. Install extruded-aluminum nailers in accordance with manufacturer's written instructions at locations indicated on Drawings.
   1. Allow for thermal movement.
   2. Install isolation barrier under roof flange at locations of dissimilar materials including concrete, masonry, or treated wood.

END OF SECTION 061053

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Sheathing joint and penetration treatment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
2. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corporation; GlasRoc.
b. G-P Gypsum Corporation; Dens-Glass Gold.
c. National Gypsum Company; Gold Bond e(2)XP.
d. Temple-Inland Inc.; GreenGlass
e. United States Gypsum Co.; Securock.

2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
3. Size: 48 by 96 inches (1219 by 2438 mm).

2.2 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C 954.

2.3 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.

1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

B. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
3. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards.

D. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 06 16 00

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.

2. Section 018113 “Sustainable Construction Requirements” – documentation for the sustainability requirements.

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Sustainable Design Submittals:
   1. Low-Emitting Materials (if applicable):
      a. Provide product data including VOC limits and emissions testing indicating compliance with low-emitting criteria as described in section 01 81 13 – Sustainable Construction Requirements.
      b. Provide quantities for each material (sf or volume)
   2. BPDO – MRc2 Building Product Disclosure and Optimization, Environmental Product Declarations Credit (if applicable):
      a. Provide product data indicating compliance with lifecycle impact reporting as described in section 01 81 13 – Sustainable Construction Requirements
      b. Environmental Product Declarations: Provide documentation from manufacturers and indicate type of EPD provided.
   3. BPDO – MRc3 Building Product Disclosure and Optimization, Sourcing of Raw Materials Credit (if applicable):
      a. Recycled Content: Provide product data with recycled content information indicated as described in section 01 81 13 – Sustainable Design Requirements.
      b. Bio-based Materials, Material Reuse, Certified Wood: Provide information indicated as described in section 01 81 13 – Sustainable Construction Requirements
      c. Manufacturing / Extraction Reports: Provide documentation for all extraction, harvest, and manufacturing locations for each product.
   4. BPDO – MRc4 Building Product Disclosure and Optimization, Material Ingredients Credit (if applicable):
      a. Provide product data indicating compliance with chemical inventory and/or screening as described in section 01 81 13 – Sustainable Construction Requirements.

C. Shop Drawings:

   1. Include plans, elevations, sections, and attachment details.
   2. Show large-scale details.
   3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
   5. Apply AWI Quality Certification Program label to Shop Drawings.

D. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size.

E. Samples for Verification: For the following:

   1. Plastic Laminates: 8 by 10 inches (200 by 250 mm, for each type, color, pattern, and surface finish required.

      a. Provide one sample applied to core material with specified edge material applied to one edge.

2. Corner Pieces:

    a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
    b. Miter joints for standing trim.

3. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Certificates: For each type of product.

1. Composite wood products.
2. Thermoset decorative panels.
3. High-pressure decorative laminate.
4. Glass.
5. Adhesives.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

D. Field quality-control reports.

E. Provide product data including VOC limits and emissions testing indicating compliance with low-emitting criteria as described in section 01 81 13 – Sustainable Construction Requirements.

1.7 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.8 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

B. Installer Qualifications: Licensed participant in AWI's Quality Certification Program.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups of typical architectural cabinets as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.10 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI certification program indicating that woodwork and installation complies with requirements of grades specified.

2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. Architectural Woodwork Standards Grade: Premium.

C. Manufacturing/Extraction Reports: Provide documentation for all extraction, harvest and manufacturing locations for each product.

D. Type of Construction: Frameless.

E. Door and Drawer-Front Style: Flush overlay.

F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

G. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Postformed Surfaces: Grade HGP.
3. Vertical Surfaces: Grade HGS.
4. Edges: Grade HGS.
5. Pattern Direction: Vertically for doors and fixed panels, horizontally for drawer fronts.

H. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.

    a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch (0.460-mm) minimum thickness, matching laminate in color, pattern, and finish.
    b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
    c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.

2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
3. Drawer Bottoms: Hardwood plywood. Must comply with requirements for low emitting materials refer to section 018113.

I. Dust Panels: 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers unless located directly under tops.

J. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

K. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.

L. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from laminate manufacturer's full range in the following categories:

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Recycled Content: Provide product data with recycled content information indicated as described in section 01 81 13 – Sustainable Design Requirements.

2. Composite Wood: Composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde. Refer to Section 018113 Sustainable Construction Requirements

3. Softwood Plywood: DOC PS 1, medium-density overlay.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
3. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of architectural cabinets.

2.4 CABINET HARDWARE AND ACCESSORIES

A. Butt Hinges: 2-3/4-inch (70-mm), five-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:

1. Semiconcealed Hinges for Flush Doors: ANSI/BHMA A156.9, B01361.
2. Semiconcealed Hinges for Overlay Doors: ANSI/BHMA A156.9, B01521.

B. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.

C. Catches: Magnetic catches, ANSI/BHMA A156.9, B03141.

D. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.

E. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.

F. Drawer Slides: ANSI/BHMA A156.9.

1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer.

    a. Type: Full extension.
    b. Material: Zinc-plated steel with polymer rollers.
2. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 2.
3. For drawers more than 3 inches (75 mm) high, but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1.
4. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-100.

G. Drawer Locks: ANSI/BHMA A156.11, E07041.

H. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

I. Grommets for Cable Passage: 1-1/4-inch (32-mm) OD, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Color: Black.

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.

1. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.

K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

1. Adhesive for Bonding Edges: Refer to section 018113 Sustainable Construction Requirements for Low Emitting Materials.

2.6 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips.

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity shall prepare and submit report of inspection.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 066400 - PLASTIC PANELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plastic sheet paneling.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 QUALITY ASSURANCE

A. Testing Agency: Acceptable to authorities having jurisdiction.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319. Panels shall be USDA accepted for incidental food contact.
   1. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E84. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 450 or less.
   2. Nominal Thickness: Not less than 0.075 inch (1.9 mm).
   3. Surface Finish: Smooth.
   4. Color: White.

2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
   1. Color: Match panels.

B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

D. Adhesive: As recommended by plastic paneling manufacturer.

E. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels so that trimmed panels at corners are not less than 12 inches (300 mm) wide.

1. Mark plumb lines on substrate at panel joint locations for accurate installation.
2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.

1. Drill oversized fastener holes in panels and center fasteners in holes.
2. Apply sealant to fastener holes before installing fasteners.

D. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.

E. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

F. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

G. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

H. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Polyisocyanurate foam-plastic board insulation.
2. Glass-fiber blanket insulation.

B. Related Requirements:

1. Section 061600 "Sheathing" for foam-plastic board sheathing installed directly over wood or steel framing.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Polyisocyanurate foam-plastic board insulation.
2. Glass-fiber blanket insulation.

1.4 INFORMATIONAL SUBMITTALS

A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

A. Polyisocyanurate Board Insulation, Glass-Fiber-Mat Faced: ASTM C1289, glass-fiber-mat faced, Type II, Class 2.

1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.2 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.

1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

2.3 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.

2.4 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches (610 mm) o.c. both ways on inside face and as recommended by manufacturer.

1. Fit courses of insulation between obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072727 - SELF-ADHERING WATER-RESISTIVE AIR BARRIER MEMBRANE

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

B. Examine all Drawings and all Sections of the Specifications for requirements and provisions affecting the work of this Section.

1.2 DESCRIPTION OF WORK

A. The work of this Section includes furnishing and installation of fully self-adhered water-resistive vapor permeable air barrier membrane at exterior wall assemblies, at locations indicated on Drawings and elsewhere as noted and as required by code.

B. The work of this Section also includes furnishing and installation of flashing membranes to bridge gaps, for transition areas around windows, curtain wall, louvers, roof to wall interface and elsewhere as indicated or required by code to provide a continuous air barrier assembly. Locations include, but are not limited to, the following:
   1. Connection of the walls to the roof membrane
   2. Connections of the walls to the foundations
   3. Seismic and expansion joints
   4. Openings and penetrations of window and door frames, store front, curtain wall
   5. Piping, conduit, duct and similar penetrations
   6. Masonry ties, screws, bolts and similar penetrations
   7. All other air leakage pathways in the building envelope

C. Provide material and work of this Section required to complete mock-up panel(s). Refer to exterior elevations for extent of mock-up panels.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Carefully examine all of the Contract Documents for requirements which affect the work of this section.

B. Other specifications sections which directly relate to the work of this section include, but are not limited to, the following:
   1. Section 042000 - Unit Masonry: Masonry units used as non-load bearing walls or partitions, veneer, and cavity unit masonry construction, including related accessories.
   2. Section 061600 - Sheathing
   3. Section 072100 - Building Insulation and Vapor Barriers
   4. Section 075300 - Thermoplastic Membrane Roofing System
   5. Section 078400 - Firestopping
   6. Section 079200 - Joint Sealants
   7. Section 084100 - Aluminum Entrances and Storefront System.

8. Section 089116 - Louvers and Grilles
9. Section 092116 - Gypsum Board Assemblies

1.4 REFERENCE STANDARDS

A. The American Association of Textile Chemists and Colorists (AATCC) - Test Method for Water Resistance: Hydrostatic Pressure Test.

B. American Society of Civil Engineers: ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

C. ASTM International (ASTM):
1. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
2. ASTM D828 – Standard Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus.
3. ASTM D5034 – Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test).
4. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
5. ASTM E96/96M – Standard Test Methods for Water Vapor Transmission of Materials.
6. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
7. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
8. ASTM E398 - Standard Test Method for Water Vapor Transmission Rate of Sheet Materials Using Dynamic Relative Humidity Measurement.
9. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials.
10. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
11. International Code Council Evaluation Service, Inc. (ICC-ES): ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers.

D. CDPH/EHLB Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2

1.5 SUBMITTALS

A. Submit manufacturers’ current product data sheets, details and installation instructions for the water-resistive vapor permeable air barrier membrane components and accessories.
1. Manufacturer's sample warranty.

B. Submit samples of the following:
1. Manufacturer's sample warranty.
2. Water-resistive vapor permeable air barrier sheet, minimum 8 by 10 inches (203 by 254 mm).
3. Accessory components.
4. Membrane flashing products.
5. Cladding and window system flashing components which interface with air barrier system (i.e. rigid metal head flashing above windows) minimum 10” length.

6. Fasteners, clips, strapping, cladding attachment fasteners and masonry ties.
7. Sealants (included by others) required to provide a complete air barrier membrane system.

1.6 QUALITY ASSURANCE

A. Single Source: Obtain self-adhered water-resistive vapor permeable air barrier membrane components and accessories from a single-source membrane system manufacturer to ensure total system compatibility and integrity.

B. Manufacturer Qualifications:
1. Company specializing in manufacturing and supply of highly vapor permeable water resistive air barrier products specified in this Section with minimum 10 ten years' experience and successful installations in similar project applications.
2. Provide manufacturer’s experienced in-house technical and field observation personal qualified to provide technical support.

C. Applicator:
1. Company specializing in performing Work of this Section with minimum 3 three years' experience.

D. Fire Performance Characteristics: Provide water-resistive barrier meeting the following fire-test characteristics.
1. Surface-Burning Characteristics: ASTM E84
a. Flame spread index: 0 or less
b. Smoke developed index: 75 or less

1.7 MOCK-UP

A. Provide mock-up of specified water-resistive vapor permeable air barrier materials under provisions of Section 01 33 23 - Shop Drawings, Product Data and Samples.
1. Coordinate construction of mockups to permit inspection and testing of air barrier and drainage place along with interfacing window, flashing and cladding system components, before external insulation and cladding are installed.

1.8 PRE-INSTALLATION CONFERENCE

A. Provide a pre-installation conference two week prior to commencing work of this section, under provisions of Section 01 31 19 - Project Meetings or as specified under General Requirements Section 01 10 00.

B. Ensure all contractors responsible for creating a continuous plane of water and air tightness are present.

C. Agenda includes the following:
1. Review of approved submittals.
2. Review of mock-ups.
3. Coordination with sequence of installation with adjacent materials.
4. Schedule for subsequent work covering air barrier.
5. Procedures for quality assurance.

1.9 DELIVERY, STORAGE AND HANDLING

A. Refer to current Product Data Sheet, Installation Instructions and Safety Data Sheets (SDS) at for proper storage and handling.

B. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.

C. Store roll materials on end in original packaging. Protect rolls from direct sunlight and inclement weather until ready for use.

1.10 COORDINATION

A. Ensure shingled lapping and continuity of the fully self-adhered water-resistive vapor permeable air barrier system throughout the scope of this section.
   1. Provide Product that includes self-adhered air and water barrier membrane, transition membranes, flashing and sealants at penetrations.
   2. At locations indicated provide unimpeded vertical drainage plane that include ventilated drainage cavity, self-adhered air and water barrier and flashings to the exterior.
   3. Coordinate for optimal sequencing with all related or interfaced building components and trades to facilitate best practices including: shingle-fashion, drainage, water-tightness, and air barrier continuity.

1.11 WARRANTY

A. Provide manufacturer’s standard material warranty in which manufacturer agrees to provide replacement material for the fully self-adhered water-resistive vapor permeable air barrier sheets installed in accordance with manufacturer's instructions that fail due to material defects within [20] twenty years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide a fully self-adhered water-resistive vapor permeable air barrier membrane components and accessories obtained from a single-source manufacture to ensure total system compatibility and integrity.

B. Water-Resistive Vapor Permeable Self-Adhered Air Barrier Materials.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide fully self-adhered air barrier sheet membrane RevealShield SA Self-Adhered Water-Resistive Vapor Permeable Air Barrier Sheet as manufactured by VaproShield, a zero VOC fully self-adhered vapor permeable air barrier sheet membrane consisting of coated spun-bonded polyethylene with vapor-permeable adhesive. Provide sheet membrane tested in accordance with ICC-ES AC 38 criteria to meet IBC and IRC requirements for weather resistive barriers having the following properties:

a. Color: Black with allowable UV exposure for 12 months, prior to coverage.
b. Dry Tensile strength and Elongation to ASTM D828: 37.7 lbf (6.6 N), machine direction; 21.3 lbf (390 N), cross-machine direction.
c. Dry Breaking strength and Elongation to ASTM D5034: 119 lbf (529 N), machine direction; 96 lbf (427 N), cross-machine direction.
d. Water Vapor Permeance tested to ASTM E398: minimum of 65.53 perms (3748 ng/Pa•s•m^2).
e. Air Leakage: ≤0.00002 cfm/ft^2 @ 1.57 psf (≤0.0001 L/s m^2 @ 75 Pa) when tested in accordance with ASTM E2178 and <0.01 cfm/ft^2 @ 1.57 psf (<0.01 L/s m^2 @ 75 Pa)) when tested in accordance with ASTM E2357. Meets Air Barrier Association of America (ABAA) requirements.
f. Water Resistance tested to AATCC 127, 550 mm hydrostatic head for 5 hours: No leakage
g. Application Temperature: Ambient temperature must be above 20 °F (minus 6 °C).
h. Surface Burning Characteristics tested to ASTM E84: Class A, Flame-Spread index of less than 0, Smoke-Developed index of less than 75.
i. Physical Dimensions: RevealShield SA: 19 mil (0.48 mm) thick, 59 inches (1.5 m) wide, 102 feet (31.1 m). 380.67 g/m^2 (11.227 oz/yd^2) membrane weight.

C. Water-Resistive Vapor Permeable Transition and Flashing Membrane
1. Provide self-adhered air barrier transition and flashing membrane for all window jambs, headers, door openings, inside and outside corners, and other transitions. Provide pre-cut RevealFlashing SA by VaproShield. RevealFlashing SA is a zero VOC fully self-adhered water-resistive vapor permeable sheet membrane having the following properties:
a. Same material and properties as RevealShield SA Self-Adhered Water-Resistive Vapor Permeable Air Barrier Sheet, factory slit to flashing sizes. (See 2.1.B.1 above).
b. Physical Dimensions: RevealFlashing SA Black: $11^3/_4$ inches (30 cm) wide x 164 feet (50 m) long.

D. VaproLiqui-Flash SA Vapor Permeable Water Resistive Flashing For Rough Openings
1. Window and door pre-cut RevealFlashing SA includes VaproLiqui-Flash by VaproShield, a liquid-applied vapor permeable air barrier flashing material with vapor permeance and resistance to air leakage properties compatible with the primary air barrier membrane.
a. Pass: CDPH/EHLB/Standard Method V1.2 (Sect. 01350) VOC test.

2.2 PENETRATION SEALANT

A. Provide sealant for penetrations as recommended by manufacturer and as specified under Division 07 Section: Sealants.

2.3 WALL ROLLER

A. Provide extendible roller tool designed to provide optimal leverage for roller-based self-adhered membrane. Provide roller incorporating heavy duty design die-cast second handle for additional leverage, two handed operation to firmly secure the adhesive to the substrate. Provide unit that is compact and lightweight with a 7.5 inch (19 cm) wide design.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify that surfaces and conditions are ready to accept the work of this section. Notify [Envelope Architect in writing of any discrepancies. Commencement of the work or any parts thereof shall mean acceptance of the prepared substrates.

B. All surfaces must be dry, sound, clean, free of oil, grease, dirt, excess mortar or other contaminants detrimental to the adhesion of the water resistive air barrier membrane and flashings. Fill voids and gaps in substrate greater than ⅞ inch (22 mm) in width to provide an even surface. Strike masonry joints full-flush. Tool sheathing joints filled with sealant materials so that no sealant is spread onto the exterior surface of the sheathing. Remove any sealant products from sheathing surface prior to installation of air barrier membrane.

C. Minimum application temperature of fully self-adhered membrane and flashings to be above 20 °F (minus 6.0 °C). Frost or water on substrate is unacceptable.

D. Ensure all preparatory work is complete prior to applying primary fully self-adhered vapor permeable air barrier.

E. Set flush with sheathing, any mechanical fasteners used to secure sheathing surfaces or that penetrate sheathing surfaces. Provide fasteners secured into solid backing and covered with the upper overlapping membrane. If exposed fasteners are present on the surface of the membrane, cover and seal with VaproLiqui-Flash or VaproBond.

F. If exposed fasteners are required, use VaproCaps™ with the appropriate fastener into structural members to ensure water/air tight seal.

3.2 COORDINATION OF SELF-ADHERED VAPOR PERMEABLE AIR BARRIER MEMBRANE INSTALLATION

A. Download Installation Instructions at http://vaproshield.com/public-documents/installation-instructions.

B. Installation Summary:
1. Self-adhered vapor permeable air barrier sheets are installed horizontally or vertically over the outside wall face of exterior sheathing board or other approved substrates.
2. Complete detail work at; wall openings, building transitions and penetrations prior to field applications allowing for shingle laps with release film temporarily left in place as needed.
3. Install fully self-adhered vapor permeable air barrier sheet over the outside face of exterior sheathing board or substrate, measure and pre-cut into manageable sized sheets to suit the application conditions.
4. Install fully self-adhered vapor permeable air barrier sheet complete and continuous to substrate in a sequential minimal 3 inch (76 mm) overlapping weatherboard.
5. Stagger all end lap seams.
6. Roll installed membrane with a two-handed roller to ensure positive contact and adhesion with substrate immediately.

3.3 BUILDING TRANSITION CONDITIONS

A. Tie-in to structural beams, columns, floor slabs and intermittent floors, parapet curbs, foundation walls, roofing systems and at the interface of dissimilar materials with self-adhering air barrier transition and flashing membrane.

B. Align and position fully self-adhered air barrier transition and flashing membrane, remove protective film and press firmly into place. Provide minimum 3 inch (76 mm) lap on to substrates.

C. Ensure minimum 3 inch (76 mm) overlap at side and end laps of membrane and 6 inch (152.4 mm) at inside and outside corners, if joints occur at corner locations.

D. Roll membrane and lap seams with roller to ensure positive contact and adhesion, immediately.

3.4 MECHANICAL EQUIPMENT PENETRATIONS

A. Mechanical pipe, electrical conduit and/or duct work must be secured solid into position prior to installation of fully self-adhered vapor permeable air barrier membrane.

B. Electrical services penetrating the wall assembly and fully self-adhered vapor permeable air barrier membrane must be placed in appropriate conduit and secured solid into position.

C. Install manufactured flanged penetration sleeves as recommended by sleeve manufacturer.

D. For straight sided penetrations, cut and fit fully self-adhered vapor permeable air barrier to accommodate sleeve, install VaproLiqui-Flash or VaproBond to seal the air barrier membrane to ductwork or preformed flange sleeve.

E. For pipe penetrations, refer to manufacturer’s standard details.

3.5 WINDOW, DOOR AND OTHER WALL OPENINGS

A. Two-part flashing system; RevealFlashing SA and VaproLiqui-Flash around window or wall rough openings subject to the opening size and installation of window, door or louver type.

1. RevealFlashing SA transition and flashing membrane installed 2¾ inch (70 mm) into rough wall openings for the sill, jambs and head.

2. Remove release film, align flashing membrane and apply pressure to ensure positive contact. Roll lap seams to ensure adhesion. For the sill installation, leave the release film on the section that will overlap the field membrane. Provide lap seams in singled fashion, to shed water.

3. VaproLiqui-Flash Vapor Permeable Water Resistive Flashing For Rough Openings:
   a. Liquid-applied window and door flashing shall be VaproLiqui-Flash by VaproShield, a liquid-applied vapor permeable air barrier flashing material with resistance to moisture and air leakage properties compatible with the primary weather resistant air barrier membrane.
   b. Apply a 12-15 wet mil (0.030-0.038 mm) coating onto the installed RevealFlashing, 1-inch (25.4 mm) onto the face continuing into the rough opening, covering the 2 ¾ inch (70 mm) PanelFlashing and the exposed rough opening surface.

3.7 FASTENING CLIPS AND MASONRY TIES

A. Install clips and masonry ties over primary self-adhered vapor permeable air barrier membrane.

B. Secure clips and masonry ties with corrosion-resistant, or stainless-steel screws with gasketed fasteners.

C. Consult VaproShield Technical Services for recommendations on fastener treatments for rainscreen screen cladding attachment components by others.

3.9 FIELD QUALITY CONTROL

A. Make notification when sections of work are complete to allow review prior to covering fully self-adhered water-resistive vapor permeable air barrier system.

B. Owner to engage independent consultant to observe substrate and membrane installation prior to placement of cladding system(s) and provide written documentation of observations.

3.10 PROTECTION

A. Protect wall areas covered with self-adhered water-resistive vapor permeable air barrier from damage due to construction activities, high wind conditions, and up to 12 months extended exposure to inclement weather.

B. Review condition of fully self-adhered water-resistive vapor permeable air barrier with attached drainage matrix prior to installation of cladding. Repair, or remove and replace damaged sections with new membrane.

C. Recommend to cap and protect exposed back-up walls against wet weather conditions during and after application of membrane, including wall openings and construction activity above completed fully self-adhered water-resistive vapor permeable air barrier installations.

D. Remove and replace water-resistive weather barrier membrane affected by chemical spills or surfactants.

END OF SECTION

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. TPO Mechanically fastened membrane roofing system.

B. Cover board.

C. Roof insulation.

D. Walkways.

1.2 RELATED SECTIONS

A. Division 06 Section "Miscellaneous Rough Carpentry" for wood nailers, cants, curbs, and blocking and for wood-based, structural-use roof deck panels.

B. Division 22 Section "Storm Drainage Piping Specialties" for roof drains.

1.3 REFERENCES

A. Roofing Terminology: Refer to the following publications for definitions of roofing work related terms in this Section:

1. ASTM D 1079 “Terminology Relating to Roofing and Waterproofing.”
2. Glossary of NRCA's "The NRCA Roofing and Waterproofing Manual."
3. Roof Consultants Institute “Glossary of Roofing Terms.”

B. Sheet Metal Terminology and Techniques: SMACNA Architectural Sheet Metal Manual.

1.4 DESIGN CRITERIA

A. General: Installed roofing membrane system shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Roofing materials shall be compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

C. Wind Uplift Performance: Roofing system shall be identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE 7.

D. FMG Listing: Roofing membrane, base flashings, and component materials shall comply with requirements in FMG 4450 and FMG 4470 as part of a roofing system and that are listed in FMG's “RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1. Fire/Windstorm Classification: Class 1A-110

1.5 SUBMITTALS

A. Product Data: Manufacturer’s data sheets for each product to be provided.

B. Detail Drawings: Provide roofing system plans, elevations, sections, details, and details of attachment to other Work, including:

1. Base flashings, cants, and membrane terminations.
2. Tapered insulation, including slopes.
3. Crickets, saddles, and tapered edge strips, including slopes.
4. Insulation fastening patterns.

C. Verification Samples: Provide for each product specified.

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in “Performance Requirements" and “Guarantees” Article.

1. Provide evidence of meeting performance requirements and intent to guarantee.

F. Qualification Data: For Installer and manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.

H. Maintenance Data: Refer to Johns Manville’s latest published documents on www.specJM.com.

I. Guarantees: Special guarantees specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive the specified manufacturer's guarantee.

B. Manufacturer Qualifications: Qualified manufacturer that has [UL listing] [FMG approval] for roofing system identical to that used for this Project.

C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

D. Test Reports:

1. Roof drain and leader test or submit plumber's verification.
2. Core cut (if requested).
3. Roof deck fastener pullout test.

E. Moisture Survey:

1. Submit prior to installation, results of a non-destructive moisture test of roof system completed by approved third party. Utilize one of the approved methods:

a. Infrared Thermography
b. Nuclear Backscatter

F. Source Limitations: Obtain all components from the single source roofing manufacturer guaranteeing the roofing system. All products used in the system must be labeled by the single source roofing manufacturer issuing the guarantee.

G. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class B ; ASTM E 108, for application and roof slopes indicated.
2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.

1.9 GUARANTEE

A. Provide manufacturer's system guarantee equal to Johns Manville's Peak Advantage No Dollar Limit Roofing System Guarantee.

1. Single-Source special guarantee includes roofing plies, base flashings, liquid applied flashing, roofing membrane accessories, roof insulation, fasteners, substrate board, walkway products, and other single-source components of roofing system marketed by the manufacturer.

2. Guarantee Period: 20 years from date of Substantial Completion.
3. Wind Rider: Guarantee shall not exclude coverage for wind events up to110 mph.
4. Hail Rider: Guarantee shall have no exclusions for hail events up to 2 inches.
5. Accidental Puncture Rider: Guarantee shall provide coverage for accidental puncture for up to 16 billed repair hours per year for the life of the guarantee.

B. Installer’s Guarantee: Submit roofing Installer's guarantee, including all components of roofing system for the following guarantee period:

1. Guarantee Period: Five Years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC POLYOLEFIN ROOFING(TPO) MEMBRANE

A. Fabric-Reinforced Thermoplastic Polyolefin (TPO) Sheet: ASTM D 6878, uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced. Basis of Design: JM TPO or architect pre approved equal

1. Thickness: 60 mils, minimum.
2. Accelerated Weathering: Minimum of 24,000 hours without cracking or crazing as tested using ASTM G155.
3. Tensile Strength: Minimum of 300 lbf as tested using ASTM D751
4. Tearing Strength: Minimum of 85 lbs as tested using ASTM D751

2.2 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane.

C. Sheet Flashing: Manufacturer's unreinforced sheet flashing of same material as sheet membrane.

D. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

E. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, with anchors.

F. Metal Battens: Manufacturer's standard aluminum-zinc-alloy-coated or zinc-coated steel sheet, prepunched.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories. Basis of Design:

2.3 AUXILIARY ROOFING SYSTEM COMPONENTS

A. Coping System: Manufacturer’s factory fabricated coping consisting of a base piece and a snap-on cap. Provide product manufactured and marketed by single-source membrane supplier that is included in the No Dollar Limit guarantee.

B. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

2.4 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads sourced from membrane roofing system manufacturer.

2.5 COVER BOARD

A. High-Density Polyisocyanurate: High-density polyisocyanurate technology bonded in-line to mineral-surfaced, fiber glass reinforced facers with greater than 125 lbs of compressive strength.

2.6 ROOF INSULATION

A. General: Preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II.

1. Provide insulation package with R Value greater than 30.
2. Provide insulation package with minimum thickness.

2.7 TAPERED INSULATION

A. Tapered Insulation: ASTM C 1289, provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

2.8 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Provide factory preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and furnished by roofing system manufacturer.

D. Urethane Adhesive: Manufacturer’s two component urethane adhesive formulated to adhere insulation to substrate.

E. Wood Nailer Strips: Comply with requirements in Division 06 Section "Miscellaneous Rough Carpentry."

2.10 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.

1. Size: Approximately36 by 60 inches (914 by 1524 mm).
2. Color: Contrasting with roof membrane.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and remover from substrate sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSULATION INSTALLATION

A. Coordinate installation of roof system components so insulation and cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installation of roof insulation and cover board.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation boards with long joints in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with like material.

E. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall thickness 1.5 Inches or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

F. Trim surface of insulation boards where necessary at roof drains so completed surface is flush and does not restrict flow of water.

G. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

H. Preliminarily Fastened Insulation for Mechanically Fastened Systems: Install insulation with

fasteners at rate required by roofing system manufacturer or applicable authority, which ever is more stringent.

I. Mechanically Fastened with Subsequent Layers Adhered Insulation: Secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type to deck type.

1. Fasten first layer according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Fasten first layer to resist uplift pressure at corners, perimeter, and field of roof.
3. Install subsequent layers in a two-part urethane adhesive according to roofing system manufacturer’s instruction.

J. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 ROOFING MEMBRANE INSTALLATION, GENERAL

A. Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Where roof slope exceeds 1/2 inch per 12 inches (1:24, contact the membrane manufacturer for installation instructions regarding installation direction and backnailing

D. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

E. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.

1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 COVER BOARD INSTALLATION

A. Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.

C. Install cover board with long joints of cover board in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with cover board.

1. Cut and fit cover board within 1/4 inch (6 mm) of nailers, projections, and penetrations.

D. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.

1. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

E. Adhered Cover Board: Adhere cover board to substrate as follows:

1. Install in a two-part urethane adhesive according to roofing system manufacturer’s instruction.

F. Mechanically Fastened Cover Board: Install each layer of cover board and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof cover board to deck type.

1. Fasten according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
2. Fasten to resist uplift pressure at corners, perimeter, and field of roof.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.6 MECHANICALLY FASTENED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing in accordance with roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical representative.

C. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

E. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

F. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight

seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
    a. Remove and repair any unsatisfactory sections before proceeding with Work.
3. Repair tears, voids, and lapped seams in roofing membrane that do not meet requirements.

G. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

H. In-Splice Attachment: Secure one edge of roofing membrane using fastening plates or metal battens centered within membrane splice and mechanically fasten roofing membrane to roof deck. Field-splice seam.

I. Through-Membrane Attachment: Secure roofing membrane using fastening plates or metal battens and mechanically fasten roofing membrane to roof deck. Cover battens and fasteners with a continuous cover strip.

J. Install roofing membrane and auxiliary materials to tie in to existing roofing.

K. Proceed with installation only after unsatisfactory conditions have been corrected.

3.7 FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Flash penetrations and field-formed inside and outside corners with sheet flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.8 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Adhere with compatible adhesive or heat weld walkway products to substrate according to roofing system manufacturer's written instructions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

B. Final Roof Inspection: Arrange for roofing system manufacturer's Registered Roof Observer (RRO) to inspect roofing installation on completion and submit report to Architect.

1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

C. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTION AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.

B. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075423

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copings.
2. Roof-edge specialties.
3. Roof-edge drainage systems.
4. Reglets and counterflashings.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
3. Section 079200 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

C. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties.

1. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work.
2. Include details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
3. Indicate profile and pattern of seams and layout of fasteners, cleats, clips, and other attachments.
4. Detail termination points and assemblies, including fixed points.
5. Include details of special conditions.

C. Samples: For each type of roof specialty and for each color and texture specified.

D. Samples for Verification:

1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.
2. Include copings, roof-edge specialties, roof-edge drainage systems, reglets and counterflashings made from 12-inch (300-mm) lengths of full-size components in specified material, and including fasteners, cover joints, accessories, and attachments.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Certificates: For each type of roof specialty.

C. Product Test Reports: For copings and roof-edge flashings, for tests performed by a qualified testing agency.

D. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class].

B. Source Limitations: Obtain roof specialties approved by manufacturer providing roofing-system warranty specified in Section.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and set quality standards for fabrication and installation.

1. Build mockup of typical roof edge, including gutter and downspout, approximately 10 feet (3.0 m) long, including supporting construction, seams, attachments, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. FM Approvals' Listing: Manufacture and install copings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-120. Identify materials with FM Approvals' markings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.

2.2 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet (3.6 m), concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.

1. Metallic-Coated Steel Sheet Coping Caps: Zinc-coated (galvanized) steel, nominal 0.028-inch (0.71-mm) thickness.

    a. Surface: Smooth, flat finish.
    b. Finish: Two-coat fluoropolymer.

2. Corners: Factory mitered and continuously welded.
3. Coping-Cap Attachment Method: Snap-on or face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.

    a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches (300 mm) wide, with integral cleats.
    b. Face-Leg Cleats: Concealed, continuous galvanized-steel sheet.

2.3 ROOF-EDGE SPECIALTIES

A. One-Piece Gravel Stops: Manufactured, one-piece, metal gravel stop in section lengths not exceeding 12 feet (3.6 m), with a horizontal flange and vertical leg fascia terminating in a drip

edge, and concealed splice plates of same material, finish, and shape as gravel stop. Provide matching corner units.

1. Metallic-Coated Steel Sheet Gravel Stops: Zinc-coated (galvanized) steel, nominal 0.028-inch (0.71-mm) thickness.

    a. Surface: Smooth, flat finish.
    b. Finish: Two-coat fluoropolymer.
    c. Color: As selected by Architect from manufacturer's full range.

2. Corners: Factory mitered and continuously welded.

2.4 ROOF-EDGE DRAINAGE SYSTEMS

A. Gutters: Manufactured in uniform section lengths not exceeding 12 feet (3.6 m), with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch (25 mm) above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.

1. Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.
2. Gutter Profile: As indicated according to SMACNA's "Architectural Sheet Metal Manual."
3. Embossed Surface: Embossed with design As selected by Architect from manufacturer's full range.
4. Corners: Factory mitered and continuously welded.
5. Gutter Supports: Manufacturer's standard supports as selected by Architect with finish matching the gutters.
6. Special Fabrications: Radiussed sections.

B. Downspouts: Plain rectangular complete with machine-crimped elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Zinc-Coated Steel: Nominal 0.028-inch (0.71-mm) thickness.

C. Zinc-Coated Steel Finish: Two-coat fluoropolymer.

1. Color: As selected by Architect from manufacturer's full range.

2.5 REGLETS AND COUNTERFLASHINGS

A. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:

1. Corners: Factory mitered and continuously welded.
2. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

B. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) and in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:

1. Zinc-Coated Steel: Nominal 0.022-inch (0.56-mm) thickness.

C. Accessories:

1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

D. Zinc-Coated Steel Finish: Two-coat fluoropolymer.

1. Color: As selected by Architect from manufacturer's full range.

2.6 MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Z275) coating designation.

2.7 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F (116 deg C).
2. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F (29 deg C).

2.8 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.

B. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.9 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Coil-Coated Galvanized-Steel Sheet Finishes:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A755/A755M and coating and resin manufacturers' written instructions.

    a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (152 mm) staggered 24 inches (610 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

1. Apply continuously under copings, roof-edge specialties, and reglets and counterflashings.
2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

3.3 INSTALLATION, GENERAL

A. Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet (3.6 m) with no joints within 18 inches (450 mm) of corners or intersections unless otherwise indicated on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

C. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

D. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

E. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F (4 deg C).

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive

solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.4 INSTALLATION OF COPINGS

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements.

3.5 INSTALLATION OF ROOF-EDGE SPECIALITIES

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.6 INSTALLATION OF ROOF-EDGE DRAINAGE-SYSTEM

A. Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 12 inches (305 mm) apart. Attach ends with rivets and solder to make watertight. Slope to downspouts.

1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.2 m) apart. Install expansion-joint caps.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c.

1. Provide elbows at base of downspouts at grade to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

3.7 INSTALLATION OF REGLETS AND COUNTERFLASHINGS

A. Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches (100 mm) over top edge of base flashings.

C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches (100 mm) over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with butyl sealant. Fit counterflashings tightly to base flashings.

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof hatches.
2. Pipe and duct supports.

B. Related Requirements:

1. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
2. Section 077100 "Roof Specialties" for manufactured fasciae, copings, gravel stops, gutters and downspouts, and counterflashing.
3. Section 237413 "Packaged, Outdoor, Central-Station Air-Handling Units" for standard curbs specified with rooftop units.

1.3 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.7 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 ROOF HATCHES

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.

B. Type and Size: Single-leaf lid, 36 by 36 inches (900 by 900 mm).

C. Loads: Minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 20-lbf/sq. ft. (0.95-kPa) internal uplift load.

1. Dome Glazing: Minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 20-lbf/sq. ft. (0.95-kPa) internal uplift load.

D. Hatch Material: Zinc-coated (galvanized)steel sheet.

1. Thickness: Manufacturer's standard thickness for hatch size indicated. First option in "Finish" Subparagraph below applies only to zinc-coated (galvanized) steel sheet.
2. Finish: Two-coat fluoropolymer.
3. Color: As selected by Architect from manufacturer's full range.

E. Construction:

1. Insulation: 1-inch- (25-mm-) thick, cellulosic-fiber board.

a. R-Value: 12.0 according to ASTM C1363.

2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
5. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.

F. Hardware: Spring operators, hold-open arm, galvanized steel spring latch with turn handles, galvanized steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

2.3 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Z275) coating designation.

1. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.

C. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

D. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

F. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof-Hatch Installation:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach safety railing system to roof-hatch curb.
3. Attach ladder-assist post according to manufacturer's written instructions.

D. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

D. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

E. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

F. Field-Adhesion-Test Reports: For each sealant application tested.

G. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with masonry substrates.

4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.8 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

2.5 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

2.6 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

2.7 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

    a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
    b. Perform one test for each 1000 feet (300 m) of joint length thereafter or one test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

    a. Whether sealants filled joint cavities and are free of voids.
    b. Whether sealant dimensions and configurations comply with specified requirements.
    c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Control and expansion joints in unit masonry.
    b. Joints between metal panels.
    c. Joints between different materials listed above.
    d. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
    e. Control and expansion joints in overhead surfaces.
    f. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Vertical joints on exposed surfaces of walls and partitions.
    c. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

    a. Control joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
    c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:

a. Aluminum thresholds.
b. Sill plates.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly, fire-rated borrowed-lite assembly, and thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.

C. Field quality control reports.

1.8 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.9 QUALITY ASSURANCE

A. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.50 deg Btu/F x h x sq. ft. (2.84 W/K x sq. m) when tested according to ASTM C518.

2.2 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches (44.5 mm).
c. Face: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Core: Manufacturer's standard.
g. Fire-Rated Core: Manufacturer's standard vertical steel stiffener core for fire-rated doors.

2. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).

b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Knocked down.

3. Exposed Finish: Prime.

2.3 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Maximum-Duty Doors and Frames: ANSI/SDI A250.8, Level 4; ANSI/SDI A250.4, Level A.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches (44.5 mm).
c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum A40 (ZF120) coating.
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Manufacturer's standard.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum A40 (ZF120) coating.
b. Construction: Knocked down.

3. Exposed Finish: Prime.

2.4 BORROWED LITES

A. Fabricate of uncoated at interior metallic-coated at exterior steel sheet, minimum thickness of 0.053 inch (1.3 mm).

B. Construction: Knocked down.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations,

provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.7 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding, or by rigid mechanical anchors.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

4. Removable Terminated Stops (Hospital Stops): Terminate stops 6 inches (152 mm) above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.

2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames according to NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

4. Solidly pack mineral-fiber insulation inside frames.
5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:
1. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements according to NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

END OF SECTION 081113

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

   A. Access doors and frames.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   A. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches (150 by 150 mm) in size.

C. Product Schedule: For access doors and frames.

1.4 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Concealed Flanges:

   A. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
   B. Locations: Wall.

C. Door Size: <Insert door size>.
D. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch (1.63 mm), 16 gage factory finished.
E. Frame Material: Same material and thickness as door.
F. Latch and Lock: Cam latch, screwdriver operated.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: Same material as door face.

D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

A. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
B. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

A. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil (0.025 mm) for topcoat.

1. Color: As selected by Architect from full range of industry colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Service doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
3. Include description of automatic-closing device and testing and resetting instructions.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Show locations of controls, locking devices and other accessories.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing and inspecting agency.

1. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Special warranty.

B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

2.3 DOOR ASSEMBLY

A. Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

B. Operation Cycles: Door components and operators capable of operating for not less than 100,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1. Include tamperproof cycle counter.

C. Door Curtain Material: Aluminum.

D. Door Curtain Slats: Flat profile slats of 1-7/8-inch (48-mm) center-to-center height.

E. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from or aluminum extrusions and finished [to match door] <Insert requirement>.

F. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats.

G. Hood: Match curtain material and finish.

1. Shape: Square.
2. Mounting: Face of wall.

H. Locking Devices: Equip door with slide bolt for padlock.

I. Electric Door Operator:

1. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
2. Operator Location: Wall.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 ft. (2.44 m) or lower.
4. Motor Exposure: Interior.

5. Emergency Manual Operation: Push-up type.
6. Obstruction-Detection Device: Automatic photoelectric sensor; self-monitoring type.

a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.

7. Control Station(s): Interior mounted.

J. Door Finish:

1. Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.

2. Interior Curtain-Slat Facing: Finish as selected by Architect from manufacturer's full range.

2.4 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Aluminum Door Curtain Slats: ASTM B209 (ASTM B209M) sheet or ASTM B221 (ASTM B221M) extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of 0.050 inch (1.27 mm); and as required.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.6 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Aluminum: 0.040-inch- (1.02-mm-) thick aluminum sheet complying with ASTM B209 (ASTM B209M), of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.

2.7 LOCKING DEVICES

A. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.8 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.9 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location(s): Operator location indicated for each door.

1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.

D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.

1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.

1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.

a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained or constant pressure on close button.

G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf (111 N).

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.10 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.11 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.

D. Power-Operated Doors: Install automatic garage doors openers according to UL 325.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to furnish reports to Architect.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

A. Lubricate bearings and sliding parts as recommended by manufacturer.

B. Adjust seals to provide tight fit around entire perimeter.

3.6 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.
2. Aluminum-framed entrance door systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication, and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

F. Delegated-Design Submittal: For aluminum-framed entrances and storefronts including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Mockup Testing Submittals:

1. Testing Program: Developed specifically for Project.
2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.

B. Qualification Data:

1. For Installer and laboratory mockup testing agency.
2. For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

C. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

D. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.

E. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C1401. Include periodic quality-control reports.

F. Source quality-control reports.

G. Field quality-control reports.

H. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and that employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

B. Laboratory Mockup Testing Agency Qualifications: Qualified according to ASTM E699 for testing as complying with ISO/IEC 17025.

C. Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated ISO/IEC 17025 and acceptable to Owner and Architect.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

E. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of storefront systems that include structural glazing.

1.7 MOCKUPS

A. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.
2. Testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on laboratory mockups.

1. Build preconstruction laboratory mockups at testing agency facility; use personnel, products, and methods of construction that will be used at Project site.
2. Size and Configuration: As indicated on Drawings.
3. Notify Architect seven days in advance of the dates and times when preconstruction laboratory mockups will be constructed and tested.

B. Preconstruction Laboratory Mockup Testing: Test preconstruction laboratory mockups according to requirements in "Performance Requirements" Article. Perform the following tests in the following order:

1. Structural, 50 percent: ASTM E330/E330M at 50 percent of positive test load.
2. Air Leakage: ASTM E283.
3. Water Penetration under Static Pressure: ASTM E331.
4. Water Penetration under Dynamic Pressure: AAMA 501.1.
5. Structural, 100 percent: ASTM E330/E330M at 100 percent of positive and negative test loads. Repeat the following:

    a. Air Leakage: ASTM E283.
    b. Water Penetration under Static Pressure: ASTM E331.

6. Thermal Cycling: According to AAMA 501.5. Repeat the following:

    a. Air Leakage: ASTM E283.
    b. Water Penetration under Static Pressure: ASTM E331.

7. Structural, 100 and 150 percent: ASTM E330/E330M at 100 and 150 percent of positive and negative test loads. Repeat the following:

    a. Air Leakage: ASTM E283.
    b. Water Penetration under Static Pressure: ASTM E331.

C. Preconstruction Adhesion and Compatibility Testing: Submit to structural glazing sealant manufacturer, for testing indicated below, Samples of each glazing material type, tape sealant,

gasket, glazing accessory, and glass-framing member that is in close proximity to or is touching the structural or nonstructural sealants of a structural glazed system.

1. Compatibility: Test materials or components using ASTM C1087.
2. Adhesion: Test for adhesion or lack of adhesion of a structural sealant to the surface of another material or component using ASTM C1135.
3. Submit no fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
6. Testing will not be required if data based on previous testing of current sealant products matches those submitted.

1.9 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures, including, but not limited to, excessive deflection.
    b. Noise or vibration created by wind and thermal and structural movements.
    c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    d. Water penetration through fixed glazing and framing areas.
    e. Failure of operating components.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Delta E units when tested according to ASTM D 2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    c. Cracking, peeling, or chipping.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.

2. Failure also includes the following:

a. Thermal stresses transfer to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to [1/175 of clear span for spans of up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m)] <Insert deflection limit>.
2. Deflection Parallel to Glazing Plane: Limited to [amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm)] <Insert deflection limit>.

a. Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.

3. Cantilever Deflection: Limited to 2l/175 at unsupported cantilevers.

E. Structural: Test according to ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceed specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. (480 Pa).

G. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft. (480 Pa)] [15 lbf/sq. ft. (720 Pa)] <Insert
2. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior.

H. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested according to AAMA 501.6 at design displacement and 1.5 times the design displacement.

I. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.25 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
b. Entrance Doors: U-factor of not more than 0.25 Btu/sq. ft. x h x deg F as determined according to NFRC 100.

2. Solar Heat-Gain Coefficient (SHGC):

a. Fixed Glazing and Framing Areas: SHGC for the system of not more than 0.23 as determined according to NFRC 200.

b. Entrance Doors: SHGC of not more than 0.23 as determined according to NFRC 200.

3. Air Leakage:

a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa) when tested according to ASTM E283.
b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. (5.08 L/s per sq. m)] at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

4. Condensation Resistance Factor (CRF):

a. Fixed Glazing and Framing Areas: CRF for the system of not less than 35 as determined according to AAMA 1503.
b. Entrance Doors: CRF of not less than 57 as determined according to AAMA 1503.

J. Noise Reduction: Test according to ASTM E90, with ratings determined by ASTM E1332, as follows.

K. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 1 for basic protection.

1. Large-Missile Test: For glazing located within 30 feet (9.1 m) of grade.

L. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F (82 deg C).
b. Low Exterior Ambient-Air Temperature: 0 deg F (minus 18 deg C)
c. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

M. Structural-Sealant Joints:

1. Designed to carry gravity loads of glazing.

N. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed, aluminum-framed entrances and storefronts without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.3 STOREFRONT SYSTEMS

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.
4. Finish: Color anodic finish.
5. Fabrication Method: Field-fabricated stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with no staining, nonferrous shims for aligning system components.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch-(3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated, and fillet welded or that incorporate concealed tie rods.

    a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: As indicated.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

    a. Provide nonremovable glazing stops on outside of door.

4. Finish: Match adjacent storefront framing finish.

2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door, to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:

a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.

C. Designations: Requirements for design, grade, function, finish, quantity, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

D. Pivot Hinges: BHMA A156.4, Grade 1.

1. Offset-Pivot Hinges: Provide top, bottom, and intermediate offset pivots at each door leaf.

E. Butt Hinges: BHMA A156.1, Grade 1, radius corner.

1. Nonremovable Pins: Provide setscrew in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while entrance door is closed.
2. Exterior Hinges: Stainless steel, with stainless-steel pin.
3. Quantities:

a. For doors up to 87 inches (2210 mm) high, provide three hinges per leaf.
b. For doors more than 87 and up to 120 inches (2210 and up to 3048 mm) high, provide four hinges per leaf.

F. Continuous-Gear Hinges: BHMA A156.26.

G. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.

H. Manual Flush Bolts: BHMA A156.16, Grade 1.

I. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.

J. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

K. Cylinders:

1. As specified in Section 087100 "Door Hardware."
2. BHMA A156.5, Grade 1.

a. Keying: No master key system. Permanently inscribe each key with a visual key control number and include notation "DO NOT DUPLICATE" to be furnished by Owner.

L. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

M. Operating Trim: BHMA A156.6.

N. Removable Mullions: BHMA A156.3 extruded aluminum.

1. When used with panic exit devices, provide[keyed] removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.

O. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.

P. Concealed Overhead Holders and Stops: BHMA A156.8, Grade 1.

Q. Doorstops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

R. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D2000 molded neoprene or ASTM D2287 molded PVC.
2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

S. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

T. Thresholds: BHMA A156.21 raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).

U. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket anchored to frame hinge-jamb at center-pivoted doors.

2.6 GLAZING

A. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

B. Glazing Sealants: As recommended by manufacturer.

C. Structural Glazing Sealants: ASTM C1184 chemically curing silicone formulation that is compatible with system components with which it comes in contact; specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.

1. Color: As selected by Architect from manufacturer's full range of colors.

D. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, Weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.

1. Color: Match structural sealant.

2.7 MATERIALS

A. Sheet and Plate: ASTM B209 (ASTM B209M).

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

2.8 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

E. Rigid PVC Filler.

2.9 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

F. Storefront Framing: Fabricate components for assembly using shear-block system.

G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior and exterior doors, provide compression weather stripping at fixed stops.

H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

J. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.

1. Color: As selected by Architect from full range of industry colors and color densities.

2.11 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.4 ERECTION TOLERANCES

A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
3. Alignment:

a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).

4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

a. Perform a minimum of two tests in areas as directed by Architect.
b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.

2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. (0.45 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

a. Perform a minimum of two tests in areas as directed by Architect.
b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.

3. Water Penetration: ASTM E1105 at a minimum uniform static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa) and shall not evidence water penetration.

C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 MAINTENANCE SERVICE

A. Entrance Door Hardware Maintenance:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 08 41 13

SECTION 085113 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes aluminum windows.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: For aluminum windows.

1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches (50 by 100 mm) in size.

D. Samples for Verification: For aluminum windows and components required, showing full range of color variations for finishes, and prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches (50 by 100 mm).
2. Exposed Hardware: Full-size units.

E. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: 10 years from date of Substantial Completion.
b. Glazing Units: Five years from date of Substantial Completion.
c. Aluminum Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: AAMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: LC.
2. Minimum Performance Grade: 25.

C. Sound Transmission Class (STC): Rated for not less than 26 STC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.

D. Outside-Inside Transmission Class (OITC): Rated for not less than 22 OITC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E1332.

2.3 ALUMINUM WINDOWS

A. Types: Provide the following types in locations indicated on Drawings:

1. Fixed.

B. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3.

C. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

D. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class II, Color Anodic Finish: AA-M12C22A32/A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, integrally colored or electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.

1. Color: As selected by Architect from full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 085113

SECTION 087100 - FINISH HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work under this section comprises of furnishing hardware specified herein and noted on drawings for a complete and operational system, including any electrified hardware components, systems, controls and hardware for aluminum entrance doors. Any door shown on the drawing and not specifically referenced in the hardware sets shall be provided with identical hardware as specified on other similar openings and shall be included in the General Contractor's base bid. All fire rated door shall be provided with fire rated hardware as required by local code Authority as part of the General Contractor's base bid. The hardware supplier shall verify all cylinder types specified for locking devices supplied as part of the door system with the door manufacturer and/or door supplies.

B. The General Contractor shall notify the Architect in writing of any discrepancies (five (5) days prior to bid date) that could and/or would result in hardware being supplied that is none functional, hardware specified and/or hardware that has not been specified that will result in any code violations and any door that is not covered in this specification. Failure of the General Contractor to address any such issue could be considered acceptance of the hardware specified and any and/or all discrepancies could be corrected at the General Contractor's expense.

C. Items include but are not limited to the following:

1. Hinges - Pivots
2. Flush Bolts
3. Exit Devices
4. Locksets and Cylinders
5. Push Plates - Pulls
6. Coordinators
7. Closers
8. Kick, Mop and Protection Plates
9. Stops, Wall Bumpers, Overhead Controls
10. Electrified Hold Open Devices
11. Thresholds, Seals and Door Bottoms
12. Silencers
13. Miscellaneous Trim and Accessories

1.2 RELATED DOCUMENTS, drawings and general provisions of contract, including General and Supplementary Conditions, and Division 1 Specification sections, apply to this section.

1.3 RELATED WORK specified elsewhere that should be examined for its effect upon this section:

A. Section 06 20 00 - Finish Carpentry
B. Section 08 11 13 – Steel Doors and Frames
C. Section 08 14 16 – Flush Wood Doors
D. Sections 08 31 13 – Access Doors
E. Section 08 39 00 – Watertight Doors
E. Section 08 41 13 – Aluminum Entrances, Storefront and Window Framing
F. Sections 08 80 00 – Glass and Glazing
G. Sections 09 91 00 - Painting
H. Division 26 – Electrical
I. Division 28 – Access Control

1.4 REFERENCES SPECIFIED in this section subject to compliance as directed:

A. NFPA-80 - Standard for Fire Doors and Windows
B. NFPA-101 - Life Safety Code
C. ADA - The Americans with Disabilities Act - Title III - Public Accommodations
D. ANSI-A 117.1 - American National Standards Institute - Accessible and Usable Buildings and Facilities
E. ANSI-A 156.5 - American National Standards institute -Auxiliary Locks and Associated Products
F. UFAS - Uniform Federal Accessibility Standards
G. UL - Underwriter's Laboratories
H. WHI - Warnock Hersey International, Testing Services
I. State and Local Codes including Authority Having Jurisdiction
J. UL10C – Positive Pressure
K. IBC-2018 – International Building Code
L. NFPA-70 – International Electrical Code

1.5 SUBMITTALS

A. HARDWARE SCHEDULES submit copies of schedule in accordance with Division 1, General Requirements. Schedule to be in vertical format, listing each door opening, including: handing of opening, all hardware scheduled for opening or otherwise required to allow for proper function of door opening as intended, and finish of hardware. At doors with door closers or door controls include degree of door opening. Supply the schedules all Finish Hardware within two (2) weeks from date purchase order is received by the hardware supplier.

B. Submit manufacturer's cut/catalog sheets on all hardware items and any required special mounting instructions with the hardware schedule.

C. Certification of Compliance:

1. Submit any information necessary to indicate compliance to these specifications as required.
2. Submit a statement from the manufacturer that electronic hardware and systems being supplied comply with the operational descriptions exactly as specified.

D. Submit any samples necessary as required by the Architect.

E. Templates for finish hardware items to be sent to related door and frame suppliers within three (3) working days of receipt of approved hardware schedule.

F. Doors and Frames used in positive pressure opening assemblies shall meet UL10C in areas where this specification includes Seals for smoke door.

1.6 QUALITY ASSURANCE

A. Hardware supplier to be a qualified, Factory Authorized, direct distributor of the products to be furnished. In addition, the supplier to have in their regular employment an AHC or AHC /CDC and/or a person of equivalent experience (minimum fifteen (15) years in the industry) who will be made available at reasonable times to consult with the Architect/Contractor and/or the Owners Representative regarding any matters affecting the finish hardware on this project.

B. All hardware used in labeled fire or smoke rated openings to be listed for those types of openings and bear the identifying label or mark indicating UL. (Underwriter's Laboratories) approved for fire. Exit devices in non-labeled openings to be listed for panic.

1.7 DELIVERY, HANDLING AND PACKAGING

A. Furnish all hardware with each unit clearly marked and numbered in accordance with the hardware schedule. Include door and item number for each.

B. Pack each item of hardware completes with all necessary parts and fasteners.

C. Properly wrap and cushion each item to prevent scratches and dents during delivery and storage.

1.8 SEQUENCING AND SCHEDULING

Any part of the finish hardware required by the frame or door manufacturers or other suppliers that is needed to produce doors or frames is to be sent to those suppliers in a timely manner, so as not to interrupt job progress.

1.9 WARRANTY

All finish hardware shall be supplied with a one- (1) year warranty against defects in materials and workmanship, commencing with substantial completion of the project except as follows:

1. All Closers shall have a thirty- (30) year written warranty.

2. All Grade 1 “ND” Locksets shall have a ten- (10) year written warranty.
3. All Exit Devices shall have a three (3) year written warranty.
4. All Continuous Hinges shall have a ten-(10) year written warranty.

PART 2 – PRODUCTS

2.1 FASTENERS

A. Furnish with finish hardware all necessary screws, bolts and other fasteners of suitable size and type to anchor the hardware in position for a long life under hard use.

B. Furnish fastenings where necessary with expansion shields, toggle bolts and other anchors designated by the Architect according to the material to which the hardware is to be applied and the recommendations of the hardware manufacturer. All closers and exit devices on labeled wood doors shall be through-bolted if required by the door manufacturer. All thresholds shall be fastened with wood screws and plastic anchors. Where specified in the hardware sets, security type fasteners of the type called for are to be supplied.

C. Design of all fastenings shall harmonize with the hardware as to material and finish.

D. All hardware shall be installed with the Manufacturers standard screws as provided. The use of any other type of fasteners shall not be permitted. The general contractor shall provide wood blocking in all stud walls specified and/or scheduled to receive wall stops, No Exception.

2.2 ENVIRONMENTAL CONCERN FOR PACKAGING

The hardware shall ship to the job site is to be packaged in biodegradable packs such as paper or cardboard boxes and wrapping.

2.3 HINGES

A. All hinges to be of one manufacturer as hereafter listed for continuity and consideration of warranty. Provide one of the following manufacturers Ives, Hager, Mc Kinney or Stanley.

B. Unless otherwise specified provide five-knuckle, heavy-duty, button tip, full mortise template type hinges with non-rising loose pins. Provide non-removable pins for out swinging doors at secured areas or as called for in this specification (Refer to 3.02 Hardware Sets).

C. Provide all out-swinging doors with non-removable pins or security studs as called for in 3.02 Hardware Sets. Furnish three (3) hinges up to 90 inches high and one (1) additional hinge for every 30 inches or fraction thereof.

D. Furnish three (3) hinges up to 90 inches high and one (1) additional hinge for every 30 inches or fraction thereof.

E. Provide size 4½" x 4½" for all 1¾" thick doors up to and including 36 inches wide. Doors over 1¾" through 2¼" thick, use 5" x 5" hinges. Doors over 36 inches use 5" x 4½" unless otherwise noted in 3.02 Hardware Sets.

F. Were required to clear the trim and/or to permit the doors to swing 180 degrees furnish hinges of sufficient throw.

G. Provide heavy weight hinges on all doors over 36 inches in width.

H. At labeled door's steel or stainless steel, bearing-type hinges shall be provided. For all doors equipped with closers provide bearing-type hinges.

2.4 LOCK AND LOCK TRIM

A. All locksets, latch sets and trim to be of one manufacturer as hereafter listed for continuity of design and consideration of warranty. Locksets Specified are Schlage "L9000" series with 06A Levers and shall be provided as.
B. Mechanical locks shall meet ANSI/BHMA A156.13, Series 1000, Grade 1 Operational, with all standard trims and conventional mortise cylinders.
C. Provide locks with a standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
D. Provide standard ASA strikes unless extended lip strike is necessary for frame/trim or 7/8" lip strike is necessary at pair with overlapping astragal.
E. Provide metal wrought box strike boxes and curved lip strikes with proper lip length to protect trim of the frame, but not to project more than 1/8 inch beyond frame trim or the inactive leaf of a pair of doors.

2.5 CYLINDERS AND KEYING

A. Provide all exterior and interior locks or Exit Devices requiring cylinders keyed to the Existing Large Format Interchangeable Core Master Key Everest System as instructed by the Owners Representative. Cylinders shall comply with performance requirements of ANSI A156.5. All keys shall be of nickel silver material only. The hardware supplier shall meet with the General Contractor, the Architect and the Owners Representative at the project jobsite to determine all permanent keying requirements.

B. Cylinders shall be factory keyed and factory maintained as directed by the owners Representative and the Architect. Provide two- (2) keys per cylinder and four- (4) master keys per master used.

C. Factory stamp all keys "Do not duplicate" and with key symbol as directed by the Owners Representative. Visual key control shall be provided on all permanent keys and cylinders.

D. Provide temporary keyed construction cores for the duration of the construction phase. Provide ten (10) construction keys and two (2) construction control keys. All construction cores shall be returned to the hardware supplier upon installation of permanent cores.

2.6 EXIT DEVICES

A. All exit devices and trim, including electrified items, to be of one manufacturer as hereafter listed and in the hardware sets for continuity of design and consideration of warranty; electrified devices and trim to be the same series and design as mechanical devices and trim.

B. Exit Devices to be “UL” listed for life safety. All exit devices for labeled doors shall have “UL” label for “Fire Exit Hardware”. All devices mounted on labeled wood doors are to be through-bolted or per the manufacturer’s listing requirements. All devices shall conform to NFPA 80 and NFPA 101 requirements.

C. All exit devices to be of a heavy duty, chassis mounted design, with a one-piece removable cover, eliminating necessity of removing the device from the door for standard maintenance and keying requirements.

D. All trims to be through-bolted to the lock stile case. Lever design to be the same as specified with the lock sets.

E. Exit Devices shall be the modern push rail design. All exit devices shall be mounted with sex bolts and installed with the manufactures standard screws. Exit Hardware Devices found to be installed with self-drilling and self-tapping screws shall be removed and reinstalled at the installer expenses.

F. All devices shall carry a three- (3) year warranty against manufacturing defects and workmanship.

G. Furnish roller strikes for all rim and surface vertical rod exit devices. Internal springs shall be coil compression type. Furnish security dead latching for all active latch bolts.

H. All Exit Devices shall be field modifiable as incorporate an Electric Latch Retraction Feature without the purchase of new Panic Exit Hardware.

J. Exit Devices shall be the Von Duprin “XP99 – EXTERIOR / 99-INTERIOR” series as specified.

2.7 SURFACE MOUNTED DOOR CLOSERS

A. All closers for this project shall be the products of a single manufacturer for continuity of design and consideration of warranty. All door closers shall be mounted as to achieve the maximum degree of opening (trim permitting).

B. All closers to be heavy duty, surface-mounted, fully hydraulic, rack and pinion action with high strength case iron cylinder to provide control throughout the entire door opening and closing cycle.

C. Size all closers in accordance with the manufacturer's recommendations at the factory.

D. All closers to have adjustable spring power sizes 1 or 2 through 4 or 6 and non-critical regulating screw valves for closing speed, latching speed and back-check control as a standard feature unless specified otherwise.

E. Provide closer covers only if provided as a standard part of the door closer package.

F. The hardware supplier shall provide all required brackets, spacers or filler plates as required by the manufacture for a proper and functional installation as part of their base bid.

G. Supply appropriate arm assembly for each closer so that closer body and arm are mounted on non-public side of door opening and on the interior side of exterior openings, except where required otherwise in the hardware sets.

H. Provide drop plates and any additional mounting brackets required for the proper installation of the door closer shall be included in the hardware supplier's base bid.

I. Finish: Baked on Powder Coated finish shall match other hardware.

J. Provide and mount all door closers with sex bolts as provided by the manufacturer.

K. Closers shall be LCN "4040XP" series as specified.

2.8 DOOR STOPS AND HOLDERS

A. Door stops are to be furnished for every door leaf. Every door is to have a floor, wall, or an overhead stop.

B. Place doorstops in such a position that they permit maximum door swing, but do not present a hazard of obstruction. Furnish floor strikes for floor holders of proper height to engage holders of doors.

C. Where overhead stops and holders are specified, or otherwise required for proper door operation, they are to be heavy duty and of extruded brass, bronze or stainless steel with no plastic parts as specified. The General Contractor shall provide wood blocking in all stud walls specified and scheduled to receive wall stops.

D. Finish: Shall match other hardware where available.

E. Acceptable Products

1. Floor and wall stops as listed in hardware sets. Equivalent products as manufactured by Ives, ABH and Trimco are acceptable.

2.9 PUSH PLATES, DOOR PULLS, AND KICKPLATES

A. All push plates, door pull, kick plates and other miscellaneous hardware as listed in hardware sets. Equivalent products as manufactured by Ives, Hager and Trimco are acceptable.

B. Kick plates to be 10 inches high and Mop plates to be 6 inches high, both by 1-½ inches or 1 inch less than door width (LDW) as specified. They are to be of 16-gauge thick base metal. For door with louvers or narrow bottom rails, kick plate height to be 1 inch less dimension shown from the bottom of the door to the bottom of the louver or glass.

C. Where required armor plates, edge guards and other protective hardware shall be supplied in sizes as scheduled in the hardware sets.

D. Finish: Same as other hardware where available.

2.10 FLUSH BOLTS AND COORDINATORS

A. Provide Flush bolts with Dust Proof Strikes as indicated in the individual hardware sets by Ives, Hager and Trimco are acceptable. Finish shall match the adjacent hardware.

2.11 THRESHOLDS AND SEALS

A. Provide materials and finishes as listed in hardware sets. Zero products have been specified to set a high level of quality, equivalent product by manufactured by National Guard Products and Pemko shall be acceptable. All thresholds must be in accordance with the requirements of the ADA and ANSI A117.1.

B. Provide thresholds with Zero 224 MSLA-4 anchoring application. Supply all necessary anchoring devices as supplied by the product manufacturer for the installation of weather strip and sound seal.

C. Seals shall comply with requirements of UL10C. All thresholds, door bottoms and weather strip inserts shall be a silicone based product as specified in 3.02 Hardware Sets. Other materials used shall be rejected, unless originally specified.

D. Seals shall comply with the requirements of the Wood Door Manufacturer's certification requirements.

E. Install all Threshold in a full bed of sealant as to prevent water & insect penetration inside of the building.

2.12 FINISHES

A. Finishes for all hardware are as required in this specification and the hardware sets.

B. Special care is to be taken to make uniform the finish of all various manufactured items.

2.13 DOOR SILENCERS

A. Provide door silencers at all openings without gasket. Provide two- (2) each at pair of doors and three- (3) or four- (4) each for each single door (coordinate with the frame manufacturer).

2.14 PROPRIETARY PRODUCTS

A. References to specific products are used to establish quality standards of utility and performance. Unless otherwise approved provide only the specified product.

B. All other materials, not specifically described, but required for a complete and proper finish hardware installation, are to be selected by the Contractor, subject to the approval of the Architect and the Owners Representative.

C. Architect and the Owners Representative reserve the right to approve all the substitutions proposed for this specification. All requests for substitution to be made prior to bid in accordance with Division 1, General Requirements, and are to be in writing, hand delivered to the Architect. Two (2) copies of the manufacturer's brochures and a physical sample of each item in the appropriate design and finish shall accompany requests for substitution.

PART 3 - EXECUTION

3.1 INSTALLATION AND SERVICE ITEMS OF FINISH HARDWARE

A. All finish hardware shall be installed by an experienced finish hardware installer with at least ten (10) years of experience after a pre-installation meeting between the contractor, hardware Manufacturers representative, the hardware supplier, the hollow metal supplier and the wood door supplier. The finish hardware installer shall be responsible for the proper installation and function of all doors and hardware.

B. The hardware supplier's office and/or warehouse shall be located within a one seventy-five (75) mile radius of the project site as to better service the general contractor and the Owners Representative during this project.

C. Check hardware against the reviewed hardware schedule upon delivery. Store the hardware in a dry and secure location to protect against loss and damage.

D. Install finish hardware in accordance with approved hardware schedule and manufacturers' printed instructions. Pre-fit hardware before finish is applied to door; remove and reinstall after finish is complete and dry. Install and adjust hardware so that parts operate smoothly, close tightly, and do not rattle.

E. Mortise and cutting to be done neatly, and evidence of cutting to be concealed in the finished work. Protect all Finish hardware from scratching or other damage.

3.2 HARDWARE SETS

106360 OPT0359288 Version 1

Hardware Group No. 001 - OH DOOR

For use on Door #(s):
118A

Provide each RU door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	MORTISE CYLINDER	20-061 ICX W/CONST. CORE TYPE/QTY REQD	626	SCH
1	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM) TYPE/QTY REQD	626	SCH
		NOTE	BALANCE OF HARDWARE BY DOOR Mfr		

-COORDINATE HARDWARE WITH DOOR MFR.
-REMOVE CYLINDER AND CORE IF NOT REQUIRED.

Hardware Group No. 103 - SGL OFFICE LOCK

For use on Door #(s):
124

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050TD 06A L583-363	626	SCH
1	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 103A - SGL OFFICE LOCK (ALUM DR)

For use on Door #(s):
101 108 117 124A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050TD 06A L583-363	626	SCH
1	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
	SET	SEAL	PERIMETER SEAL BY DOOR/FRAME MANUFACTURER		

Hardware Group No. 201C - SGL STOREROOM LOCK CLOSER

For use on Door #(s):
113

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080TD 06A	626	SCH
1	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
1	EA	SURFACE CLOSER	4040XP-SCUSH-SNB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 203 - SGL OFFICE LOCK

For use on Door #(s):
127A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080TD 06A	626	SCH
1	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 205 - SGL EXTERIOR STORAGE

For use on Door #(s):
127 201

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	L9080TD 06A	626	SCH
1	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
1	EA	SURFACE CLOSER	4040XP-SCUSH-SNB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA DW + 4" (OMIT @ COVERED OPENINGS)	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC HEADER WIDTH	AA	ZER
1	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	65A-226-MSLA-FRAME WIDTH	A	ZER

Hardware Group No. 210 - PAIR INTERIOR MECH/ELEC RM

For use on Door #(s):
109

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CONST LATCHING BOLT	FB51P/FB61P AS REQ	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	L9080TD 06A	626	SCH
1	EA	FSIC PERMANENT CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4040XP-RW/PA-TBSRT	689	LCN
2	EA	ARMOR PLATE	8400 32" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
1	SET	MEETING STILE	8193AA (2 PCS - 1 SET) (OMIT @ NON-RATED DOORS)	AA	ZER

Hardware Group No. 212S - PAIR STORAGE OH STOPS

For use on Door #(s):
122

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458-LENGTH REQ	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	L9080TD 06A	626	SCH
1	EA	FSIC PERMANENT CORE	23-030	626	SCH
2	EA	OH STOP	100S (SIZE/MNT AS REQD)	630	GLY
2	EA	ARMOR PLATE	8400 32" X 1" LDW B-CS AS REQD	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
1	EA	OVERLAPPING ASTRAGAL	383AA-DOOR HEIGHT	AA	ZER

Hardware Group No. 341 - SGL PRIV TOILET

For use on Door #(s):
103 121

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIV W/DB COIN TURN W/ OUTSIDE INDICATOR	L9444 06A L583-363 OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4040XP-RW/PA-TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
1	EA	COAT AND HAT HOOK	582M	626	IVE

-INDICATOR ON OUTSIDE OF DOOR.

Hardware Group No. 503 - SGL CLASSROOM LOCK

For use on Door #(s):
105 107 123D

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070TD 06A	626	SCH
1	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 503A - SGL CLASSROOM LOCK

For use on Door #(s):
102

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070TD 06A	626	SCH
1	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
	SET	SEAL	PERIMETER SEAL BY DOOR/FRAME MANUFACTURER		

Hardware Group No. 503AP - SGL CLSSRM LOCK WALL HOLDR /ARMOR

For use on Door #(s):
118

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070TD 06A	626	SCH
1	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
1	EA	ARMOR PLATE	8400 32" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP/HOLDER	FS495	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 551AH - SGL SECTY CLASSROOM LOCK (A/G) HOLD-OPEN

For use on Door #(s):
120A 120B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	L9071TD 06A IS-LOC	626	SCH
2	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
1	EA	SURFACE CLOSER	4040XP-SHCUSH-SNB	689	LCN
1	EA	MOUNTING PLATE	4040XP-18/18PA (AS REQD)	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30	689	LCN
	SET	SEAL	PERIMETER SEAL BY DOOR/FRAME MANUFACTURER		

Hardware Group No. 551H - SGL CLASSROOM SECTY LOCK/CLOSE/WALL HOLDR

For use on Door #(s):
112 114 115 116

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY W/ INSIDE INDICATOR	L9071TD 06A IS-LOC	626	SCH
2	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
1	EA	SURFACE CLOSER	4040XP-RW/PA-TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP/HOLDER	FS495	626	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 714AM - PR EXTERIOR PANIC - EO

For use on Door #(s):
104

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112XY HEIGHT AS REQ	628	IVE
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
2	EA	PANIC HARDWARE	XP99-EO	626	VON
1	EA	MORTISE CYLINDER	20-061 ICX W/CONST. CORE	626	SCH
1	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
2	EA	DOOR PULL	VR910 DT	630	IVE
2	EA	SURFACE CLOSER	4040XP-SCUSH-SNB	689	LCN
2	EA	MOUNTING PLATE	4040XP-18/18PA (AS REQD)	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30	689	LCN
1	EA	RAIN DRIP	142AA DW + 4" (OMIT @ COVERED OPENINGS)	AA	ZER
	SET	SEAL	PERIMETER SEAL BY DOOR/FRAME MANUFACTURER		
2	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-EV3-226-MSLA-FRAME WIDTH	A	ZER

Hardware Group No. 714M - PR EXTERIOR PANIC

For use on Door #(s):
123B 123C

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112XY HEIGHT AS REQ	628	IVE
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
2	EA	PANIC HARDWARE	LD-XP99-EO-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX W/CONST. CORE	626	SCH
2	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
1	EA	DOOR PULL	VR910 DT	630	IVE
1	EA	DOOR PULL	VR910 NL	630	IVE
2	EA	SURFACE CLOSER	4040XP-SCUSH-SNB	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS WHERE APPLICABLE	630	IVE
1	EA	RAIN DRIP	142AA DW + 4" (OMIT @ COVERED OPENINGS)	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC HEADER WIDTH	AA	ZER
2	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-EV3-226-MSLA-FRAME WIDTH	A	ZER

Hardware Group No. 715 - SGL EXTERIOR PANIC - VR TRIM

For use on Door #(s):
125A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	XP99-EO-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
1	EA	DOOR PULL	VR910 NL	630	IVE
1	EA	SURFACE CLOSER	4040XP-SCUSH-SNB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA DW + 4" (OMIT @ COVERED OPENINGS)	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC HEADER WIDTH	AA	ZER
1	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-EV3-226-MSLA-FRAME WIDTH	A	ZER

Hardware Group No. 750M - PR INTERIOR PANICS - CDSI

For use on Door #(s):
123 123A 125

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
1	EA	PANIC HARDWARE	CDSI-99-L-DT-06-SNB	626	VON
1	EA	PANIC HARDWARE	CDSI-99-L-NL-06-SNB	626	VON
1	EA	RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
3	EA	MORTISE CYLINDER	20-061 ICX W/CONST. CORE (FOR MULLION)	626	SCH
4	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
2	EA	SURFACE CLOSER	4040XP-RW/PA-TBSRT	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
1	SET	MEETING STILE	8193AA (2 PCS - 1 SET) (OMIT @ NON-RATED DOORS)	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER

Hardware Group No. 751 - SGL PANIC SECURITY WITH -2SI INDICATOR

For use on Door #(s):
106 106A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PANIC HARDWARE	LD-99-L-2SI-06-SNB	626	VON
2	EA	RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
2	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
1	EA	SURFACE CLOSER	4040XP-RW/PA-TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 801L - SGL PUSH/PULL/CLOSER/CLSSRM D-LOK

For use on Door #(s):
110 111

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM DEADBOLT	B663T 12-631	626	SCH
1	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
1	EA	PUSH PLATE	8200 8" X 16"	630	IVE
1	EA	PULL PLATE	8303 8" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4040XP-RW/PA-TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. R714AM - PR EXTERIOR PANIC ACCESS CONTROLLED

For use on Door #(s):
100 100A

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY HEIGHT AS REQ	628	IVE
1	EA	CONT. HINGE	112XY EPT HEIGHT AS REQ ACTIVE	628	IVE
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
1	EA	ELEC PANIC HARDWARE	CD-RX-XP99-NL-OP-110MD-CON ACTIVE	626	VON
1	EA	PANIC HARDWARE	CD-XP99-EO	626	VON
1	EA	RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
3	EA	MORTISE CYLINDER	20-061 ICX W/CONST. CORE	626	SCH
4	EA	FSIC CORE	23-030 CKC EV29 T (VERIFY/MATCH EXIST SYSTEM)	626	SCH
2	EA	90 DEG OFFSET PULL	8190-O 10"	630	IVE
2	EA	SURFACE CLOSER	4040XP-SCUSH-SNB	689	LCN
2	EA	MOUNTING PLATE	4040XP-18/18PA (AS REQD)	689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30	689	LCN
1	EA	RAIN DRIP	142AA DW + 4" (OMIT @ COVERED OPENINGS)	AA	ZER
	SET	SEAL	PERIMETER SEAL BY DOOR/FRAME MANUFACTURER		
2	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-EV3-226-MSLA-FRAME WIDTH	A	ZER
2	EA	WIRE HARNESS (1 IN DOOR & 1 IN FRAME)	ALLEGION CONNECT TYPE & LENGTH AS REQ		SCH
1	EA	HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS		SCH
	EA	DESK MOUNT BUTTON	660-PB OR SIM (PROVIDED BY SEC 28)	628	SCE
	EA	DOOR CONTACT (DPDT)	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O
	EA	MAGNETIC LOCK	PROVIDED BY SECURITY CONTRACTOR ACTIVE ONLY		B/O

END OF SECTION

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fixed extruded-aluminum and formed-metal louvers.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing according to AMCA 500-L.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.
2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

D. Delegated-Design Submittal: For louvers indicated to comply with structural performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

B. Windborne-debris-impact-resistance test reports.

C. Sample Warranties: For manufacturer's special warranties.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.2/D1.2M.
2. AWS D1.3/D1.3M.
3. AWS D1.6/D1.6M.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 WARRANTY

A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

B. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Wind-Driven-Rain-Resistant Louver:

1. Louver Depth: 5 inches (127 mm).
2. Frame and Blade Nominal Thickness: Not less than 0.060 inch (1.52 mm) for blades and 0.080 inch (2.03 mm) for frames.
3. Louver Performance Ratings:

2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

1. Screen Location for Fixed Louvers: Interior face.
2. Screening Type: Insect screening.

B. Secure screen frames to louver frames with stainless-steel machine screws spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.

2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:

1. Insect Screening: Stainless steel, 18-by-18 (1.4-by-1.4-mm) mesh, 0.009-inch (0.23-mm) wire.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E 488/E 488M conducted by a qualified testing agency.

2.6 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Channel unless otherwise indicated.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.

1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
2. Exterior Corners: Prefabricated corner units with mitered and welded blades and with fully recessed mullions at corners.

F. Provide subsills made of same material as louvers or extended sills for recessed louvers.

G. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.7 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation Reports: For post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

B. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 10 lbf/sq. ft. (480 Pa).

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized unless otherwise indicated.

B. Studs and Tracks: ASTM C 645. Use either steel studs and tracks or embossed steel studs and tracks.

1. Steel Studs and Tracks:

   a. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection.
   b. Depth: As indicated on Drawings.

2. Embossed Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally equivalent to conventional ASTM C 645 steel studs and tracks.

   a. Minimum Base-Metal Thickness: As required by horizontal deflection performance requirements.
   b. Depth: As indicated on Drawings.

C. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 1-1/2 inches (38 mm).
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

B. Hanger Attachments to Concrete:

1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or AC308 as appropriate for the substrate.

a. Uses: Securing hangers to structure.
b. Type: Torque-controlled, expansion anchor or adhesive anchor.
c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch (25 by 5 mm) by length indicated.

E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.367 mm) and minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: As indicated on Drawings.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226/D 226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 079219 "Acoustical Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
3. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum wallboard.
2. Gypsum ceiling board.
3. Impact-resistant gypsum board.
4. Water-resistant gypsum backing board.
5. Joint treatment materials.
6. Sound-attenuation blankets.
7. Acoustical sealant.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C1396/C1396M.
1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

B. Gypsum Ceiling Board: ASTM C1396/C1396M.
1. Thickness: 1/2 inch (12.7 mm).
2. Long Edges: Tapered.

C. Impact-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.

1. Core: As indicated on Drawings.
2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 3 requirements.
4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.

5. Hard-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements according to test in Annex A1.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.3 TILE BACKING PANELS

A. Water-Resistant Gypsum Backing Board: ASTM C1396/C1396M, with manufacturer's standard edges.
   1. Core: As indicated on Drawings.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
   2. Shapes:

      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. L-Bead: L-shaped; exposed long flange receives joint compound.
      d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      e. Base-of-Wall Galvanized Moisture Barrier Trim: Galvanized-steel sheet, 2 inches (50 mm) high.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

   1. Interior Gypsum Board: Paper.
   2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

   1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

      a. Use setting-type compound for installing paper-faced metal trim accessories.

   3. Fill Coat: For second coat, use setting-type, sandable topping.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.6 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: As indicated on Drawings.
2. Ceiling Type: As indicated on Drawings.
3. Impact-Resistant Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLATION OF TILE BACKING PANELS

A. Water-Resistant Backing Board: Install where indicated with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Ceramic mosaic tile.
2. Porcelain tile.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

C. Face Size: Actual tile size, excluding spacer lugs.

D. Module Size: Actual tile size plus joint width indicated.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product.

D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Waterproof membrane.
2. Crack isolation membrane.
3. Cementitious backer units.
4. Metal edge strips.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation in swimming pools, on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

A. Ceramic Wall Tile Type: Unglazed porcelain tile.

1. Certification: Tile certified by the Porcelain Tile Certification Agency.
2. Face Size Variation: Rectified.
3. Thickness: 1/4 inch (6.4 mm)).
4. Face: Plain with square or cushion edges.
5. Dynamic Coefficient of Friction: Not less than 0.42.
6. Tile Color, Glaze, and Pattern: As selected by Architect from manufacturer's full range.
7. Grout Color: As selected by Architect from manufacturer's full range.
8. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

a. Base Cap: Surface bullnose, module size same as adjoining flat tile.
b. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above it, same size as adjoining flat tile.
c. Internal Corners: Field-butted square corners.
d. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.4 mm) across nominal 4-inch (100-mm) dimension.

2.4 SETTING MATERIALS

A. Standard Dry-Set Mortar (Thinset): ANSI A118.1.

1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.

2.5 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F (60 and 100 deg C), respectively, and certified by manufacturer for intended use.

2.6 MISCELLANEOUS MATERIALS

A. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

2.7 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF CERAMIC TILE

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

    a. Exterior tile floors.
    b. Tile floors in wet areas.
    c. Tile swimming pool decks.
    d. Tile floors in laundries.
    e. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
    f. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
2. Glazed Wall Tile: 1/16 inch (1.6 mm).
3. Porcelain Tile: 1/4 inch (6.4 mm).

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

3.4 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.5 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Wall Installations, Wood or Metal Studs or Furring:

1. Ceramic Tile Installation: TCNA W243; thinset mortar on gypsum board.

a. Thinset Mortar: Modified dry-set mortar.
b. Grout: Water-cleanable epoxy grout.

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY.

A. This Section includes acoustical panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.3 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch- (300-mm-) long Samples of each type, finish, and color.

C. Maintenance Data: For finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
2. Suspension System: Obtain each type through one source from a single manufacturer.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A, B ,C materials as determined by testing identical products per ASTM E 84:

a. Smoke-Developed Index: 450 or less.

D. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:

1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

1.8 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. As shown in the drawings.

C. Color: White.

D. LR: Not less than 0.85.

E. NRC: Not less 0.80.

F. CAC: Not less than 35.

G. Edge/Joint Detail: SLT.

H. Thickness: 7/8 inch (22 mm).

I. Modular Size: 24 by 24 inches (610 by 610 mm).

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Type: Postinstalled expansion anchors.
b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.

3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
4. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-),0.135-inch- (3.5-mm-) diameter wire.

E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. As shown in the drawings.

C. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 9/16-inch- (15-mm-) wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. Face Design: Flat, flush.
3. Cap Material: Steel cold-rolled sheet.
4. Cap Finish: Painted white.

2.5 ACOUSTICAL SEALANT

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. USG Corporation; SHEETROCK Acoustical Sealant.

2. Acoustical Sealant for Concealed Joints:

a. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
b. Pecora Corporation; BA-98.
c. Tremco, Inc.; Tremco Acoustical Sealant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
8. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
9. Do not attach hangers to steel deck tabs.
10. Do not attach hangers to steel roof deck. Attach hangers to structural members.
11. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
12. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

    a. As indicated on reflected ceiling plans.
    b. Install panels with pattern running in one direction parallel to long axis of space.
    c. Install panels in a basket-weave pattern.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

D. Product Schedule: For resilient products. Use same designations indicated on Drawings.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Mockups: Provide resilient products with mockups specified in other Sections.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Resilient Base:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allstate Rubber Corp.; Stoler Industries.
b. Armstrong World Industries, Inc.
c. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
d. Endura Rubber Flooring; Division of Burke Industries, Inc.
e. Estrie Products International; American Biltrite (Canada) Ltd.
f. Flexco, Inc.
g. Johnsonite.
h. Mondo Rubber International, Inc.
i. Musson, R. C. Rubber Co.
j. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
k. PRF USA, Inc.
l. Roppe Corporation, USA.
m. VPI, LLC; Floor Products Division.

B. Minimum Thickness: 0.125 inch (3.2 mm).

C. Height: As indicated on Drawings.

D. Lengths: Cut lengths 48 inches (1219 mm) long or coils in manufacturer's standard length.

E. Outside Corners: Preformed.

F. Inside Corners: Preformed.

G. Finish: Matte.

H. Colors and Patterns: Match Architect's sample.

2.2 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
b. Flexco, Inc.
c. Johnsonite.
d. R.C.A. Rubber Company (The).
e. Roppe Corporation, USA.
f. VPI, LLC; Floor Products Division.

B. Description: Carpet edge for glue-down application, Nosing for resilient floor covering, Reducer strip for resilient floor covering,[Joiner for tile and carpet and Transition strips.

C. Material: Rubber.

D. Profile and Dimensions: As indicated.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Cove Base Adhesives: Not more than 50 g/L.
b. Rubber Floor Adhesives: Not more than 60 g/L.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

D. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet & resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 096566 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sheet vinyl flooring.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" for wall base and accessories installed with resilient athletic flooring.

1.2 COORDINATION

A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details and locations of the following:

1. Border tiles.
2. Floor patterns.
3. Layout, colors, widths, and dimensions of game lines and markers.
4. Locations of floor inserts for athletic equipment installed through flooring.
5. Seam locations for sheet flooring.

C. Samples: For each exposed product and for each type, color, and pattern specified, 6-inch-square in size and of the same thickness indicated for the Work.

1. Game-Line- and Marker-Paint Samples: Include Sample sets showing game-line- and marker-paint colors applied to flooring.

D. Samples for Initial Selection: For each type of resilient athletic flooring.

1. Game-Line and Marker Paint: Include charts showing available colors and glosses.

E. Samples for Verification: For each type, color, and pattern of flooring specified, 6-inch- square in size and of same thickness and material indicated for the Work.

1. Game-Line- and Marker-Paint Samples: Include Sample sets showing game-line- and

marker-paint colors applied to flooring.

2. Seam Samples: For each vinyl sheet flooring color and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For sheet vinyl flooring Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For resilient athletic flooring to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sheet Flooring: Furnish full-width rolls of not less than 10 linear feet for each 500 linear feet or fraction thereof, of each type, color, and pattern of flooring installed.

1.7 QUALITY ASSURANCE

A. Sheet Vinyl Flooring Installer Qualifications: An experienced installer who has completed sheet vinyl flooring installations using seaming methods indicated for this Project and similar in material, design, and extent to that indicated for this Project; who is acceptable to manufacturer; and whose work has resulted in installations with a record of successful in-service performance.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.

B. Store materials to prevent deterioration.

1. Store tiles on flat surfaces.
2. Store rolls upright.

1.9 FIELD CONDITIONS

A. Adhesively Applied Products:

1. Maintain temperatures during installation within range recommended in writing by

manufacturer, but not less than 70 deg F or more than 95 deg F in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.

2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
3. Close spaces to traffic during flooring installation.
4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.

B. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 ACCESSORIES

A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.

B. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.

C. Game-Line and Marker Paint: Complete system including primer, if any, compatible with flooring and recommended in writing by flooring and paint manufacturers for use indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of flooring.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Alkalinity Testing: Perform pH testing according to ASTM F710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5.
3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.

1. Do not install flooring until it is the same temperature as space where it is to be installed.

F. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 FLOORING INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions.

B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

3.4 SHEET FLOORING INSTALLATION

A. Unroll sheet flooring and allow it to stabilize before cutting and fitting.

B. Lay out sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Locate seams according to approved Shop Drawings.

C. Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

D. Vinyl Sheet Flooring Seams: Prepare and finish seams to produce surfaces flush with adjoining flooring surfaces.

1. Heat-Welded Seams: Comply with ASTM F1516. Rout joints and use welding bead to permanently fuse sections into a seamless flooring.
2. Chemically Bonded Seams: Comply with ASTM F693. Seal seams to prevent openings from forming between cut edges and to prevent penetration of dirt, liquids, and other substances into seams.

3.5 GAME LINES AND MARKERS

A. Mask flooring at game lines and markers, and apply paint to produce sharp edges. Where crossing, break minor game line at intersection; do not overlap lines.

B. Apply game lines and markers in widths and colors according to requirements indicated on Drawings.

3.6 FIELD-APPLIED FINISHES

A. Apply finish after game-line and marker paint is fully cured.

B. Apply finish according to manufacturer's written instructions to produce a sealed surface that is ready for use.

C. Do not cover flooring after finishing until finish reaches full cure.

3.7 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing flooring installation:

1. Remove adhesive and other blemishes from flooring surfaces.
2. Sweep and vacuum flooring thoroughly.

3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.

B. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 096566

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Modular carpet tile.

B. Related Requirements:

1. Section 096513 "Resilient Base and Accessories" and Section 096519 "Resilient Tile Flooring" for resilient wall base and accessories installed with carpet tile.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:

a. Review delivery, storage, and handling procedures.
b. Review ambient conditions and ventilation procedures.
c. Review subfloor preparation procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.

3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples for Initial Selection: For each type of carpet tile.

1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 3 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups at locations and in sizes shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Carpet and Rug Institute's CRI 104.

1.10 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.11 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

    a. More than 10 percent edge raveling, snags, and runs.
    b. Dimensional instability.
    c. Excess static discharge.
    d. Loss of tuft-bind strength.
    e. Loss of face fiber.
    f. Delamination.

3. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Color: As selected by Architect from manufacturer's full range.

B. Provide carpet of any irregularities in weave or materials, and each color of one dye. Moth and vermin-proof and pre-shrink carpet.

C. Carpet title shall be a symtex 24”x24” Title with 12 pile units per inch. The Dynex SD/Nylon should be 50% solution/50% yarn dyed with an ensures soil/stain protection.
   1. The primary backing system should be made from 50.2% Pre-Consumer and 40.2% Post-Consumer recycled content. The secondary backing should be 100% Recycled Content with Tru Bloc barriers system. The total weight should be 134.9 oz per square yard.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Painted Subfloors: Perform bond test recommended in writing by adhesive manufacturer.

1. Underlayment surface is flat, smooth, evenly planed, tightly jointed, and free of irregularities, gaps greater than 1/8 inch (3 mm) protrusions more than 1/32 inch (0.8 mm), and substances that may interfere with adhesive bond or show through surface.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Primers.
2. Water-based finish coatings.

B. Related Requirements:

1. Section 099300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Samples: For each type of topcoat product.

C. Samples for Initial Selection: For each type of topcoat product.

D. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

E. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As selected by architect from manufacturer’s full range.

2.2 PRIMERS

A. Interior Latex Primer Sealer: Water-based latex sealer used on new interior plaster, concrete, and gypsum wallboard surfaces.

2.3 WATER-BASED FINISH COATS

A. Interior, Latex, Semigloss: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.

1. Gloss Level: Manufacturer's standard semigloss finish.

2.4 SOLVENT-BASED FINISH COATS

A. Interior, Alkyd, Semigloss: Pigmented, solvent-based alkyd paint for use on primed/sealed interior plaster, gypsum, wood, and metal walls primarily in residential and moderate traffic commercial environments.

1. Gloss Level: Manufacturer's standard semigloss finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.
h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Traffic Surfaces:

1. Water-Based Concrete Floor Sealer System:

a. First Coat: Matching topcoat.
b. Topcoat: Water-based concrete floor sealer.

B. Steel Substrates:

1. High-Performance Architectural Latex System:

a. Prime Coat: Alkyd quick-dry primer for metal.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Topcoat: Interior, latex, high-performance architectural coating, satin.

2. High-Performance Architectural Latex System:

a. Prime Coat: Interior latex primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, high-performance architectural coating, low sheen.

C. Acoustic Panels and Tiles:

1. High-Performance Architectural Latex System:

a. Prime Coat: Matching topcoat.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, high-performance architectural coating, low sheen.

SECTION 101100 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Visual display board assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
2. Include electrical characteristics for motorized units.

B. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:

1. Samples of facings for each visual display panel type, indicating color and texture.
2. Fabric swatches of fabric facings for tackboards.
3. Actual factory-finish color samples, applied to aluminum substrate.
4. Include accessory Samples to verify color selected.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each visual display unit, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display units to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.9 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Surfaces lose original writing and erasing qualities.
b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50.

2.2 VISUAL DISPLAY BOARD ASSEMBLY

A. Visual Display Board Assembly: Field or factory fabricated.

1. Assembly: markerboard.
2. Corners: Square.
3. Width: As indicated on Drawings.
4. Height: As indicated on Drawings.
5. Mounting Method: Direct to wall.

B. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.

1. Color: White.

C. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; standard size and shape.

1. Field-Applied Trim: Manufacturer's standard, snap-on trim with no visible screws or exposed joints.
2. Aluminum Finish: Clear anodic finish.

3. Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.

2.3 MARKERBOARD PANELS

A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with high-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.

1. Face Sheet Thickness: 0.021 inch (0.53 mm) uncoated base metal thickness.
2. Manufacturer's Standard Core: Minimum 1/4 inch (6 mm) thick, with manufacturer's standard moisture-barrier backing.
3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

2.4 MATERIALS

A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

B. Hardboard: ANSI A135.4, tempered.

C. Particleboard: ANSI A208.1, Grade M-1.

D. MDF: ANSI A208.2, Grade 130.

E. Fiberboard: ASTM C208 cellulosic fiber insulating board.

F. Extruded Aluminum: ASTM B221 (ASTM B221M), Alloy 6063.

G. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

D. Prime wall surfaces indicated to receive visual display units and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Field-Assembled Visual Display Board Assemblies: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
2. Where size of visual display board assemblies or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

C. Factory-Fabricated Visual Display Board Assemblies: Adhere to wall surfaces with egg-size adhesive gobs at 16 inches (400 mm) o.c., horizontally and vertically.

D. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.

1. Mounting Height 36 (914) inches (mm) above finished floor to top of chalktray.

3.4 CLEANING AND PROTECTION

A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

3.5 DEMONSTRATION

END OF SECTION 101100

SECTION 101416 - PLAQUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes metal plaques.

B. Related Requirements:

1. Section 101423 "Panel Signage" and Section 101423.16 "Room-Identification Panel Signage" for plaques or signs similar to metal plaques, with or without frames, except that they are made of materials other than solid metal.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plaques.

1. Include fabrication and installation details and attachments to other work.
2. Show plaque mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each plaque at least half size.

C. Samples for Verification: For each type of plaque showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Plaques: Half-size Sample.
2. Exposed Accessories: Half-size Sample of each accessory type.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For plaques to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PLAQUES

A. Cast Plaque: Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Plaque Material: Cast bronze.
2. Plaque Thickness: 0.50 inch (12.7 mm).
3. Finishes:

a. Integral Metal Finish: As selected by Architect from full range of industry finishes.
b. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
c. Overcoat: Manufacturer's standard baked-on clear coating.

4. Background Texture: Smooth.
5. Integrally Cast Border Style: Square cut without border.
6. Mounting: Concealed studs.
7. Text and Typeface: Typeface as selected by Architect from manufacturer's full range. Finish raised characters to contrast with background color, and finish Braille to match background color.

B. Etched Plaque: Chemically etched or photochemically engraved metal sheet or plate with texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Plaque Material: Sheet or plate stainless steel.
2. Plaque Thickness: 0.250 inch (6.35 mm).
3. Finishes:

    a. Integral Stainless-Steel Finish: As selected by Architect from full range of industry finishes.
    b. Overcoat: Manufacturer's standard baked-on clear coating.

4. Integral Edge Style: Plain bevel, brushed.
5. Applied Frame Material, Style, and Finish: As indicated on Drawings.
6. Mounting: Countersunk flathead through fasteners.
7. Text and Typeface: Typeface matching Architect's sample. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.2 MATERIALS

A. Bronze Castings: ASTM B584, alloy recommended by manufacturer and finisher for finish indicated.

B. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 316, stretcher-leveled standard of flatness.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:

    a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
    b. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant Allen-head, spanner-head or one-way-head slots unless otherwise indicated.

2.4 FABRICATION

A. General: Provide manufacturer's standard plaques according to requirements indicated.

1. Preassemble plaques in the shop to greatest extent possible. Disassemble plaques only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.
6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted plaques to suit plaque construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

1. Stainless-Steel Brackets: Factory finish brackets to match plaque background finish unless otherwise indicated.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.6 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2. Directional Satin Finish: No. 4.
3. Dull Satin Finish: No. 6.
4. Reflective, Directional Polish: No. 7.
5. Mirrorlike Reflective, Nondirectional Polish: No. 8.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that plaque-support surfaces are within tolerances to accommodate plaques without gaps or irregularities between backs of plaques and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.

1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
    b. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Through Fasteners: Drill holes in substrate using predrilled holes in plaque as template. Countersink holes in plaque if required. Place plaque in position and flush to surface. Install through fasteners and tighten.
3. Brackets: Remove loose debris from substrate surface and install bracket supports in position, so that plaque is correctly located and aligned.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as plaques are installed.

C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101416

SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cast dimensional characters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Dimensional Characters: Half-size Sample dimensional character.
2. Exposed Accessories: Half-size Sample of each accessory type.
3. Full-size Samples, if approved, will be returned to Contractor for use in the Project.

D. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer of products.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS

A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:

1. Character Material: Cast aluminum.
2. Character Height: As indicated on Drawings.
3. Thickness: As indicated on Drawings.
4. Finishes:

a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
b. Overcoat: Manufacturer's standard baked-on clear coating.

5. Mounting: Projecting studs.

2.2 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.

3. Exposed Metal-Fastener Components, General:

    a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
    b. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant Allen-head, spanner-head or one-way-head slots unless otherwise indicated.

4. Sign Mounting Fasteners:

    a. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

2.3 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.

1. Stainless-Steel Brackets: Factory finish brackets to match Architect's sample finish unless otherwise indicated.

2.4 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.5 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
    b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101419

SECTION 101423.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes room-identification signs that are directly attached to the building.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Room-Identification Signs: Full-size Sample.
2. Full-size Samples, if approved, will be returned to Contractor for use in Project.

D. Product Schedule: For room-identification signs. Use same designations indicated on Drawings or specified.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra material, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tools: One set(s) of specialty tools for assembling signs and replacing variable sign components.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

2.2 ROOM-IDENTIFICATION SIGNS

A. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated[over subsurface graphics] to [acrylic] [phenolic] <Insert material> backing sheet to produce composite sheet.

    a. Composite-Sheet Thickness: As indicated on Drawings.
    b. Color(s): As selected by Architect from manufacturer's full range.

2. Sign-Panel Perimeter: Finish edges smooth.

    a. Edge Condition: As indicated on Drawings.
    b. Corner Condition in Elevation: As indicated on Drawings.

3. Mounting: Manufacturer's standard method for substrates indicated.
4. Text and Typeface: Accessible raised characters and Braille. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 SIGN MATERIALS

A. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.

B. Adhesive: As recommended by sign manufacturer.

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides.

D. Hook-and-Loop Tape: Manufacturer's standard two-part tape consisting of hooked part on sign back and looped side on mounting surface.

E. Magnetic Tape: Manufacturer's standard magnetic tape with adhesive on one side.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

C. Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.

C. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
    b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
5. Hook-and-Loop Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply sign component of two-part tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage; push to engage tape adhesive. Keep tape strips 0.250 inch (6.35 mm) away from edges to prevent visibility at sign edges when sign is initially installed or reinstalled. Apply substrate component of tape to substrate in locations aligning with tape on back of sign; push and rub well to fully engage tape adhesive to substrate.
6. Magnetic Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position.

3.2 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423.16

SECTION 102113.17 - PHENOLIC-CORE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for blocking overhead support of floor-and-ceiling-anchored compartments.
2. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.
5. Show overhead support or bracing locations.

C. Samples for Initial Selection: For each type of toilet compartment material indicated.

1. Include Samples of hardware and accessories involving material and color selection.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch- (152-mm-) square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hinges: One hinge(s) with associated fasteners.
2. Latch and Keeper: One latch(es) and keeper(s) with associated fasteners.
3. Door Bumper: One door bumper(s) with associated fasteners.
4. Door Pull: One door pull (s) with associated fasteners.
5. Fasteners: Ten fasteners of each size and type.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 PHENOLIC-CORE TOILET COMPARMENTS

A. Toilet-Enclosure Style: Overhead braced.

B. Urinal-Screen Style: Wall hung.

C. Door, Panel and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system. Provide minimum 3/4-inch- (19-mm-) thick doors and pilasters and minimum 1/2-inch- (13-mm-) thick panels.

D. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch (0.79-mm) nominal thickness and 3 inches (76 mm) high, finished to match hardware.

E. Brackets (Fittings):

1. Stirrup Type: Ear or U-brackets, stainless steel.

F. Phenolic-Panel Finish:

1. Facing Sheet Finish: One color and pattern in each room.
2. Color and Pattern: As selected by Architect from manufacturer's full range with manufacturer's standard dark color core.
3. Edge Color: Manufacturer's standard.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.

1. Material: Stainless steel.
2. Hinges: Manufacturer's standard paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees allowing emergency access by lifting door.
3. Latch and Keeper: Manufacturer's standard recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
4. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
5. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).

C. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

D. Stainless-Steel Castings: ASTM A 743/A 743M.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch (13 mm).
b. Panels and Walls: 1 inch (25 mm).

2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.

a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and doors in entrance screens to return doors to fully closed position.

END OF SECTION 102113.17

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Corner guards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner Guards: 12 inches (300 mm) long. Include example top caps.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of handrail.

B. Material Certificates: For each type of exposed plastic material.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include

precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.

a. Store corner-guard covers in a vertical position.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.3 CORNER GUARD

A. Adhesive: As recommended by protection product manufacturer.

2.4 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

D. Wood Handrails: Miter corners and ends of wood handrails for returns.

2.5 FINISHES

E. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

F. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of the Work.

B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

Section 102800 – TOILET, BATH AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.

B. Related Requirements:

1. Section 088300 "Mirrors" for frameless mirrors.
2. Section 093013 "Ceramic Tiling" for ceramic toilet and bath accessories.

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Samples: For each exposed product and for each finish specified, full size.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify accessories using designations indicated.

D. Delegated-Design Submittal: For grab bars.

1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

A. Owner-Furnished Materials: Refer to drawings.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf (1112 N) concentrated load applied in any direction and at any point.

2.3 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- (0.8-mm-) minimum nominal thickness unless otherwise indicated.

B. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:

a. Portable fire extinguisher.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets.

1.3 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire-protection cabinets, including, but not limited to, the following:

a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
2. Show location of knockouts for hose valves.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed finish required, prepared on samples 6 by 6 inches (150 by 150 mm) square.

D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.Use same designations indicated on Drawings.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher

B. Cabinet Construction: Nonrated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- (1.09-mm-) thick cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Cold-rolled steel sheet.

1. Shelf: Same metal and finish as cabinet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

1. Square-Edge Trim: 1-1/4- to 1-1/2-inch (32- to 38-mm) backbend depth.
2. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.

E. Cabinet Trim Material: Steel sheet.

F. Door Material: Steel sheet.

G. Door Style: Center glass panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide manufacturer's standard.

J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

a. Identify fire extinguisher in fire-protection cabinet with the words FIRE EXTINGUISHER.

1) Location: Applied to cabinet door.
2) Application Process: Silk-screened.
3) Lettering Color: White.
4) Orientation: Vertical.

K. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
c. Color: As selected by Architect from manufacturer's full range.

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.

2. Miter corners and grind smooth.
3. Provide factory-drilled mounting holes.

Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

4. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
5. Fabricate door frames of one-piece construction with edges flanged.
6. Miter and weld perimeter door frames and grind smooth.

B. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at height indicated below.

1. Fire-Protection Cabinets: 42 inches (1067 mm) above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

B. Related Requirements:

1. Section 104413 "Fire Protection Cabinets."

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:

a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.

1.5 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.7 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

1. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type: UL-rated nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

C. Multipurpose Dry-Chemical Type in Steel Container 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 104416

SECTION 107300 - PROTECTIVE COVERS

PART 1 – GENERAL

1.1 WORK INCLUDED:
Provision, fabrication and installation of Extruded Aluminum Walkway Covers & Canopies, as shown on drawings and specified herein, and as needed for a complete and proper installation.

1.2 RELATED WORK:
1. Section 01-03-00 Alternates
2. Section 07-60-00 Flashing
3. Section 07-90-00 Sealants
4. Section 03-30-00 Concrete
5. Section 05-12-00 Structural Steel

1.3 REFERENCE STANDARDS: (Specifications for)
1. The Aluminum Association – Aluminum Design Manual 2010
2. American Welding Society- AWS D1.2/D1.2M: 2008
3. ASTM B 209 Aluminum & Aluminum Alloy Sheet and Plate
4. ASTM B 221 Aluminum & Aluminum Ally Extruded Bars, Rods, Wire, Shapes, and Tubes

1.4 SAMPLES:
1. Submit samples in accordance with Section 01-30-00
2. Product data: manufacturer's brochures, manuals and literature.
3. Shop Drawings:
    a. Includes the complete layout, sections, details, components, finishes, sizing, spacing, and fasteners specific to the project. The site-specific shop drawings shall show reactions at surface attachment points and bear the seal of a Registered Structural Engineer.
    b. General Contractor shall submit shop drawings for approval by the Architect prior to fabrication of any materials.
    c. General Contractor to verify all dimensions and elevations prior to submittal to Architect.
    d. Manufacturer shall field verify dimensions prior to fabrication.
4. Finishes: samples of canopy finishes.

1.5 QUALITY ASSURANCE:
1. Canopy shall be designed to comply with state and local building codes.
2. Canopy manufacturer shall have a minimum of 10 years' experience in designing and installing the specified system.
3. The installation of the canopy shall be performed by the manufacturer to assure single source responsibility.

1.6 MATERIALS:
1. Delivery, Storage, and Handling: protect components from one another during shipping, storage and handling. Exercise care when unloading, storing, and erecting to prevent damage.

1.7 WARRANTY:
1. Provide manufacturer's 1-year warranty against defects in material and workmanship.

PART 2 – PRODUCTS

2.1 MANUFACTURER QUALIFICATIONS:
1. Acceptable manufacturer for Extruded Aluminum Walkway Covers & Canopies: Subject to strict compliance with the specified requirements and the plans, the following manufacturer is acceptable:

2.2 MATERIALS:
1. Components: all components shall be 6063, 6061, or 6005 alloy extruded aluminum.
2. Design Criteria: all components shall be sized to comply with live load and wind load requirements of the project and shall not be less than the dimensions shown on the plan.

2.2 COMPONENTS:
1. Configuration: as shown on the drawings
2. Sizes: minimum sizing as shown on the drawings
3. Columns: all columns shall have radius corners
4. Beams: beams are open at top to drain canopy system internally into columns
5. Deck: deck thickness shall be at least .078" thick
6. Flashing: flashing thickness shall be at least .040" thick

2.3 FASTENERS, CONNECTIONS, AND FITTINGS:
1. Bolted Connections: All bolts, nuts, washers, and screws used in joining the members shall be stainless steel up to 3/8" diameter. Over 3/8" diameter may be Hot Dipped Galvanized.
2. General Contractor shall provide structural attachment points flush with the outside surface of the building.
3. Rafters shall be heliarc welded to wall mounting plates which are bolted to walls.
4. Beams are fastened to Rafters with Concealed Clips.
5. Blades are mechanically fastened to structure with Stainless Steel Screws, concealed where able.

2.4 FINISH:
1. Fluropon 70% PVDF: AAMA 2605-17 Fluropolymer 3-Coat System / Color: Per Color Schedule
   - (10 year finish warranty)
2. Woodgrain: AAMA 2604 – Super Polyester Powder Coated / Color: Per Color Schedule
   - (15 year finish warranty)

PART 3 – EXECUTION

3.1 INSTALLATION:
1. The components and accessories are to be supplied and installed by the manufacturer.
2. Install canopy in strict accordance to manufacturer's recommendations.
3. Erect canopy after concrete and masonry work in the vicinity is completed and washed down.

3.2 WORKMANSHIP:
1. Take extreme care to prevent damage or scratching. Replace damaged components prior to installation. All workmanship must be top quality with meat miters and fitted joints.

3.3 CLEANING:

1. Just prior to completion of project, strip protective coatings of covering from aluminum and clean all parts. Repair to new condition to replace any materials damaged during installation.

END OF SECTION 107300

SECTION 114000 - FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Documents, apply to the Work specified in this Section.

1.2 SUMMARY OF THE WORK

A. Project Name and Location: Fresno Boys & Girls Club
1031 W Sycamore Rd
Fresno, Tx. 77545

B. Approval of Working Surface: Any contractor performing work over the work of other contractors shall notify the Architect of any unsatisfactory conditions. The beginning of work by any contractor shall constitute acceptance of the previous work.

C. Field Verification of All Dimensions: Before ordering any materials or doing any work, field verify all measurements of the building and be responsible for their accuracy. No extras will be allowed for variations from drawings in existing conditions or work performed under this contract. Any discrepancies found shall be submitted to the Architect or Foodservice Design Professionals (FDP) for instructions before proceeding.

D. Cutting and Patching: No excessive cutting will be permitted, nor shall any structural members be cut without the written approval of the Architect. Each Contractor shall leave all chases and openings straight, true, and of the proper size in their work, as may be necessary for the proper installation of their and other contractors' work. After such work has been installed, the contractor shall carefully fit around, close, repair, patch, and point up the same as directed to the satisfaction of the Architect.

E. Cooperation: The General Contractor, all other contractors, and all subcontractors shall coordinate their work with all adjacent work and shall cooperate with all other trades to facilitate the general progress of the work. Each trade shall afford all the other trades every reasonable opportunity to install their work and store their material.

F. Inspection and Tests: The architect, Owner, Foodservice Design Professionals (FDP), and their representative shall always have access to the work, whether in preparation or progress. Provide proper and safe facilities for such access and inspection.

G. Fees, Permits, and Inspections: Secure and pay fees for all permits, licenses, and inspections as required by all authorities having jurisdiction. Give all notices and comply with all laws, ordinances, codes, rules, regulations, and contract requirements bearing on the work.

1.3 SCOPE OF WORK

A. Include the Work specified, shown, or inferable as part of Food Service Equipment. Portions of this Work may be subcontracted to those qualified to do such work as necessary because of jurisdictional trade agreements and restrictions.

B. The General Contractor is responsible for Related Work specified in other Sections: i.e., final plumbing, electrical and mechanical connections. The Kitchen Equipment Contractor (KEC) is responsible for all internal connections.

C. Specifications and drawings have been prepared to form the basis for procurement, erection, start-up, and equipment adjustment in this contract. Plans and specifications shall be considered mutually explanatory. Work required by one, but not by the other, shall be performed as though required by both. Items required by one but not by the other shall be provided as though required by both. Work shall be accomplished as called for in specifications and shown on drawings so that all equipment items shall be entirely functional for the purpose for which they were designed and intended. Provide all necessary material, tools, equipment, and labor required for the complete delivery, un-crating, erection, and installation as designated on the food service equipment plan and, in the specifications, to be made ready for final connection by the appropriate Division contractors. When there is any discrepancy between drawings and specifications, bidders should seek clarification of any discrepancies from the Architect and or Foodservice Design Professionals (FDP) before bidding.

D. Should the drawings disagree in themselves or the specifications with the drawings *(and clarification was not sought before bidding)*, the higher cost, better quality, more stringent, and greater quantity of the work or materials shall be completed without additional costs to the Owner.

1.4 OTHER DIVISIONS/CONTRACTORS RELATED WORK

A. Division 22 (Plumbing) is responsible for but not limited to:

1. All connections shall be made in accordance with local codes and national standards, except where plans and specifications exceed those codes and standards.

2. Empty PVC and wide-sweep bends for refrigerant piping to beverage lines, Co2 lines, and remote food service equipment refrigeration systems.

3. Rough-in and final connection of plumbing systems to food service equipment and between components (including materials and labor). Accessories provided loose with food service equipment by Section 114000 to be field installed by Division 22. This includes but is not limited to the installation of all faucets (water fill faucets, pre-rinse faucets, etc.), hoses, gas disconnects, and drains from the equipment point of connection to building plumbing systems. All drain lines are provided and installed by Div. 22.

    a. Kitchen Equipment Contractor is responsible for providing all faucets (water fill faucets, pre-rinse faucets, etc.), drain fittings, mixing valves, control valves,

water pressure regulators, vacuum breakers, and all accessories for equipment specified under 114000. Division 22 is responsible for installation.

4. Indirect drain line runs from the equipment to the nearest drain or floor sink—lines to be type 'K' Copper.

5. If any plumbing accessories or fittings are provided loose with equipment by 114000, Div. 22 is to attach to equipment and provide final connection.

6. Water Supply Systems with all components and fittings required for a complete system.

7. Compressed Air Systems with all components and fittings required for a complete system (if required for this project).

8. Piping and Drainage Systems (Sanitary and Grease-laden). ***Systems must be cleaned and flushed before the final connection with food service equipment - Critical.***

9. Floor Sinks (Provide and Install). Flange and grates to be flush with the finished floor.

10. Floor Drains (Provide and Install). Flange and grates to be flush with the finished floor.

11. Trench Drains (Provide and Install). Trench Liners provided by 114000. Flange and liners to be flush with the finished floor.

12. Grease Traps as required (Size, Provide, Locate, and Install). Verify with local codes to bypass or pipe through Grease Trap and/or Interceptor.

13. P-Traps as required (including all disposers).

14. Interconnect water through Water Filter (Filter provided by 114000 unless otherwise specified) to equipment.

15. Safety Restraint Cable Installation (Safety Restraint Cable Provided by 114000).

16. Specified couplings and piping to all equipment furnished by 114000.

17. Air Compressors (if required for this project) (Size, Provide, and Install unless otherwise specified).

18. Water Softeners (if required for this project) (Size, Provide, and Install unless otherwise specified).

19. Pressure Boilers (if required for this project) (Size, Provide, and Install unless otherwise specified).

20. Hand Sinks (Provide (unless otherwise specified) and Install). Provide a hot water tempering valve if required. Water temperature to be at least 100 degrees and flow for at least 20 seconds.

21. Ice Bin Drain Insulation (if Ice Machine is provided in this project) (Provide and Install).

22. Unions at disposer solenoid valves (if Disposer is provided in this project) (Provide and Install).

23. Back Flow Prevention as required (Provide and Install - including all disposers). Back-Siphonage shall be installed at all fixtures and equipment where backflow and/or back-siphonage may occur and where a minimum air gap cannot be provided between the water to the fixture or equipment at its flood/level rim. When furnished with equipment, vacuum breakers shall override the above if acceptable with applicable codes. Division 22 is responsible for verifying requirements with local codes.

24. Reverse Osmosis Systems (Size, Provide (unless otherwise specified), Locate, and Install).

25. All piping within the counter body or under fabricated counters must be run to a connection point below the counter body by Section 114000—final connection by Division 22.

26. Interconnection of ½" CW to Pre-Rinse and Disposers cone/body inlets piped through the solenoid and vacuum breaker (if Disposer is provided in this project).

27. Pipe ½" cold water to swirl inlets at disposers (if Disposer is provided in this project).

28. Water Treatment for Ice Builders (Non-Chlorinated water with a PH Level of 10 or Higher) and any drains and overflows. Piping from Ice Builders to Tumble Chillers by Div. 23 (if Ice Builders and Tumble Chillers are provided in this project).

29. Refer to Section 2.2 PLUMBING / MECHANICAL REQUIREMENTS for additional information.

B. Division 23 (Mechanical) responsible for but not limited to:

1. All connections shall be made following local codes and national standards, except where plans and specifications exceed those codes and standards.

2. Empty EMT Conduit with pull-wire and wide-sweep bends for refrigerant piping to remote food service equipment refrigeration systems.

3. Rough-in and final connection of mechanical systems to food service equipment, walk-in assemblies, and between components (including materials and labor).

4. Refer to Section 2.2 PLUMBING / MECHANICAL REQUIREMENTS for additional information.

C. Division 26 (Electrical) responsible for but not limited to:

1. Rough-in and final connection of electrical systems to food service equipment, and between components (including materials and labor). Accessories provided loose with food service equipment by Section 114000 to be field installed by Division 26.

2. Table Limit Switch Installation (Provided loose by Section 114000) (if Dishmachine is provided in this project).

3. Electrical Materials and Devices (Shunt-trip breakers, surge protectors, lighting control devices, conduit, wire, etc.).

4. Switches and Stainless Steel Disconnects as required (Provide, Locate, and Install – to be in an accessible location).

5. Interconnection between Condensate Fan and Dishmachine control panel (if equipment is provided in this project).

6. If any electrical accessories, fittings, and cord/plugs are provided loose with equipment by 114000, Div. 26 is to attach to equipment and provide final connection.

7. Provide waterproof receptacles in wet areas.

8. Receptacles will be pre-wired to Junction Box or Load Center for final connection by Division 26.

9. All electrical lighting, power, and distribution systems.

10. Do not interconnect more than three (3) convenience outlets on one (1) breaker.

11. Other than convenience outlets, all electrical connections on food service plans are dedicated breakers.

12. Refer to Section 2.5, ELECTRICAL REQUIREMENTS, for additional information.

D. General Contractor responsible for but not limited to:

1. Any wall penetration required for food service equipment utilities. Escutcheon plates or S/S sleeves are to be provided and installed as needed.

2. Furnish and Install ¾" Plywood blocking in the wall for mounting equipment furnished by Section 114000 as required.

3. Soap and towel dispenser provided by Owner. G.C. is responsible for installation.

4. Final cleaning of all equipment before demonstrations.

1.5 QUALITY ASSURANCE

A. In addition to complying with all applicable laws, statutes, building codes, and regulations of public authorities, comply with the following:

1. National Sanitation Foundation (all equipment to bear label)

2. National Electric Code

3. Underwriters' Laboratories, Inc. (all applicable equipment to bear label)

4. American Gas Association Laboratories

5. National Fire Protection Association

6. Americans with Disabilities Act

7. Food and Drug Administration HAACP Guidelines

8. International Energy Conservation Code (IECC)

9. Department of Energy

10. Environmental Protection Agency

B. Furnish certification of regularly manufactured equipment listing or classification by Underwriter's Laboratories, Inc. with the initial submittal.

C. Furnish a list of equipment and components (internal and external) that are not of domestic origin. All equipment and components (internal and external) should be of domestic origin when possible. This information should be provided with the initial submittal.

D. Projects outside the continental United States shall adhere to all local authorities having jurisdiction over that project.

1.6 SUBSTITUTIONS

A. **Equipment items or components specified are intended to be the Basis of the Bid. All other brands, including any additional names, which may be listed as "Alternates" or "Approved Equal," must conform with the general and item specifications, warranties, size/dimensions, quality, accessories, function, voltage, horsepower, etc. of the first-named brand and be subject to Paragraph C-03 of this Article.**

B. Proposed Substitutions:

1. Submitted at least 14 calendar days before Bid Date.

2. Submit proposed substitutions with catalog data and manufacturer's shop details indicating all modifications required to conform with the specified brand.

3. List of deviations must include equipment name, model number, accessories, and features with deviation(s) noted for specified and proposed alternate equipment. Equipment without listed deviation(s) will be considered furnished as specified.

C. Substitutions with prior approval:

1. Submitted on Bidder's letterhead attached to Proposal Form with individual additive/deductive amounts stipulated and the documentation required in Paragraph B-02.

2. Owner reserves the right to accept or reject any or all substitution proposals before execution of the Contract.

3. Provide all design/engineering services required to adjust in space, systems, utilities, etc., and pay all additional costs of utilities, construction, or professional services that may be incurred due to the acceptance of any substitution.

D. All appliances within a common group or category (e.g., refrigerators, kettles, ovens, etc.): same manufacturer.

1.7 INTERPRETATION OF DOCUMENTS

A. During Bidding: Bidder's, supplier's, or vendor's questions and comments about Construction Document's clarity or intent will be addressed by addendum.

B. After Award:

1. Clarification Bulletin will confirm Construction Document requirements.

2. Request for Information submitted by Contractor shall contain Contractor's proposed resolution.

1.8 WARRANTY

A. Provide a written warranty for parts and labor for one year ***from the date of Substantial Completion***, including an extended four-year replacement warranty on compressor bodies.

B. Components of equipment subject to replacement before one year's use (such as refrigerator door gaskets) and those items which may fail due to improper or inadequate periodic maintenance by the Owner/Operator (such as an uncleaned refrigeration system condenser) are not intended to be included within the scope of the Warranty.

C. Refrigeration Systems/Equipment: One-year free service available within twenty-four hours of notification.

D. Furnish three copies of a list of all equipment and their respective local service agencies, indicating the address, telephone number, and name of the person to contact. The service agencies selected shall be factory-authorized for the equipment assigned whenever possible.

E. Provide the following for refrigeration systems/equipment unless specified otherwise:

1. One (1) year of free refrigeration system service is available within twenty-four hours of notification.

2. Provide five (5) year manufacturer's registered written replacement warranty certificate covering compressor bodies. Warranty to cover labor costs for the first year.

3. Provide ten (10) years of the manufacturer's registered written replacement/repair warranty certificate covering walk-in assembly panels. Warranty to cover defects in material and workmanship. Warranty to cover labor costs for the first year.

4. Provide two (2) year parts and labor warranty for ***all parts/components (including third-party components that may be utilized)*** of the refrigeration system(s) ***(including freon)***, walk-in cooler(s), and freezer(s) not otherwise covered herein.

F. ***All above-stated warranty periods are from the date of Substantial Completion***. All replacement parts due to a warranty call should be the same quality as the original, or better if the original were defective. Replacement parts should be of a domestic origin where possible.

1.9 SUBMITTAL DATA

A. **All submittals must be received, reviewed, and approved as noted prior to equipment procurement. If any equipment is procured prior to this process, it is on the KEC to replace any equipment, accessories, or other components that may not meet the specifications or design intent for the facility, including all costs associated with rectifying the errors made procuring the equipment before this critical process.**

B. Special Requirements: The following are in addition to any general requirements given elsewhere in the Documents.

C. Submittal Requirements:

1. Kitchen Equipment Contractor to furnish all submittals via PDF, drawings to be scaled per General Specifications and provided in Three (3) submittal packages.

2. Foodservice Design Professionals requires the below-listed business days for each package submitted. Packages are to be submitted within 14 days between each issued package. Each package should contain individual submittal sets.

a. Package One to include (2) Individual sets: 10 Business Days for Review

i. Equipment rough-in

ii. Equipment Brochure

b. Package Two to include (4) Individual sets: 15 Business Days for Review

i. Custom Fabrication

ii. Miscellaneous Submittals

D. Submittals to be identified with the below-listed file name structure:

1. 114000-1 EQUIPMENT BROCHURE

2. 114000-2 EQUIPMENT ROUGH-IN PLANS

3. 114000-3 CUSTOM FABRICATION

E. Package One (1) requires both submittals: Brochure and Rough-in plans. **If not sent together, the submittal will be rejected.**

F. Foodservice Design Professionals (FDP) will notate all submittals in RED. Architects and General contractors will be notated in color per their direction.

G. If hard copy submittals are required, Kitchen Equipment Contractor will furnish all copies to the specified trades as required.

H. If discrepancies, missing information, or incorrect information occur within the documents, Kitchen Equipment Contractor is to seek clarification or note the need for further direction on submittals. The Kitchen Equipment Contractor is to bid the higher of the discrepancies. *Refer to Section 1.3 SCOPE OF WORK: Subsection D.*

I. Brochure Format (for regularly manufactured equipment and components):

1. Front and rear protective cover with labeled project name.

2. Brochure index: Indicate Functional Area/Room number, item number, quantity, description, and manufacturer.

3. A separate flysheet for each component or item of equipment, indicating item number, name, quantity, manufacturer, optional equipment, modifications, special instructions, and utility requirements. Any equipment or assembly containing more than one buyout sub-assembly or component shall have the second item listed in parenthesis beside the primary item name—for example, Serving Counter (hot food well).

4. Catalog specification sheet with all options notated on the specification sheet and manufacturer's drawing.

J. Shop Drawings (Rough-In Drawings):

1. Separate drawing sheets: same size as Contract Drawings (Contract Drawings are not to be traced or reproduced). Submittal drawings are to be provided by Kitchen Equipment Contractor and not copied or reproduced from Contract Documents. Any reproduced submittal drawings will be rejected.

2. ¼" scale drawing of fixed/movable food service equipment with itemized schedules.

3. Special Conditions Drawings, sizing, and locating the following conditions:

a. Slab depressions, cores, sleeves, or block-outs (walk-in assemblies, drain trenches, piping, etc.).

b. Concrete or masonry platforms.

c. Pipe sleeves or roof jacks.

d. Wall openings or block-outs for pass-through equipment, recessed control panels, in-wall fire-protection system components, etc.

e. Blocking grounds or anchor plates required in walls for equipment support/attachment.

f. Access panels in walls or ceiling for service of equipment.

4. Electrical Rough-In Drawing

5. Plumbing and Mechanical Rough-In Drawing

6. Required information:

a. All fixed and portable food service equipment shown on Contract Drawings.

b. Conveyor/Dishtable Assemblies shown on Contract Drawings.

c. All general-use and convenience utilities or services indicated on Contract Drawings, including those required by or connected to equipment or devices, not in this Section.

d. All Rough-In Drawings: Fully dimensioned from engineering benchmark (column lines, when provided) and finished-room surface to the point of stub-up through floor and stub-out through wall or ceiling for all mechanical, electrical, and plumbing services.

e. Connection number/tag system and symbols: Identical to Contract Drawings.

K. Shop Drawings (Manufacturer's and Fabricator's):

1. Sheet Size: Identical to Contract Drawings, drawn or plotted at a ¼" scale for plan view, ½" for elevations, and 1½" for sections and construction details.

2. Included information: The item number, name, and quantity.

3. Construction details, sections, and elevations to reflect the requirements of the Specifications and Drawings.

4. Indicate adjacent walls, columns, and equipment.

5. Indicate plumbing and electrical schematic drawings for equipment such as conveyors, waste systems, self-cleaning exhaust hoods, exhaust hood fire protection systems, and fabricated fixtures with a single electrical or plumbing connection.

6. Mechanical or electrical operating components or products integrated into a fabricated fixture: ventilation and service access required or recommended by the manufacturer, including panel size and location to permit easy lubrication, adjustment, or replacement of all moving parts.

L. All equipment and engineering rough-in plans sheet numbers are to match the contract documents. All equipment item numbers and engineer item numbers located on the schedules are to match the contract documents. All engineering requirements must be updated to accommodate the provided equipment and match the contract documents. The Kitchen Contractor coordinates any MEP revisions to accommodate the supplied and proposed equipment. The Kitchen Equipment Contractor is responsible for any costs associated with equipment substitution.

M. Foodservice Design Professionals (FDP) drawings and schedules are not to be copied in any way. Any replicated drawings of Foodservice Design Professionals (FDP) will be rejected.

1.10 SERVICE MANUAL

A. Three copies bound in 1½" hardback, three-ring binders (as many volumes as required by the scope of the project) with the same data as the brochure after installation (Refer to "Submittal Data"). Provide separate service manuals for each independent area within the project scope (Main Kitchen, Culinary, Concession, etc.).

B. Each Volume: Section for maintenance of finish materials (e.g., stainless steel, plastic laminates, FRP, Plexiglas, etc.).

C. Catalog specification sheet and/or manufacturer's shop drawings.

D. Each Volume: Index of items, manufacturer's operating/maintenance information, replacement parts data, list of all product warranties, and price lists. Provide the name, title, and address of personnel at each respective manufacturer and service personnel to be contacted for spare/replacement parts and service after the warranty period.

E. To the extent possible, provide two copies of the manufacturer's video instructional cassettes for operating, maintenance, and equipment service.

F. Internally subdivide binder contents with permanent page dividers, logically organized by equipment item number or manufacturer name, with tab titling printed under reinforced, laminated plastic tabs.

G. Electronically submitted manuals must follow the formatting requirements listed above.

H. **Service Manual to be provided to the owner before kitchen equipment demonstration.**

1.11 VERIFICATION AND COORDINATION OF PROJECT / DATA

A. Utilities Rough-in Drawings and field verifications are to be completed within four weeks after receipt of notice-to-proceed. Review Contract Drawings and Submittal Data for accuracy and completeness and notify Architect of conflicts and proposed adjustments. Coordinate work with other sub-contractors.

1. KEC to provide on-site field verification of all underground utilities before pouring concrete for capacity and location and coordinate with General Contractor. Submit a review to Architect and General Contractor. If rough-ins need to be relocated, KEC will compensate other trades for the required relocation.

2. KEC to provide on-site field verification of all other utility connections and locations and coordinate with General Contractor. Submit a review to Architect and General Contractor.

B. On-Site Inspection Reports

1. Before concrete pour: The Kitchen Equipment Contractor is to submit a copy of the report below to the Architect, General Contractor, and Foodservice Design Professionals (FDP) within 24 hours of the inspection. The form to be submitted is contained within these General Specifications.

2. Before delivery of equipment: The Kitchen Equipment Contractor is to submit a copy of the report below to the Architect, General Contractor, and Foodservice Design Professionals (FDP) within 24 hours of the inspection. The form to be submitted is contained within these General Specifications.

FOODSERVICE DESIGN PROFESSIONALS

0n - Site Inspection Report

Prior to Concrete Pour

Inspection Date_____ **Project Name** _____

Project Location_____

Inspector's Name_____ **Company** _____

Inspector's Contact Number_____ **Email** _____

Architectural Firm_____ **Project Architect** _____

Architect's Contact Number_____ **Email** _____

General Contractor_____ **Project Manager** _____

G.C. Contact Number_____ **Email** _____

Food Service Consultant Foodservice Design Professionals, LLC **Project Manager**_____

Contact Number 281.350.2323 **Email** _____

An on-site Inspection to verify the location of UNDERGROUND utilities was conducted on this date. The following conditions were observed and brought to the attention of the General Contractor. (KEC is to provide a written description and copy of the Utility Plan indicating the corrective action required).

1. What difficulties were encountered?

Inspector's Initials _____

This Inspection Report is the responsibility of the Kitchen Equipment Supplier and the General Contractor. Coordination between the two parties is mandatory.
Neither the Architect nor FDP need to be present at these inspections.

EMAIL A COPY OF THIS REPORT AND ANY ADDITIONAL INFORMATION TO THE ARCHITECT, GENERAL CONTRACTOR AND FOODSERVICE DESIGN PROFESSIONALS, LLC.

FOODSERVICE DESIGN PROFESSIONALS

0n - Site Inspection Report

Prior to Delivery of Equipment

Inspection Date_____ **Project Name** _____

Project Location_____

Inspector's Name_____ **Company** _____

Inspector's Contact Number_____ **Email** _____

Architectural Firm_____ **Project Architect** _____

Architect's Contact Number_____ **Email** _____

General Contractor_____ **Project Manager** _____

G.C. Contact Number_____ **Email** _____

Food Service Consultant Foodservice Design Professionals, LLC **Project Manager**_____

Contact Number 281.350.2323 **Email** _____

An on-site Inspection to verify the location of INSTALLED utilities was conducted on this date. The following conditions were observed and brought to the attention of the General Contractor. (KEC is to provide a written description and copy of the Utility Plan indicating the corrective action required).

1. What difficulties were encountered?

Inspector's Initials _____

This Inspection Report is the responsibility of the Kitchen Equipment Supplier and the General Contractor. Coordination between the two parties is mandatory.
Neither the Architect nor FDP need to be present at these inspections.

EMAIL A COPY OF THIS REPORT AND ANY ADDITIONAL INFORMATION TO THE ARCHITECT, GENERAL CONTRACTOR AND FOODSERVICE DESIGN PROFESSIONALS, LLC.

C. Review critical systems/components for application, performance, and capacity and submit calculation worksheets with the initial submission of brochure/rough-in drawings, with all proposed adjustments noted, including:

1. Locations of Vacuum Breakers.

2. Conformance of Refrigerated Components/Equipment with HACCP Guidelines (e.g., salad/sandwich pans, upright/open refrigerator cabinets, salad bars) with HACCP Guidelines.

3. Gas and water line sizes and manifold configurations.

4. Diameter and length of flexible connector lines for fixed/movable gas appliances.

5. Fabricated Equipment load center panels (individual and total amperage calculations and circuit balance).

6. ADA compliance of workstations, service positions, passageways, etc.

D. Dimension Responsibility: Obtain actual or guaranteed measurements for the proper equipment fit. All dimensions indicated in Contract Documents are approximate and are as accurate as can be determined at the time. Field-check all horizontal/vertical measurements and conditions at the building before fabrication or delivery of equipment and notify the Architect of all conflicts or deviations from the dimensions shown.

E. Checking Dimensions at Site: Before ordering any materials or doing any work, verify all measurements of the building and be responsible for their correctness. No extras will be allowed for variations from drawings in existing conditions or work performed under this contract. Any discrepancies found shall be submitted to the Architect for instructions before proceeding.

F. Scheduling to Fit Openings: Should it become necessary to schedule the construction of walls or partitions before delivery of fixed equipment, the equipment must be fabricated for passage through finished openings. Maintain close contact with the project and be cognizant of all conditions, including vertical handling limitations within the building (elevator cabs or openings, stairs, etc.) and possible hoisting requirements. Coordinate all procedures with General Contractor and Project Team.

G. Color/Pattern Selections: Submit selection samples of solid polymer products, plastic laminate, paint or stain finishes, and vinyl-coated surface material of equipment as selected by the Owner.

H. Movable Equipment Interface: Rolling stock (pan racks, carts, dollies, dish/tray/rack dispensers) required to fit through or into fixed equipment (roll-in refrigerators, counter bodies, etc.) is to be reviewed and coordinated for compatibility at the time initial of shop drawing submittal. Indicate conflicts and proposed adjustments.

I. Relocation of Work: Relocate or re-route work as required to coordinate related items free of charge if no extra work is involved.

J. **Kitchen Equipment Contractor must provide FDP with the food service equipment lump sum pricing (including material and labor) after the contract has been executed and *before submittals* are provided to FDP. *This information is critical to FDP for accounting/billing purposes.***

1.12 EQUIPMENT FURNISHED / INSTALLED BY OTHERS

A. Obtain and coordinate utility requirements of Owner-Furnished/Owner-Installed (OF/OI) equipment with the building utilities and rough-in drawings/provisions.

B. Coordinate physical data of OF/OI appliances or equipment and incorporate information into Submittal Drawings. Vendor- or Purveyor-Furnished equipment (e.g., coffee/tea equipment): same as OF/OI.

1.13 WORK INSTALLED BUT FURNISHED BY OTHERS

A. Coordinate delivery/installation schedule of Owner-Furnished/Contractor-Installed (OF/CI) equipment with the Owner at least ninety (90) days before equipment requirement.

B. Obtain and coordinate utility requirements of OF/CI equipment with the building utilities and rough-in drawings/provisions.

C. Receive at the job site and fully incorporate into installation procedures as if furnished under this Section.

PART 2 - PRODUCTS

2.1 FABRICATED FIXTURES MATERIAL / COMPONENTS

A. Stainless steel sheets or shapes: 18-8, Type 302, polished to 180 grit No. 4 finish.

1. Stainless steel joints and seams: Heli-arc welded, free of pits and flaws, ground smooth, and polished to a No. 4 finish.

2. The “grain” direction of horizontal stainless-steel surfaces: Longitudinal, including the backsplash. The polishing procedure at right-angle corners of fixtures shall provide a mitered appearance.

B. Galvanized Iron Sheets: Armco copper bearing Zinc Grip or Zinc Grip/Paint Grip.

1. Galvanized iron joints and seams: Arc-welded, free of pits, flaws, and ground smooth.

2. Galvanized sheets or shapes: Washed with mineral spirits and painted with Rust-Oleum gray semi-gloss enamel.

C. Sound Deadening: Schnee Butyl Sealant ½” wide rope positioned continuously between all frame members or contact material and underside of stainless-steel surface (sinks, tabletops, food wells, over shelves, and undershelves). Tighten stud bolts for maximum compression of sealant and trim excess.

D. Plastic Laminates: Color/pattern selected by Architect, in 1/16" thickness for flat surfaces: 1/32" thickness for radiused surfaces. Plastic laminates and adhesives must be NSF-approved (Standard No. 35).

E. Solid Polymer products: Color/pattern/material selected by Architect in thickness as specified. Solid Polymers and adhesives must be N.S.F. approved (Standard No. 51).

F. Casters:

1. Fabricated fixtures with "Open Base" construction: Jarvis and Jarvis Model No. 5-405-113P-NSF swivel casters with grease seals on forks and wheels; Zerk fitting in swivel; two casters: Model No. E-75 Verti-Lock brakes. All casters: B-7" rolling bumpers with stainless steel top discs.

G. Cutting Boards: 1/2" thick Read Products, Inc. "Richlite" cutting board, size as indicated.

H. Identification Plates, Labels, Tags:

1. Prohibited Information: Names of suppliers, fabricators, and contractors.

2. NSF Labels: Required on all pieces of equipment.

3. Required Information: Function or purpose of controls such as display light switches, food warmer controls, etc.

4. Plate Construction: Engraved phenolic plastic, secured to equipment with epoxy cement or stainless-steel screws. Furnish samples.

2.2 PLUMBING / MECHANICAL REQUIREMENTS

A. Plumbing Fittings and Components: Furnished under this Section as follows:

Note: Fitting and components described in Items 1, 2, 3, 4, and 5 are furnished loose by 114000 for final installation and connection by Division 22.

1. Control valves and appliance pressure regulators for water, gas, steam, and vacuum breakers: wherever required on food service equipment (chrome-plated where exposed).

2. Faucets and drains with and without connected overflows (unless otherwise indicated) for all sinks.

3. Specialty food service water-fill faucets, hose bibbs, or hose assemblies indicated in drawings/specifications.

4. Wade Model No. W-10 Shock-Stop shock absorbers for all food service equipment with quick-opening or solenoid-operated water valves.

5. T&S HW-6 Series Water Quick Disconnect hose, diameter per water connection size requirements, with safety fitting, w/coiled restraining device, full port ball valve, antimicrobial coating, lifetime warranty.

6. Extensions of indirect waste fittings to open-sight floor sink or floor drains from sinks, under bar equipment, and food-holding components of serving counters (e.g., cold pans, hot food wells, refrigerator/freezer coils not equipped with condensate evaporators) furnished and installed by Division 22. Drains: All drains to be type 'K' Copper – Paint with aluminum paint where exposed**. Div. 22 to ensure a minimum air gap of 1" and not less than twice the effective opening of the indirect waste pipe, per code. Div. 22 to ensure all drain lines are centered over floor sink grate openings and no water splashes on the floor.**

7. Piping brackets and supports beneath fabricated equipment.

8. Closed Base Bodies: Removable 18-gauge stainless steel closure panel at plumbing penetrations under the top.

9. Control valves on Open Base fixtures: Mounted on a 14-gauge stainless steel gusset-shaped panel with h 3½" setback from the countertop edge/rim to the face of the control handle.

10. Fill hose/faucet at support pedestals or Closed Base Body: Installed in a 15" x 18" x 5" deep recessed mounting panel. Panel bottom: sloped on a 60° angle, with 3/8" stainless steel rod hanger-bracket for the hose.

11. Provide filtration option as shown on contract documents (a, b, c, or combination thereof):

    a. In-line Water Filter System:

        i. Everpure System filters for coffee/tea brewers, icemakers, water chillers, convection steamers, and beverage systems. They should be sized per the manufacturer's recommendation.

    b. Remote Central Water Filter System.

    c. Remote and/or In-line Reverse Osmosis system.

B. Final Plumbing Connections Provisions:

1. Fabricated equipment containing components, fittings, and devices indicated on food service connection drawings to be connected to the building systems: each component, fitting, or group thereof pre-piped to a utility compartment for final connection by Division 22. Refer to drawings for capacities.

2. Field-assembled equipment (e.g., prefabricated walk-in assemblies, exhaust hoods, ware wash machines, convection ovens, etc.): plumbing components completely interconnected under this Section for final connection arrangements indicated on Utility Connection Drawings.

3. All plumbing final connection points of equipment shall be tagged, indicating the following:

    a. Item number

b. Name of devices or components

c. Type of utility (water, gas, steam, drain, chilled water)

C. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Sub Sections E. Plumbing and F. Mechanical for additional information.

2.3 FOOD SERVICE EQUIPMENT REFRIGERATION SYSTEMS

A. Install complete with all refrigerants, oil, dials, dehydrators, gauges, and controls required for the system's proper operation.

B. Self-contained or factory-installed compressors: Check and adjust to the proper operating temperature prescribed by FDA/HACCP.

2.4 PLUMBING TRIM

A. Faucets: Furnished for all sinks or equipment requiring open water supply.

B. Fill Faucets: Furnished for appliances requiring open water supply.

C. Drain Fittings: Furnished for all sinks or equipment requiring removal of liquids. Install specified chrome-plated or stainless-steel fittings in die-stamped openings with washers and locknuts. The solder may be used as a sealer but shall not be applied to the top surface of the drain fittings.

2.5 ELECTRICAL REQUIREMENTS

A. All electrical systems, components, and accessories within the work of this Section: Certified to be in accordance with NEC 70.

B. Electrical Fittings and Components: Furnished under this Section as follows. Coordinate food service equipment loads, voltage, and phase with the building system and confirm any existing or OF/OI equipment requirements.

C. Cord and Caps:

1. Coordinate all food service equipment cord/caps with related receptacles.

2. All 120, 120/208, and 208 volts "plug-in" equipment shall have Type SO or SJO cord and plug with ground wire fastened to the frame/body of the item.

3. Cord lengths for fixed equipment: Adjusted to eliminate loose-hanging excess.

4. All non-fixed plug-in "buy-out" equipment: Hubbell configuration and ratings as required.

5. All mobile electrical support equipment (heated cabinets, dish carts, etc.) and counter appliances mounted on mobile stands (mixers, food cutters, toasters, coffee makers, microwave ovens, etc.): 8'-0" cord length with cord-hanger strap secured to the rear of equipment or mobile stand.

D. Switches and Controls:

1. Each motor-driven appliance or electrically heated unit: Equipped with a control switch or starter per Underwriters' Laboratories, Inc., with low-voltage and overload protection.

2. Disposer controls recess-mounted in the wall: External fittings and accessories removed from the enclosure and furnished with 16-gauge stainless steel perimeter angle flange with welded corners. Install control at 4'-0" AFF to the bottom of the enclosure.

3. Disposer controls recess-mounted in counter-splash risers: External fittings and accessories removed from NEMA 4 enclosure and furnished with 16-gauge stainless steel perimeter angle flange with welded corners. Install control at 3'-0" AFF to the bottom of the enclosure. Provide the panel with a 60" long Seal-Tite electrical conduit from the bottom of the control panel for final field connections under Division 26.

4. Equipment that is not provided with built-in circuit breakers or fused terminal block and is indicated on Utility Connections Drawings to be directly connected to the building electrical system: a NEMA 4 stainless steel disconnect switch furnished and installed by Division 26.

5. All remote manual starters, disconnect switches, magnetic contactors or starters, and push-button stations: NEMA Type 4 enclosure; NEMA Type 1 enclosure only when installed in a Closed Base Body.

E. Heating Elements:

1. Electrically heated equipment: Thermostatic controls.

2. Water heating equipment: Equipped with positive low water shut-off.

F. Receptacles and Switches:

1. Receptacles installed in vertical panels of support pedestals or Closed Base Bodies: installed in 12" x 8½" x 3" deep recessed mounting panel sloped at a 60° angle and turned up to the top of the opening.

2. Pre-wire receptacles in closed base fixtures to a junction box installed within 6" from the bottom of utility or compressor compartments.

3. Receptacles mounted on Open Base fixtures: Installed on a 12" x 10½" x 4½" deep 14-gauge stainless steel panel with returned ends and sloping recess—secure panel to the underframe of fixture top.

4. Pre-wire receptacles on open base fixtures to a junction box secured to a leg or mounted on the underside of the lower shelf. Vertical runs of wiring: Made in rigid conduit or within the tubular leg.

5. Receptacles installed in/on-fabricated equipment: Hubbell, Inc. assemblies horizontally mounted in a metal box with stainless steel cover plate.

6. Switches installed in/on-fabricated equipment: Hubbell, Inc. with metal box and stainless-steel cover plate. Switches: pre-wired to the controlled device and a junction box installed within 6” from the bottom of the utility or compressor compartment. All refrigeration system switches: Installed within the compressor compartment near the door opening.

7. Load centers installed in/on fabricated equipment to have all fixture components pre-wired to the load center with balanced phase loading. Load center: Ready for final connection by Division 26 and flush-mounted within the utility compartment rear panel, set back 8” from the access door. All breaker/device information will be typewritten on the circuit schedule in the load center door (number corresponding breaker/device) with an enclosed schematic wiring diagram of fixture components.

8. All receptacles are to be pre-wired to the cord and plug assembly and routed through the over-shelf post at all island equipment locations unless specified otherwise.

G. Light Fixtures:

1. Light fixtures with lamps installed in/on fabricated or field-assembled equipment: pre-wired to a junction box for final connection (continuous-run fixtures when indicated).

2. LED Display Light: Install light fixtures full-length of Display Stand and Serving Shelf with stud bolts and pre-wire through support posts to an apron-mounted switch.

H. Final Electrical Connection Provisions:

1. Fabricated equipment containing electrically operated components or fittings indicated on Utility Connections Drawings: Direct connected, with each component, fitting, or group pre-wired to a junction box for final connection by Division 26. Refer to drawings for circuit loading.

2. Fabricated equipment containing electrically operated components and devices indicated: Circuit-breaker load center with each component or device pre-wired to a separate circuit breaker for balanced phase loading and single final connection by Division 26.

3. Field-assembled equipment (e.g., prefabricated walk-in assemblies, exhaust hoods, ware wash machines, etc.) shall have electrical components completely interconnected in this Section for final connection arrangements as indicated on Utility Connection Drawings by Division 26.

4. Pre-wire the following groups of walk-in assembly electrical devices to a top-mounted junction box for final connection by Division 26 per compartment grouping (unless otherwise indicated).

a. Light fixtures and switches; heated pressure-relief ports.

b. Door/jamb heaters.

c. Evaporator fans, defrost elements and drain line heaters.

5. All electrical final connection points of equipment shall be tagged, indicating the following:

    a. Item number.

    b. Name of devices on the circuit.

    c. Total electrical load.

    d. Voltage and phase.

I. Lamps: in all food service equipment containing light fixtures. Refrigerator or heated cabinets: All exposed LED lamps above or within a food zone: Shat-R-Shield lamps or standard lamps, sleeved with end caps.

J. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Subsection F. Division 26 (Electrical) for additional information.

2.6 CUSTOM – FABRICATED / ASSEMBLED UNITS

A. Mechanical or electrical operating components or products integrated into a fabricated fixture: Ventilation and service access required or recommended by the manufacturer. The size and placement of the service access panel(s) permit easy lubrication, adjustment, or replacement of all moving parts and are to be indicated on fabrication shop drawings.

2.7 COUNTER / TABLETOPS

A. 14-gauge stainless steel; all free edges turned down 2” with ¾” tight hem at the bottom—free corners: rounded on ¾” radius.

B. Marine edges: Turned up ½” on 45º angle and turned down 2” with ¾” tight hem at the bottom.

C. Cafeteria serving countertops at hot food stations: Full-length x 3½” x ½” high raised rail at (customer’s) front side with 45º integral turndown to counter surface.

D. Tops abutting high fixtures or walls: Cove up specified height and slope back 1½” at the top on 45º angle; 2½” slope where piping occurs. Turn down 1” at the rear of the splash and tight ends to the bottom of the top turndown. Secure splash turndown to the wall with a 4” long 14-gauge stainless steel “Z” clip anchored to the wall, 36” OC.

E. Freestanding tables and all serving counter splash-risers: Turned back at a 90º angle with 1” turndown at the rear.

F. Brace tops with rigid-welded 1½” x 1½” x 1/8” galvanized steel angle frame at the perimeter with cross bracing 2’-0” OC maximum. Provide 4” x 4” x 12-gauge stainless steel triangular pads where leg gusset welds to frame. Paint the entire frame with Rust-Oleum gray semi-gloss enamel. Angle frames: Secured to the underside of top surfaces with ¼” studs welded 9” OC maximum with chrome-plated washer, lock washer, and cap nut. Studs: Such length

that cap nuts can be made up tight, bringing the top down snugly on the angle frame, eliminating all vibrations or "oil-canning."

G. Tops: 1½" overhang at free sides of underframe or Closed Base Body.

H. Mockett Model No. SG5-26 chrome-plated/plastic grommet assembly or integrally welded stainless-steel flange or inverted gusset where service utilities or support posts penetrate or abut tops, ground, and polished to match the top. When conditions permit, provide a 1" x 1½" rectangular backsplash opening for service utilities instead of piercing the horizontal surface. Install stainless steel split tubing at the raw edge of the opening.

I. Extend underbracing members to the wall, turn down 6", and anchor to the wall when specified to be mounted on leg/bracket assembly.

J. All openings in tops: 3/16" high raised die-formed edges.

K. All top openings for pans or inserts: 20-gauge stainless steel, watertight liners, 8½" deep, secured to the underside of the countertop.

L. All "built-in" and "drop-in" counter equipment/appliances to have framing members at the perimeter of the opening.

M. Scrap Basket: 18-gauge stainless steel construction 6½" x 6½" x 21¾" long. Top of container: 5/8" wide x ¼" high full perimeter flange with ¼" diameter stainless steel rod bail handle. Interior vertical corners coved on ½" radius. Countertop: Fitted with 6¾" square die-stamped opening.

2.8 DRAWERS

A. Stainless Steel Liners: Component Hardware Model No. S80-2020 (20" x 20"), easily removable with drawer in the fully extended position.

B. Drawer Frame: 16-gauge stainless steel flanged out at the top. Weld the frame to a double-panel 16-gauge stainless steel drawer front with full-length recessed pull at the top (similar profile as Garcy Model No. R-1060) with closed ends.

C. Channel-formed horizontal pull: ¾" turndown at the front and ends with ½" tight hem. The front edge of the pull: flush with the face of the drawer. Recess behind pull: sloped up on a 60° angle, terminating 1" below the bottom edge of pull.

D. Mount drawer frame on Component Hardware Model No. S52-2020 self-closing slides, with Delrin bearings, full-depth of the fixture. Secure slides to the body or brackets to eliminate lateral movement in the extended position. Refrigerator drawers: Component Hardware Model No. S52-2024 stainless steel slides with Delrin bearings.

E. Drawer enclosure in an Open Base Fixture: 18-gauge stainless steel flanged out at the top for attachment to the underside of the tabletop. The lower edge of the enclosure is flanged in toward the open bottom. Mount drawer slides to enclosure and brace as required. The face of the enclosure is to be the same length and height of the drawer face. Provide ¾" deep offset in front of the enclosure and 2½" from the underside of the tabletop for a flush-fitting appearance.

F. Drawer enclosure on freestanding fixture: Full depth of table framing.

G. Drawer enclosure in a Closed Base Fixture: Completely partitioned from the adjoining area. Drawer front: Flush fitting with the face of the body.

H. Drawer Liners other than tool/utility: Bread Drawer: Component Hardware Model No. S83-2020; Refrigerated Drawer: Component Hardware Model No. S81-1520 stainless steel liner.

I. Cash Drawer: Integral stainless-steel body, 3" deep.

2.9 SINKS

A. 14-gauge stainless steel; all interior corners (horizontal/vertical) coved on ¾" radius. 1½" wide double-walled partitions with flat tops between compartments.

B. Continuous exterior panels of multiple-compartment sinks: 14-gauge stainless steel filler panel welded ground and polished between compartments.

C. Sinks (with overflow): Score and slope sink bottom ½" to die-stamped opening fitted with Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. 14-gauge stainless steel bracket: Welded to sink bottom for drain stem with 1½" handle clearance.

D. Where sinks are installed in fixtures with Closed Base Body, provide a Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. (Sinks with dimensions larger than 20" x 20" in Closed Base Body will not have overflow fitting.) 14-gauge stainless steel bracket: welded to sink bottom with T & S Model No. BL-4740-1 guide bushing. Install on shortened drain stem, one T & S Model No. BL-4710-1 remote control stem assembly only (length as required) with Model No. 113-L universal joint and white blank button. Set drain control handle in Cambro Model PSB-6 bowl with bottom omitted (dress raw edge) to permit passage of drain handle—secure bowl in utility compartment door or body panel with clear silicone.

E. When single-hole deck-mounted faucets are specified, install overflow fitting in the sidewall of the sink compartment and provide ell-fitting in connecting tubing.

F. Flush Covers when specified: 1/2" thick Read Products, Inc. "Richlite" cutting board, size as indicated. Support clips: ¼" stainless steel rod 2" long, formed at 45º with two ¾" leg ends (¼" long threaded ends). Insert rod clips through tight-clearance holes in the sink, seal watertight, and secure with stainless steel acorn nuts or tack-weld at the exterior of the sink wall. Set support clips ½" below the top. Provide a 14-gauge stainless steel channel or angle support frame to store covers when not in use. Cover holder: Adjacent to sink compartment, below countertop, or under drawer assembly.

2.10 UTENSIL – WASH COUNTERS

A. 14-gauge stainless steel; all free edges coved up 3" with 1½" diameter rolled rim and bullnose corners.

B. Edges of utensil-wash counters next to high fixtures or walls: Coved up 10" and sloped back 1½" on 45º angle; 2½" slope where piping occurs. Turn down 1" at the rear of splash and

secure backsplash to the wall with 4" long 14-gauge stainless steel "Z" clip anchored to wall @ 36" OC. Vacuum breaker pockets: 4" long square turnback sections aligned with the slope break line.

C. Exposed Rear Splash: 16-gauge stainless steel finished panel from the top of the splash to the bottom edge of the rolled rim with a welded vertical joint at the end of the splash and ½" turnback at the bottom of the panel. Secure the panel with concealed attachment and install bracing 24" OC.

D. Cove all interior corners (horizontal/vertical) on ¾" radius and slope tables 1/8" per foot, maintaining level crown.

E. Brace utensil-wash counters with 1" x 4" 12-gauge stainless steel channels down the centerline of the top and between each pair of legs, with closed ends. Bracing: Secured to underside of dishtable with ¼" studs welded 6" OC. maximum, with a chrome-plated washer, lock washer, and cap nut. Studs: Such length that the cap nuts can be made up tight, bringing the dishtable down on the channel members, eliminating all vibration and "oil-canning."

F. Integrally welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or abut tops: ground and polished to match the top.

G. Extend underbracing members to the wall, turn down 6", and anchor to the wall when specified to be mounted on a leg/bracket assembly.

H. Hose Bibb: Chicago Model No. 305VBRCF; mounted on 12-gauge stainless steel flange or inverted gusset bracket with 3/8" stainless steel rod hose hanger.

2.11 CLOSED BASE BODIES

A. Frame: Rigid-welded 1½" x 1½" x 1/8" galvanized steel angle forming a continuous structure around the top and bottom perimeters of the fixture, a post at each corner, studs spaced 48" OC maximum. The top of the frame is cross-braced with 1½" angles, 2'-0" OC maximum.

B. 18-gauge stainless steel panels and trim with concealed attachment. All seams: Welded, ground, and polished.

C. Exposed Vertical Corners: Rounded on ¾" radius. Closed Base Bodies adjacent to walls or fixtures: square corners.

D. Vertical and horizontal channel members at shelf interior or drawer enclosures, such as corners and center mullions: Closed and sealed.

E. Closed Base Bodies set on finished masonry platforms: closed and caulked at the underside of equipment overhang and bolted to the platform. Body overhang of the platform: 1" at free ends and 2" at the front and exposed rear sides.

F. Closed Base Bodies not set on the platform: Component Hardware Model No. A54-2-6, 6" legs spaced 4'-0" OC maximum.

2.12 COMPRESSOR COMPARTMENTS

A. Same material as Closed Base Bodies with back and end partitions; omit bottoms only.

B. 10-gauge steel slide-out support: Channel frame on full extension slides with 125 lb. minimum capacity secured to fixture frame with anti-vibration mountings for maximum sound deadening. Closed Base Body on the solid platform: front-to-back slide-out support channels set 4” above the bottom for air circulation.

C. Access Door: 18-gauge stainless steel double-pan type with a channel formed horizontal recessed pull full length of the top (similar profile as Garcy Model No. R-1060) with closed ends. Channel-formed horizontal pull: ¾” turndown at front and face of the door. Recess behind pull slopes up on a 60° angle, terminating 1” below the bottom edge of pull. Offset the lower horizontal framing member of the Closed Base Body to align the flush access door with the bottom of the body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and Component Hardware Model No. 35-2000 concealed magnetic catch.

D. Access Doors Louver: Full-height, with 1½” x 1” x 18-gauge stainless steel channel-formed frame with welded corners. 18-gauge stainless steel louver. Submit a sample of the design for approval.

2.13 UTILITY COMPARTMENTS

A. Closed Base Bodies or Pedestal Supports: Fitted with utility compartments wherever piping or wiring is required in/on the fixture.

B. Same material as Closed Base Bodies with full-height back and end partitions. Omit bottoms except at hose-reel locations.

C. Access Doors: 18-gauge stainless steel double-pan type with a channel formed horizontal recessed pull full-length of the top (similar profile to Garcy Model No. R-1060) with closed ends. Channel-formed horizontal pull: ¾” turn down at the front of the door, a recess behind the pull slopes up on a 60° angle, terminating 1” below the bottom edge of the pull. Offset the lower horizontal framing member of the Closed Base Fixture to permit flush alignment of the door with the face and bottom edge of the body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and one Component Hardware Model No. 35-2000 concealed magnetic catch.

D. No shelves of Closed Base Fixtures are to be penetrated.

2.14 OPEN BASE STRUCTURES

A. 1-5/8” OD x 16-gauge seamless stainless-steel tubing legs beveled at the bottom. 1¼” OD cross rails fully welded (360° smooth and polished) to legs at 10” AFF, OC.

B. Top of Leg: Inserted in Component Hardware Model No. A20-0206 gusset fully welded to table frame or sink bottom.

C. Bullet Foot: Component Hardware Model No. A10-0851.

D. Freestanding fixtures requiring utility connections: Component Hardware Model No. A10-0854 flanged feet at the fixture corners, anchored to the floor with non-corrosive bolts.

E. Table Bases: Maximum leg spacing of 6’-0” OC; dishtable and utensil wash counter bases at 5’-0” OC.

F. Open Base equipment specified to be supported by brackets at the rear side only (not completely cantilevered): Tubular legs at the front side only with Component Hardware Model No. A10-0854 flanged feet anchored to the floor with non-corrosive bolts. Front-to-back cross rail: fitted into Component Hardware Model No. A20-0406 circular gusset secured to the wall with non-corrosive bolts.

2.15 UNDER SHELVES

A. Open Base Structures: 16-gauge stainless steel turned down 1½” with tight hem at the bottom. Notch all corners to fit tubular legs and weld from the underside to fill the gap, grind, and polish. Cove up 2” at the rear or ends adjacent to wall, columns, refrigerators, etc. The turn-up at freestanding fixtures is to be hemmed tight to the bottom of the turndown. Brace undershelf with 1” x 4” 14-gauge stainless steel channel at the longitudinal centerline and each intermediate pair of legs.

B. Open Base Structure specified to be supported by brackets at the rear side only (not completely cantilevered): 16-gauge stainless steel turned down 1 ½” at free sides with tight hem at the bottom edge. Notch all corners to fit tubular legs as required and weld from the underside to fill the gap, grind, and polish. Cove up 2” at rear ends, as indicated. Fill the gap at the front-to-back rail, grind, and polish. Brace undershelf with 1” x 4” x 1” 14-gauge stainless steel channel at longitudinal centerline between front to back rails.

C. Closed Base Fixtures: 16-gauge stainless steel turned down 1½” at front. Front edge of bottom shelf: Turned back and sealed to finished masonry platform or boxed for leg application. Center shelf has ¾” tight hem.

1. Shelves: Turn up square at ends (coved up at rear only) to the shelf above or countertop flanged out for attachment with no open spaces at interior.

2. All shelf partitions at exposed ends of cabinet bodies or interiors: Free of exposed framing members.

3. Reinforce shelves with full-length 1” x 4” x 14-gauge stainless steel closed hat channel.

4. Unless otherwise noted, all closed base undershelves must be 22” deep and clear.

5. Fully weld smooth and polish the vertical seam of the shelf turndown/turn up with the face of the body partition.

6. Seal the vertical seam of the square turn-in at the exposed interior of open shelf sections.

2.16 ANCHOR PLATES / WOOD GROUNDS

A. Behind the finished surface, wherever building walls, partitions, or ceiling construction will not accommodate direct attachment of equipment such as over shelves, wall cabinets, hose reels, utensil racks, exhaust hoods, display cases, etc. Material and installation by General Contractor. Location and coordination with trades by Section 114000.

B. Anchor Plates: Not less than 12" x 12" x ¼" thick steel, secured to the structure above or behind the finished surface, positioned at attachment points.

C. Wood Grounds: Length required by fixture, component, or device, 24" wide x ¾" thick plywood secured to partition system before gypsum board installation.

D. Above ceiling supports: Structural shapes (4" x 8.0 lb. channel) suspended from the structure. Maximum height 15'-0" AFF. Size: width of equipment x length of equipment plus 6'-0". Cross bracing at 6'-0" OC maximum.

2.17 OVER SHELVES

A. 16-gauge stainless steel with free edges turned down 1" with ½" tight hem at the bottom—¾" radius at free corners.

B. Turn up 2" raw at walls and sides with a horizontal coved corner at the rear. Round front corners of turn up on ¾" radius.

C. Where shelf width exceeds 12" width, reinforce with ½" x 4" x 14-gauge stainless steel closed hat channel full-length of the shelf.

D. Wall-Mounted Shelves: 16-gauge stainless steel brackets 48" OC maximum, set in 6" from ends.

E. Freestanding Shelves: Where splash is required at free over shelves, turn up square 2" at ends, cove up at the rear, and hem tight to lower edge of front turndown. Weld exposed corners.

1. Freestanding over shelves: 16-gauge stainless steel cantilevered brackets at the rear of the table; double-cantilevered brackets at the center of the table. Posts for cantilevered over shelves are 1-5/8" OD x 16-gauge stainless steel secured to the underframe, 4'-0" OC. Ends of shelves: Secured to adjacent wall/fixture or mounted on 1¼" diameter stainless steel posts.

2. Freestanding over shelves not on cantilevered brackets: 1¼" OD x 16-gauge stainless steel posts, each pair at 4'-0" OC maximum.

F. Glass/Cup Rack Over shelf at Dishtables: 14-gauge stainless steel with 1½" deep "vee" trough at free long sides with 1" tight hem inside the trough. Provide a ½" marine edge at free ends and; a 4" splash at the wall. Suspend shelf at 18" above dishtable surface on posts/brackets anchored to dishtable frame/wall at rear; 1" OD stainless steel tubing supports from the structure above the ceiling at front edge, 60" OC at each end.

1. Install at both ends a ½" stainless steel drain tube (connecting both vee-troughs) extended to the dishtable surface through splash turnback.

2. Rack-rest: horizontal full-length 1-5/8" OD stainless steel tubing supported at 10" OC above shelf (8" OC for double service shelf) by 1¼" OD stainless steel tubing with closed ends. Support tubing: welded, ground, and polished, spaced 60" OC.

3. Rack-rest supports to wall: 4" x 4" x 10-gauge stainless steel flange plates welded to support tubing. Anchor flanged plates to blocking ground with non-corrosive bolts.

2.18 WALL PANELS

A. Wall Panels: 18-gauge stainless steel, double pan-formed ½" thick with internal stiffener members. Fill with USDA-approved thermal insulation, full height, and width of panels, and attach to the interior with mastic. The maximum allowable temperature at the rear side of the panel: is 120°F.

1. Height of panels as required: Top of tile base to the underside of the hood, top of tile base to the top cap of stub wall, or top of splash to the underside of the hood.

2. Level and square lower edge and sides.

3. Butt joints on all panels.

2.19 HIGHLIGHTING

A. Polish the following vertical surfaces to a No. 8 finish:

1. Serving and display shelf turndowns.

2. Conveyor and dish/tray deposit station turndowns/frame.

3. Tray slide turndowns.

2.20 SHOP / FIELD JOINTS

A. Field joints: The least number is used only when equipment size must be limited for building or interior space access.

B. Stainless steel tops (including edges and splashes): Fully welded, ground, and polished to match adjacent surfaces.

C. Vertical field joints of fixture backsplashes that are inaccessible from the back: terminate 1" above the horizontal coved corner. The remaining height of the field joint: hairline butt joint with offset draw-angle behind. All horizontal/vertical draw joints: located and noted on shop drawings.

D. Hairline butt joint: 1½" x 1½" x 1/8" steel angles welded to the back/underside of countertop/shelf. Offset angle beyond joining metal edge ½" (min.) to provide a flat backing surface for a joint with the angle of other joining metal edge, set for ½" space between

vertical legs of angles. Bolt sections together with 5/16" machine bolts, lock washers, acorn head cap nuts, set 3" OC.

E. Closed Base Bodies: Draw-type with hairline seam fully field-welded.

F. Millwork: Plastic laminated joints shall be dowelled, glued, and draw-bolted with fasteners.

G. Solid Polymer: Surfaces drawn tight, filled, sanded, and finished to match adjacent surfaces.

2.21 PRE-APPROVED KITCHEN SUPPLIERS

A. Only the following named Subcontractors and those approved later, if any, are approved for inclusion in the Contractor's Bid.

B. **Any contractor requesting inclusion within this bid must submit AIA form 305 a minimum of 14 days before the bid date for review or as required by Architect.**

1. Stafford Smith, Mr. JP Garcia, 7129 North Loop East, Houston, TX 77028, (713) 892-5001, E-mail: jpgarcia@staffordsmith.com

2. Texas Metal Equipment Company, Mr. Andrew Harman, 6707 Mayard, Houston, Texas 77041, (713) 466-8722, Fax: (713) 466-0166

3. Kirby Restaurant Supply, Mr. Brian Kernan, 809 S. Eastman Road, Longview, Texas 75602, Phone: (903) 757-2723, Fax: (903) 757-9519, Email: briank@kirbysupply.com

4. Mission Restaurant Supply, 1126 S. St. Mary's Street, San Antonio, Texas 78210. Mr. Brian Mosher, Phone (210) 354-0690, Fax (210) 354-0746, E-mail: brianM@missionrs.com

5. Kommercial Kitchens, Mr. Terry Woodard, 13544 East Fwy., Houston, TX 77015, (409) 769-1199, E-mail: terry@kommercialkitchens.com

6. Supreme Fixtures Co., Inc., Mr. Tim Hampel, 11900 Vinny Ridge Road, P.O. Box 193655, Little Rock, AR 72219, Phone: (501) 455-2552, Fax: (501) 455-0802, E-mail: tim@supremefixture.com

2.22 PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS

A. Only the following named Subcontractors and those approved later, if any, are approved for inclusion in the Contractor's Bid. Pre-approved fabricators shown below shall not sub out fabrication.

B. **Any supplier requesting inclusion within this bid must submit AIA form 305 at least 14 days before the bid date for review or as required by Architect.**

1. Texas Metal Equipment Company, Mr. Andrew Harman, 6707 Mayard, Houston, Texas 77041, (713) 466-8722, Fax: (713) 466-0166

2. Kommercial Kitchens, Mr. Terry Woodard, 13544 East Fwy., Houston, TX 77015, (832) 767-5287

3. Mission Restaurant Supply, 1126 S. St. Mary's Street, San Antonio, Texas 78210. Mr. Brian Mosher, Phone (210) 354-0690, Fax (210) 354-0746, E-mail: brianM@missionrs.com

PART 3 - EXECUTION

3.1 DELIVERY AND INSTALLATION

A. Supervision: Provide a skilled and proficient foreman or supervisor who shall remain on the job during the entire installation.

B. Delivery: Coordinate with the progress of construction and Owner's operation schedules. Unless otherwise instructed and documented by Owner or General Contractor, the following procedures apply:

1. Field-Assembled Fixed Equipment integrated into the structure (e.g., walk-in assemblies, exhaust hoods, drain trench/grate assemblies, conveyor systems, ceiling-mounted utensil racks, etc.) are to be sent to the job site when directed by the General Contractor and installed/protected accordingly.

2. All other Fixed Equipment: delivered after completion of work on adjacent finished ceilings, lighting, finished floor and wall systems, including painting.

3. Major Movable Equipment: delivered, when possible, to inventory in a secured area for interim job-site storage or, if the secured area is unavailable when fixed equipment installation/clean-up has been completed.

4. Minor appliances and loose items (e.g., pans, covers, flatware containers, etc.) should be delivered only when the Owner is prepared to receive and inventory such items.

C. Installation: performed by the manufacturer of custom fabricated fixtures.

1. Assemble, square, level, and ready all items for the final utility connections.

2. Cut neatly around obstructions to provide sanitary conditions.

3. Where gaps of ¼" or less occur adjacent to or between equipment, insert rope backing and smoothly apply General Electric construction sealant Series SE-1200 silicone mastic (silver color). Mask both sides of the gap for neat sealant application and remove excess. If space exceeds ¼," neatly install 18-gauge stainless steel trim molding of proper shape with concealed attachment. Use epoxy cement or "Z" clips wherever possible to secure stainless steel trim. Exposed edges or corners of trim: eased and smooth.

4. Refrigeration coil drain line runs to an indirect drain connection greater than 2" from the face of the wall or panel: Either of the following field procedures:

a. Trench the floor and provide a 6" wide x 2" deep 16-gauge stainless steel sloping (-1" to -2") trough from the face of the cooler/freezer wall to the body of the floor sink/floor drain. Trough: turned up 4" at the wall; ¾" flange with ½" turndown at both long sides. Set trough in waterproof mastic and seal 1" OD

drain tube penetration into floor sink/floor drain at -2½" BFF. Patch the floor to match adjacent material/surface.

b. Provide 12" x 6" x 2" deep 16-gauge stainless steel condensate pan mounted to cooler/freezer wall at 6" AFF clear. Trench the floor and install a 1" OD drain line from the bottom of the pan to the body of the floor sink/drain. Slope drain line ¼" per foot and seal all connections watertight. Patch the floor to match adjacent material/surface.

D. Protection of Work:

1. Fabricated fixtures: Fiberboard or plywood taped to tops and exposed body panels/components.

2. Manufactured Equipment: Fiberboard or plywood taped as required by equipment shape and installation-access requirements.

3. Prohibited use of equipment: Tool and materials storage, workbench, scaffold, stacking area, etc.

4. Damaged Equipment: Immediately documented and submitted to the Owner with the Contractor's recommendation of action for repair or replacement and its impact on the Project Schedule and Contract Amount, if any.

3.2 CLEAN AND ADJUST

A. Clean up and remove all debris from this Work from the job site as the installation progresses.

B. Lubricate and adjust drawer slides, hinges, and casters.

C. Adjust pressure regulating valves, timed-delay relays, thermostatic controls, temperature sensors, exhaust hood grilles, etc.

D. Clean or replace faucet aerators and line strainers.

E. Touch-up damage to painted finishes.

F. Start up and check the operation of all refrigeration systems for at least 72 hours before acceptance.

3.3 EQUIPMENT START-UP/DEMONSTRATION

A. Carefully test, adjust, and regulate all equipment following the manufacturer's instructions and certify in writing to the Owner that the installation, adjustments, and performance are in full compliance.

B. Provide the Owner or food service Operators with a thorough operational demonstration of all equipment and furnish instructions for general and specific care and maintenance. Coordinate and schedule selected equipment items and attendees with the Owner at least two weeks before the demonstration starts.

3.4 FINAL OBSERVATION

A. Final observation will be made when the Contractor certifies that they have completed their work, thoroughly reviewed the installation/operation of each item in the contract and found it to comply with the Construction Documents.

B. Repetitive final observations (more than two) and all costs associated with it which may be incurred due to the Contractor's failure to comply with the requirements of this Article will be invoiced to this Contractor on a $70.00/hr and expense basis.

PART 4 - EQUIPMENT SCHEDULE

4.1 REGULARLY MANUFACTURED EQUIPMENT/COMPONENTS: Standard finishes and accessories unless specifically deleted or superseded by the Contract Documents.

4.2 FABRICATED AND FIELD-ASSEMBLED EQUIPMENT: Arrangement and configuration as shown on Plans, Elevations, Detail Drawings, and outlined in Specifications.

4.3 REFER TO DRAWINGS: For unit quantities and plumbing, electrical or mechanical provisions are required, including the manufacturer's optional voltages, wattages, burner capacities, etc.

4.4 REFER TO PART 2 – PRODUCTS: For accessories, fittings, requirements, and procedures related to the listed buy-out and fabricated equipment.

4.5 ALTERNATE MANUFACTURER REQUIREMENTS: A specific product manufactured by the listed pre-approved equals shown under Section 4.7 Food Service Equipment are acceptable only if the specific product can evidence compliance with the specified line items and the contract documents (Refer to Section 1.6; Sub-Section A.).

4.6 FOOD SERVICE EQUIPMENT

A. All equipment is to have a performance check from factory-authorized personnel. Warranties will begin on the day of the performance check.

B. All equipment and internal components should be of domestic origin where possible.

C. Architect to verify/coordinate the aesthetic options below (Food Service color, material, or signage selections) if these items are provided in this project:

1. Countertops: Stone (stainless steel is provided unless otherwise specified)

2. Tray slides: Corian or Stone (stainless steel is provided unless otherwise specified)

3. General color, material and graphic selections:

    a. Pass Thru or Reach In Holding Cabinets - Color selection: Powder Coat (Mfg.: True) or Plastic Laminate (Mfg.: Traulsen) (Stainless steel is provided unless otherwise specified)

    b. Graphics Package information

D. Architect to verify/coordinate the finishes below:

1. Walls: Ceramic Tile, Flat FRP, or Molded FRP (Smooth, Impervious, and easily cleanable as approved by local jurisdiction)

2. Ceilings: Removable Vinyl Face Tile (Smooth, impervious, and easily cleanable as approved by local jurisdiction)

3. Floors: Tile, Epoxy, or Rubberized flooring system (Smooth, impervious, easily cleanable and slip resistant as approved by local jurisdiction) (Coordinate floor tile transition at serving lines)

ITEM NO. 109 ICE MAKER W/ BIN

QUANTITY 1

Manufacturer:	Owner Furnished / Contractor Installed
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Refer to General Specifications Part 1, section 1.13 re: WORK INSTALLED BUT FURNISHED BY OTHERS.

ITEM NO. 193 REACH-IN REFRIGERATOR - 2DR

QUANTITY 1

Manufacturer:	Owner Furnished / Contractor Installed
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Refer to General Specifications Part 1, section 1.13 re: WORK INSTALLED BUT FURNISHED BY OTHERS.

ITEM NO. 249 THREE COMPARTMENT SINK

QUANTITY 1

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Top: 14-gauge S/S 3" high 1-1/2" rolled rim at free sides, 10" high splash at walls.
2. Open base construction.

3. Omit rear rail at sink, Omit front rail at Hose Bibb and Omit front and rear rail at Item 640 Undercounter Dishmachine
4. Three (3) 15" x 26" x 15" deep sink compartment.
5. Two (2) T&S model no. B-0291, splash mount faucet, 18" swing nozzle, LL inlets, for ¾" hot and cold water connections.
6. Three (3) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. Provide 18 gauge S/S bracket for drain handle welded to sink bottom.
7. 12" deep single post mounted perforated overshelf mounted at 18" above counter top.
8. 18-gaugebutt jointwall panel from splash to underside of shelf.
9. One (1) Chicago model no. 305-VBRCF hose bibb and rack mounted on 12 gauge S/S bracket ground and polished to match top. Hose and spray nozzle by owner.
10. Post mounted utensil rack, extend 1-5/8" diameter S/S post from back splash, turn forward 12" and weld full length x 2" x ¼" S/S bar with Component Hardware model no. V-77-4401 S/S sliding hooks at 8" on center. Height to be standard 84" a.f.f..
11. Coordinate counter fabrication with Item 640 Undercounter Dishmachine installation requirements.
12. Flanged feet at front only of counter.
13. Anchor flanged feet to floor with non-corrosive bolts. Secure wall mounted equipment / components to in wall grounds or anchor plates. Coordinate installation with the general contractor.

ITEM NO. 260 HAND SINK

QUANTITY 1

Manufacturer:	Advance Tabco
Model:	7-PS-50
Size and Shape:	Refer to drawings
Alternate:	---

1. 20 gauge stainless steel construction.
2. Basket drain and wall bracket.
3. Gooseneck faucet with wrist handles.
4. Soap and towel dispensers by Owner.
5. P-Trap assembly, delete open/close drain vavle.
6. Custom fabricated removable end splashes on sides as required by code. height same as rear splash.
7. Trade contractor to provide temperature adjustment valves as required.

ITEM NO. 800 INSULATED ENCLOSED TRAY CART

QUANTITY 1

Manufacturer:	Owner Furnished Owner Installed
Model:	---
Size and Shape:	Refer to drawings

Alternate: ---

1. Refer to General Specifications Part 1, section 1.12 re: EQUIPMENT FURNISHED / INSTALLED BY OTHERS

ITEM NO. 801 COUNTER WITH SINK & PASS THRU WINDOW

QUANTITY 1

Manufacturer: MILLWORK BY ARCHITECT
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. Refer to General Specifications Part 1, section 1.13 re: WORK INSTALLED BUT FURNISHED BY OTHERS.

END OF SECTION 114000

SECTION 116623 - GYMNASIUM EQUIPMENT

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Basketball equipment.
2. Volleyball equipment.
3. Safety pads.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installation of floor-insert sleeves to be cast in concrete slabs and footings.
2. Section 096466 "Wood Athletic Flooring" for game lines and markers.
3. Section 096566 "Resilient Athletic Flooring" for game lines and markers.

1.3 DEFINITIONS

A. BWF: Badminton World Federation.

B. FIBA: Federation Internationale de Basketball (The International Basketball Federation).

C. FIVB: Federation Internationale de Volleyball (The International Volleyball Federation).

D. NBA: National Basketball Association.

E. NCAA: The National Collegiate Athletic Association.

F. NFHS: National Federation of State High School Associations.

G. WNBA: Women's National Basketball Association.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include assembly, disassembly, and storage instructions for removable equipment.
2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: For gymnasium equipment.

1. Include plans, elevations, sections, and attachment details.
2. Include details of field assembly for removable equipment, connections, installation, mountings, floor inserts, and operational clearances.
3. Include transport and storage accessories for removable equipment.
4. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each item and color specified.

D. Samples for Initial Selection: For each type of gymnasium equipment.

E. Samples for Verification: For the following products:

1. Basketball Net: Full size.
2. Pad Fabric: Wall padding minimum 3 inches (76 mm) square, and corner and column Samples minimum 3 inches (76 mm) long, with specified treatments applied. Mark face of material.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Court layout plans, reflected ceiling plans, and other details, drawn to scale, and coordinated with ceiling-suspended gymnasium equipment, floor inserts, game lines, and markers applied to finished flooring, and coordinated with each other, using input from installers of the items involved:

1. Structural members to which overhead-supported gymnasium equipment will be attached.
2. Suspended ceiling components, if any.
3. Items supported from building structure above the courts, including the following:

a. Luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Smoke detectors.
f. Acoustical treatments or panels.
g. Access panels.

B. Setting Drawings: For embedded items and cutouts required in other work.

C. Qualification Data: For Installer.

D. Product Certificates: For each type of gymnasium equipment.

E. Field quality-control reports.

F. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gymnasium equipment to include in operation and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Basketball backboard failures, including glass breakage.
b. Faulty operation of basketball backstops.

2. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

A. Seismic Performance: Basketball backstops and anchors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Revise articles below to suit Project. These include paragraphs that are examples of gymnasium equipment and are not intended to be all inclusive. Indicate individual equipment or assembled system dimensions and elevations on Drawings. Use these example paragraphs as guides for developing paragraphs for other types of gymnasium equipment.

2.2 BASKETBALL EQUIPMENT

A. Source Limitations: Obtain from single source from single manufacturer.

B. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.

C. Connections: Manufacturer's standard connections or connections recommended in writing by manufacturer and complying with Section 055000 "Metal Fabrications" of size and type required to transfer loads to building structure.

D. Backstop Electric Operator: Provide operating machine of size and capacity recommended in writing by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components, Devices, and Accessories: Listed and labeled according to NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operator Type: Cable drum with grooved drum and cable tension device to automatically take up cable slack and retain cable in grooves.
3. Operator Mounting: On wall with equipment-mounting board.
4. Motor Electrical Characteristics:

5. Remote-Control Station(s): NEMA ICS 6, Type 1 enclosure for recessed or flush mounting and momentary-contact, three-position, switch-operated control with up, down, and off functions.

    a. Group Key Switch Control Stations: One switch per each backstop.
    b. Keys: Provide dual keys, one key for up and one for down per station.
    c. Switches, Ganged: Single faceplate with multiple switch cutouts for two switches operating four backstops.
    d. Control Station Enclosure: Provide prime-painted metal enclosure with key access, with two sets of keys per enclosure.

6. Limit Switches: Adjustable switches at each backstop, interlocked with motor controls and set to automatically stop backstop at fully retracted and fully lowered positions.

E. Basketball Goals: Basket ring complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.

1. Single-Rim Basket Ring Competition Goal: Materials, dimensions, and fabrication per manufacturer's standard design.
2. Type:
    a. Movable: Pressure-release design with manufacturer's standard breakaway mechanism and rebound characteristics identical to those of fixed, nonmovable ring.

3. Pressure-Release Characteristics: Positive-lock movable breakaway design, with manufacturer's standard mechanism, including preset pressure release, set to release

between 181- and 231-lb (82- and 105-kg) load, and automatic reset. Provide movable ring with rebound characteristics identical to those of fixed, nonmovable ring.

4. Field Adjustment: Provide ring that is field adjustable for rebound elasticity without being removed from the backboard.
5. Mount: Rear.
6. Net Attachment: No-tie loops for attaching net to ring without tying.
7. Finish: Polyester powder-coat finish.

F. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches (380 to 460 mm) long, sized to fit ring diameter, and as follows:

1. Cord: Made from white nylon.
2. Competition Cord: Antiwhip, made from white nylon cord, minimum 120-gm thread and maximum 144-gm thread.

G. Backboard Safety Pads: Designed for backboard thickness and extending continuously along bottom and up sides of backboard and over backstop to manufacturer's standard design.

1. Attachment: Manufacturer's standard.
2. Color: As selected by Architect from manufacturer's full range.

2.3 VOLLEYBALL EQUIPMENT

A. Source Limitations: Obtain from single source from single manufacturer.

B. Standard Rules: Provide equipment according to the requirements of NCAA's "Women's Volleyball Rules and Interpretations."

C. Floor Insert: Chrome-finished steel floor plate and steel pipe sleeve, concealed by floor plate, with capped bottom end, sized with ID to fit post standards, minimum 9 inches (230 mm) long ,to securely anchor pipe sleeve below finished floor in concrete footing with anchors designed for securing floor insert to floor substrate indicated; quantity as indicated on Drawings.

1. Flush Floor Plate: Manufacturer's standard hinged access cover, designed to be flush with adjacent flooring. Provide one tool(s) for unlocking access covers.

D. Post Standards: Removable, adjustable-height, telescoping, paired volleyball post standards and a center post standard for multicourt play, as indicated on Drawings, designed for easy removal from permanently placed floor inserts.

1. Materials: Manufacturer's standard metal pipe or tubing, with nonmarking plastic or rubber end cap or floor bumper to protect permanent flooring.
2. Nominal Pipe or Tubing Diameter: 3-inch (76-mm) OD at base.
3. Finish: Manufacturer's standard factory-applied, polyester powder-coat finish or plated metal finish.
4. Net Height Adjuster: Track or rail system and lock mechanism, designed for infinite height adjustment, complete with fittings; designed for positioning net at heights indicated.

a. Net Heights: Between sitting volleyball net height and boys'/men's volleyball net height, 36 and 95-5/8 inches (910 and 2430 mm) or more.

E. Net: 32 feet (9.75 m) long; one per pair of paired post standards and as follows:

1. Width and Polyester Mesh: 36 inches (910 mm) with 4-1/2-inch- (114-mm-) square mesh made of black polyester string.

a. Hem Band Edges: White, 2-inch- (50-mm-) wide top binding; black, 1-inch- (25-mm-) wide bottom and side bindings; tie offs at top and bottom of each side end of net; and 1/4-inch- (6-mm-) diameter rope, at least 42 feet (12.8 m) long, threaded through top hem of binding.

F. Net-Tensioning System: Designed to adjust and hold tension of net. Fully enclosed, nonslip, manufacturer's standard-type winch with cable length and fittings for connecting to net lines, positive-release mechanism, and manufacturer's standard handle. Mount net tensioner on post standard at side away from court. Provide end post with post top pulley. Provide opposing post with welded-steel loops, hooks, pins, or other devices for net attachment and post top grooved line guide.

G. Bottom Net Lock Tightener: Manufacturer's standard quick-release-type tension strap; a spring-loaded, self-locking tensioner; a turnbuckle; a pulley; or other device and linkage fittings designed to quickly and easily tighten bottom line or net.

H. Safety Pads: Consisting of minimum 1-1/4-inch- (32-mm-) thick, multiple-impact-resistant polyurethane foam filler covered by puncture- and tear-resistant fabric cover, minimum 14-oz./sq. yd. (475-g/sq. m) PVC-coated polyester, treated with fungicide for mildew resistance manufacturer's standard; with fire-test-response characteristics indicated. Provide pads with hook-and-loop closure or attachments for the following components:

1. Post Standards: Wraparound style pads, designed to totally enclose each standard to a minimum height of 66 inches (1680 mm); one per post.
2. Net Lines: Four per net.
3. Judges' Stands: Pads designed to totally enclose front and sides.
4. Fabric Cover Flame-Resistance Ratings: Complies with NFPA 701.
5. Fabric Color: As selected by Architect from full range of industry standard colors and color densities.

I. Post Standard Transporter: Manufacturer's standard wheeled unit designed for transporting a single post.

J. Storage Cart: Manufacturer's standard wheeled unit designed for transporting and storing volleyball equipment and passing through 36-inch- (910-mm-) wide door openings. Fabricate welded-steel tubing units with heavy-duty casters, including no fewer than two swivel casters. Fabricate wheels from materials that do not damage or mark floors; number of units as required to provide transport and storage for specified equipment.

2.4 SAFETY PADS

A. Source Limitations: Obtain from single source from single manufacturer.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. Pad Coverings: Provide safety pad fabric covering that is fabricated from puncture- and tear-resistant, PVC-coated polyester or nylon-reinforced PVC fabric, minimum 14-oz./sq. yd. (475-g/sq. m) and treated with fungicide for mildew resistance; with surface-burning characteristics indicated, and lined with fire-retardant liner.

D. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board, with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.

1. Backer Board: Minimum 3/8-inch- (9.5-mm-) thick fire-retardant-treated plywood by pressure process according to AWPA U1, Use Category UCFA Fire Retardant Interior.
2. Size: Each panel section as indicated on Drawings.
3. Number of Modular Panel Sections: As indicated on Drawings.
4. Installation Method: Manufacturer's standard.

E. Column Safety Pads: Pads covering exposed flange of columns to height indicated, consisting of minimum 1-1/4-inch- (32-mm-) thick, multiple-impact-resistant, closed-cell, polyethylene-foam filler, covered on both sides and all edges by fabric covering with self-adhesive, hook-and-loop attachment to exposed face of column.

1. Length: Each pad matching length of wall safety pads.
2. Fabric Covering Color(s): Match color of wall safety pads color(s).

F. Cutout Trim: Manufacturer's standard flanged cutout trim kits for fitting pads around switches, receptacles, and other obstructions.

1. Color: Gray.

2.5 MATERIALS

A. Support Cable: Manufacturer's standard galvanized-stranded-steel wire rope with a breaking strength of 7000 lb (3175 kg). Provide fittings according to the wire rope manufacturer's written instructions for size, number, and installation method.

B. Castings and Hangers: Malleable iron, according to ASTM A47/A47M; grade as required for structural loading.

C. Softwood Plywood: DOC PS 1, exterior.

D. Particleboard: ANSI A208.1.

E. Equipment-Mounting Board: Wood, transparent finish; size and quantity as required to mount gymnasium equipment according to manufacturer's written instructions.

F. Anchors, Fasteners, Fittings, and Hardware: Gymnasium equipment manufacturer's standard corrosion-resistant or noncorrodible units; concealed; tamperproof, vandal- and theft-resistant design.

G. Grout: Nonshrink, nonmetallic, premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, according to ASTM C1107/C1107M, with minimum strength recommended in writing by gymnasium-equipment manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for court layout, alignment of mounting substrates, installation tolerances, operational clearances,accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.

1. Verify critical dimensions.
2. Examine supporting structure, subgrades, subfloors, and footings below finished floor.
3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions and competition rules for each type of gymnasium equipment.

B. Install gymnasium equipment after other finishing operations, including painting, have been completed unless otherwise indicated.

C. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relationship to adjacent construction; and aligned with court layout.

1. Floor-Insert Locations: Coordinate locations with application of game lines and markers, and core drill floor for inserts after game lines are applied.
2. Floor-Insert Elevation: Coordinate installed heights of floor inserts with installation and field finishing of finish flooring and floor-plate type.
3. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.

D. Floor-Insert Setting: Clean oversized, recessed voids in concrete substrate of debris. Position each sleeve, and fill void around sleeve with grout, mixed and placed according to grout manufacturer's written instructions. Protect portion of sleeve above subfloor and footing from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.

E. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure built-in and permanently placed gymnasium equipment to structural support and to properly transfer load to in-place construction.

F. Connections: Connect electric operators to building electrical system.

G. Removable Gymnasium-Equipment Components: Assemble in place to verify that equipment and components are complete and in proper working order. Disassemble removable gymnasium equipment after assembled configuration is approved by Architect, and store units in location indicated on Drawings.

3.3 INSTALLATION OF SAFETY PADS

A. Mount with bottom edge at 4 inches (102 mm) above finished floor.

B. Cutout Trim: Limit cuts in face of padding so that cuts are securely and fully concealed behind trim-kit flange.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform visual inspections and operational tests as recommended by referenced standard rules of each sport and the equipment manufacturer.
2. Test rebound elasticity of basketball goals.
3. Test basketball goal pressure-release characteristics and adjustability.

C. Gymnasium equipment will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly; free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range; and lubricate as recommended in writing by manufacturer.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment.

END OF SECTION 116623

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples: For each exposed product and for each color and texture specified, 10 inches (250 mm) long.

D. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 3 inches (76 mm) square. Mark interior face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 16 inches (400 mm) wide by 36 inches (900 mm) long for each type of roller shade indicated.
3. Installation Accessories: Full-size unit, not less than 10 inches (250 mm) long.

F. Product Schedule: For roller shades.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material.

C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard.

    a. Loop Length: Full length of roller shade.
    b. Limit Stops: Provide upper and lower ball stops.
    c. Chain-Retainer Type: Clip, jamb mount.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

E. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

    a. Type: Enclosed in sealed pocket of shadeband material.

b. Color and Finish: As selected by Architect from manufacturer's full range.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

a. Shape: L-shaped
b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches (102 mm).

2. Endcap Covers: To cover exposed endcaps.

3. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.

a. Closure-Panel Width: As indicated on Drawings.

4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.
2. Type: PVC-coated fiberglass.
3. Weave: Basketweave.
4. Thickness: 0,23.
5. Weight: 165 g/m2.
6. Orientation on Shadeband: Up the bolt.
7. Openness Factor: 3 percent.
8. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus

or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

B. Roller Shade Locations: As indicated on Drawing.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Verification: For the following products:

1. Countertop material, 6 inches (150 mm) square.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Build mockup of typical countertop as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Type: Provide Standard type unless Special Purpose type is indicated.
2. Colors and Patterns: As selected by Architect from manufacturer's full range.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Premium.

B. Configuration:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops: 1/2-inch- (12.7-mm-) thick, solid surface material with front edge built up with same material.

D. Backsplashes: 1/2-inch- (12.7-mm-) thick, solid surface material.

E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.
2. Install integral sink bowls in countertops in the shop.

F. Joints: Fabricate countertops without joints.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.
b. Provide 3/4-inch (20-mm) full bullnose edges projecting 3/8 inch (10 mm) into fixture opening.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints where indicated. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

I. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

SECTION 126600 - TELESCOPING STANDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manually operated telescoping stands.

1.3 DEFINITIONS

A. Forward Folding: Wall- or floor-attached bleachers that open in the forward direction by moving the front row away from the stack to the fully extended position.

B. Freestanding: Being free or away from a permanent wall.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for telescoping stands.
2. Include load capacities, assembly characteristics, and furnished accessories.

B. Shop Drawings: For telescoping stands in both stacked and extended positions.

1. Include plans, elevations, sections, and attachment details.
2. Include load capacities.
3. Show seating layout, aisle widths, row-lettering and seat-numbering scheme, and wheelchair accessibility provisions.

C. Samples for Verification: For the following products prepared on Samples of size indicated below:

1. Decking: 6-inch- (150-mm-) square Samples of finished material.
2. Metal Components: 6-inch- (150-mm-) square Sample of each color and finish indicated.
3. Seating Material: 6-inch- (150-mm-) square Sample of each seating material, color, and finish indicated.
4. Seat Unit: Full-size unit of each type.
5. Signage: Full-size units for each type of accessibility sign.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Welding certificates.

C. Product Certificates: For each type of telescoping stand assembly.

D. Material Certificates: For each type of flame-retardant treatment of upholstery fabric.

E. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For telescoping stands to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Procedures for conducting periodic inspections.
b. Precautions for cleaning materials and methods that could be detrimental to telescoping-stand finishes and performance.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1. Build mockup of typical telescoping stand as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 FIELD CONDITIONS

A. Finished Spaces: Do not deliver or install telescoping stands until finishes in spaces to receive them are complete, including suspended ceilings, floors, and painting.

B. Field Measurements: Indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Telescoping stands shall withstand the effects of gravity loads, operational loads, and other loads and stresses according to ICC 300.

B. Fire-Test-Response Characteristics of Upholstered Chairs: Comply with California Technical Bulletin 117 and Bulletin 133.

C. Accessibility Standard: Comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design.

2.2 TELESCOPING STANDS

A. System Description: Operable system of multiple-tiered seating on interconnected folding platforms that close for storage, without being dismantled, into a nested stack. Telescoping-stand units permit opening and closing of adjacent, individual and multiple rows, and close with vertical faces of platforms in the same vertical plane.
   1. Telescoping-Stands Standard: ICC 300.

B. Freestanding, Forward-Folding, Telescoping Stands: Floor-attached system, in which the bleachers open in the forward direction, by moving the front row away from the stack to the fully extended position, and the rear of bleacher understructure permanently attaches to floor construction.

   1. Row Spacing: As indicated on Drawings.
   2. Row Rise: As indicated on Drawings.
   3. Seat Type: Benches.
   4. Operation: Manually operated.

2.3 COMPONENTS

A. Benches: Seats and skirts.

   1. Material: Lumber with transparent finish.

      a. Color: As selected by Architect from manufacturer's standard.

2. Bench Height: Not less than 16 inches (406 mm) or more than 18 inches (457 mm).
3. Bench Depth: [10 inches (254 mm)] [12 inches (305 mm)] <Insert dimension>.

B. Wheelchair-Accessible Seating: Locate seating cutouts to provide wheelchair-accessible seating at locations indicated on Drawings.

1. Equip tiers adjacent to wheelchair-accessible seating with front rails as required by ICC 300.
2. Equip cutouts with full-width front closure panels that match decking construction and finish and that extend from underside of tiers adjacent to cutouts to 1-1/2 inches (38 mm) from finished floor.

C. Deck: Aluminum.

1. Finish: Manufacturer's standard.

a. Color: As selected by Architect from manufacturer's standard colors.

D. Risers: Steel sheet with manufacturer's standard, rust-inhibiting coating or hot-dip galvanized finish.

E. Safety Rails: Steel, finished with manufacturer's standard powder coat system.

1. Folding mid-aisle handrails located at centerline of each aisle with seating on both sides.
2. End rails (guards) that are telescoping and self-storing.
3. Back rails (guards) along rear of units where required by ICC 300.
4. [Removable] [Fixed] rails around accessible seating cutouts and truncations.
5. Color: Manufacturer's standard neutral color.

F. Understructure: Structural steel.

1. Finish: Manufacturer's standard rust-inhibiting finish.
2. Color: Manufacturer's standard.

G. Support Column Wheels: Nonmarring, soft, rubber-face wheel assembly under each support column.

1. Include wheels of size, number, and design required to support stands and operate smoothly without damaging the flooring surface, but no fewer than four per column or less than 4 inches (100 mm) in diameter and 1-1/2 inch (32 mm) wide.

H. Fasteners: Vibration proof, in manufacturer's standard size and material.

2.4 ACCESSORIES

A. Steps:

1. Slip-resistant, abrasive tread [nosings] [surfaces] at aisles.

2. Intermediate aisle steps, fully enclosed, at each aisle.
3. Transitional top step, fully enclosed, at each aisle where last row of telescoping stands is adjacent to a cross aisle.

B. Closure Panels and Void Fillers:

1. Aisle closures at foot level that produce flush vertical face at aisles when system is stored.
2. End panels covering exposed ends of stands in the stored position.
3. Back panels covering rear of freestanding units. Panels extend full height and width of unit.
4. Panels at cutouts and truncations for accessible seating.
5. Rear fillers including supports for closing openings between top row and rear wall of adjoining construction.
6. Gap fillers for closing openings between stand units or between stand units and adjoining construction.

C. Signage:

1. Accessibility signs at each accessible space and accessible aisle seat.

D. Scorer's Table: Removable unit that attaches to mounting sockets installed in telescoping stand unit.

2.5 MATERIALS

A. Lumber: Kiln dried, surfaced four sides; southern pine complying with SPIB's "Standard Grading Rules for Southern Pine Lumber" for B & B finish (B and better) grade-of-finish requirements.

B. Plywood: PS 1 as standard with manufacturer.

C. Molded Plastic: High-density polyethylene; blow or injection molded, color-pigmented, textured, impact-resistant, with integral reinforcing ribs for attachment and anchoring points. Provide with UV inhibitors to retard fading.

2.6 FABRICATION

A. Fabricate telescoping stands to operate easily without special tools or separate fasteners unless otherwise indicated.

B. Round corners and edges of components and exposed fasteners to reduce snagging and pinching hazards.

C. Form exposed work with flat, flush surfaces, level and true in line.

D. Supports: Fabricate supports to withstand, without damage to components, the forces imposed by use of stands without failure or other conditions that might impair their usefulness.

1. Cantilever bench seat supports to produce toe space uninterrupted by vertical bracing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install telescoping stands according to ICC 300 and manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. ICC 300 Inspection: Inspect installed telescoping stands to verify that construction, installation, and operation are according to ICC 300 requirements.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Telescoping stands will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust backrests so that they are at proper angles and aligned with each other in uniform rows.

B. Adjust hardware and moving parts to function smoothly, and lubricate, test, and adjust each telescoping stand unit to operate according to manufacturer's written instructions.

C. Clean installed telescoping stands on exposed and semiexposed surfaces. Touch up factory-applied finishes or replace components as required to restore damaged or soiled areas.

D. Replace upholstery fabric damaged during installation or work of other trades.

3.5 [

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to inspect, adjust, operate, and maintain telescoping stands.

END OF SECTION 126600

SECTION 133419 - METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Structural-steel framing.
2. Metal roof panels.
3. Metal wall panels.
4. Accessories.

B. Related Requirements:

1. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface.
2. Section 083323 "Overhead Coiling Doors" for coiling vehicular doors in metal building systems.
3. Section 083613 "Sectional Doors" for sectional vehicular doors in metal building systems.

1.3 DEFINITIONS

A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.

1.4 COORDINATION

A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to metal building systems including, but not limited to, the following:

a. Condition of foundations and other preparatory work performed by other trades.
b. Structural load limitations.
c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
d. Required tests, inspections, and certifications.
e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.

2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:

a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
b. Structural limitations of purlins and rafters during and after roofing.
c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
d. Temporary protection requirements for metal roof panel assembly during and after installation.
e. Roof observation and repair after metal roof panel installation.

3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:

a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
b. Structural limitations of girts and columns during and after wall panel installation.
c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
d. Temporary protection requirements for metal wall panel assembly during and after installation.
e. Wall observation and repair after metal wall panel installation.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Metal roof panels.
b. Metal wall panels.

B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:

1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.

2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.

   a. Show provisions for attaching canopies shown on design drawings.
   b. Show provisions for lateral support of masonry veneer walls.

3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

   a. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
   b. Show wall-mounted items including personnel doors, vehicular doors, windows, louvers, and lighting fixtures.

4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:8):

   a. Flashing and trim.

C. Samples for Initial Selection: For units with factory-applied finishes.

D. Samples for Verification: For the following products:

1. Panels: Nominal 12 inches (300 mm) long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
2. Flashing and Trim: Nominal 12 inches (300 mm) long. Include fasteners and other exposed accessories.
3. Accessories: Nominal 12-inch- (300-mm-) long Samples for each type of accessory.

E. Delegated-Design Submittal: For metal building systems.

1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Welding certificates.

C. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:

1. Name and location of Project.
2. Order number.
3. Name of manufacturer.
4. Name of Contractor.
5. Building dimensions including width, length, height, and roof slope.
6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
7. Governing building code and year of edition.
8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
10. Building-Use Category: Indicate category of building use and its effect on load importance factors.

D. Erector Certificates: For qualified erector, from manufacturer.

E. Material Test Reports: For each of the following products:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

F. Source quality-control reports.

G. Field quality-control reports.

H. Surveys: Show final elevations and locations of major members. Indicate discrepancies between actual installation and the Contract Documents. Have surveyor who performed surveys certify their accuracy.

I. Sample Warranties: For special warranties.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panel finishes to include in maintenance manuals.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer.

1. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.
2. Build mockups for typical wall metal panel including accessories.

a. Size: 48 inches (1200 mm) long by 48 inches (1200 mm).

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

1.11 FIELD CONDITIONS

A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.12 WARRANTY

A. Special Warranty on Metal Panel Finishes: Manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 25 years from date of Substantial Completion.

B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

A. Provide a complete, integrated set of mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

B. Primary-Frame Type:

1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.
2. Rigid Modular: Solid-member, structural-framing system with interior columns where shown on design plans.

C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns.

D. Secondary-Frame Type: Manufacturer's standard purlins and joists and flush-framed girts or studs.

E. Eave Height: Manufacturer's standard height, as indicated by nominal height on Drawings.

F. Bay Spacing: As indicated on Drawings.

G. Roof Slope: 1/4 inch per 12 inches (1:48).

H. Roof System: Manufacturer's standard standing-seam, trapezoidal-rib metal roof panels.

I. Exterior Wall System: Manufacturer's standard concealed-fastener, flush-profile, metal wall panels.

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal building system.

B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."

1. Design Loads: As indicated on Drawings and in accordance with ASCE/SEI 7.
2. Deflection and Drift Limits: Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
3. Deflection and Drift Limits: No greater than the following:

    a. Elements supporting floors:
        1) Vertical deflection under Live loads: 1/360 of the span.
        2) Vertical deflection under Total loads: 1/240 of the span.
    b. Elements supporting roofs:
        1) Vertical deflection under Live loads: 1/240 of the span.
        2) Vertical deflection under Total loads: 1/240 of the span.
    c. Elements supporting masonry veneer:
        1) Horizontal deflection under Wind loads: 1/600 of the span.
    d. Elements supporting flexible siding:
        1) Horizontal deflection under Wind loads: 1/240 of the span.
    e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
    f. Lateral Drift: Maximum of1/400 of the building height.

C. Seismic Performance: Metal building system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F material surfaces.

E. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: Calculate in accordance with ASCE/SEI 7 with parameters indicated on Drawings.

F. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E1680 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).

G. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).

H. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646[or ASTM E331] at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa).

I. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: [2.86 lbf/sq. ft. (137 Pa)] [6.24 lbf/sq. ft. (300 Pa)].

J. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.

1. Uplift Rating:UL 90.

K. FM Global Listing: Provide metal roof panels and component materials that comply with requirements in FM Global 4471 as part of a panel roofing system and that are listed in FM Global's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

1. Fire/Windstorm Classification: Class 1A-[60] [75] [90] [105] [120] <Insert number>.
2. Hail Resistance: [MH] [SH].

L. Energy Performance: Provide roof panels according to one of the following when tested according to CRRC-1:

1. Three-year, aged, solar reflectance of not less than 0.55 and emissivity of not less than [0.75] <Insert value>.
2. Three-year, aged, Solar Reflectance Index of not less than 64 when calculated according to ASTM E1980.

2.4 STRUCTURAL-STEEL FRAMING

A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."

B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."

C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

D. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.

1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.

    a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.

2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
3. Rigid Modular Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.
4. Frame Configuration: Varies, see architectural drawings.
5. Exterior Column: Uniform depth
6. Rafter: Uniform depth

E. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:

1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

F. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other

miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:

1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch- (64-mm-) wide flanges.

    a. Depth: needed to comply with system performance requirements.
2. Girts or Studs: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch- (64-mm-) wide flanges.

    a. Depth: As indicated on Drawings.

3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
4. Flange Bracing: Minimum 2-by-2-by-1/8-inch (51-by-51-by-3-mm) structural-steel angles or 1-inch- (25-mm-) diameter, cold-formed structural tubing to stiffen primary-frame flanges.
5. Sag Bracing: Minimum 1-by-1-by-1/8-inch (25-by-25-by-3-mm) structural-steel angles.
6. Base or Sill Angles: Manufacturer's standard base angle, minimum 3-by-2-inch (76-by-51-mm), fabricated from zinc-coated (galvanized) steel sheet.
7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
8. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
9. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

G. Bracing: Provide adjustable wind bracing as follows:

1. Rods: ASTM A36/A36M; ASTM A572/A572M, Grade 50 (345); or ASTM A529/A529M, Grade 50 (345); minimum 1/2-inch- (13-mm-) diameter steel; threaded full length or threaded a minimum of 6 inches (152 mm) at each end.
2. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
3. Diaphragm Action of Metal Panels: Design metal building to resist wind forces through diaphragm action of metal panels to rigid frames.

H. Materials:

1. W-Shapes: ASTM A992/A992M; ASTM A572/A572M, Grade 50 or 55 (345 or 380); or ASTM A529/A529M, Grade 50 or 55.
2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.

3. Plate and Bar: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55; or ASTM A529/A529M, Grade 50 or 55.
4. Steel Pipe: ASTM A53/A53M, Type E or S, Grade B.
5. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B or C, structural tubing.
6. Structural-Steel Sheet: Hot-rolled, ASTM A1011/A1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS) or High-Strength Low-Alloy Steel with Improved Formability (HSLAS-F), Grades 45 through 70; or cold-rolled, ASTM A1008/A1008M, Structural Steel (SS), Grades 25 through 80, or HSLAS, Grades 45 through 70.
7. Metallic-Coated Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G60 (Z180) coating designation; mill phosphatized.
8. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755/A755M.

    a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, SS, Grades 33 through 80, or HSLAS or HSLAS-F, Grades 50 through 80; with G90 (Z275) coating designation.
    b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, SS, Grade 50 or 80; with Class AZ50 (AZM150) coating.

9. Joist Girders: Manufactured according to "Standard Specifications for Joist Girders," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated on Drawings and required for primary framing.
10. Steel Joists: Manufactured according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated on Drawings and required for secondary framing.
11. Non-High-Strength Bolts, Nuts, and Washers: ASTM A307, Grade A, carbon-steel, hex-head bolts; ASTM A563 (ASTM A563M) carbon-steel hex nuts; and ASTM F844 plain (flat) steel washers.

    a. Finish: Hot-dip zinc coating, ASTM F2329, Class C.

12. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M,Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, (ASTM A563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

    a. Finish: Hot-dip zinc coating, ASTM F2329, Class C.

13. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490 (Grade A490M), Type 1, heavy-hex steel structural bolts or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, (ASTM A563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

14. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, (ASTM A563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1 hardened carbon-steel washers.

    a. Finish: Plain

15. Unheaded Anchor Rods: ASTM F1554, Grade 36 or 50.

    a. Configuration: Straight.
    b. Nuts: ASTM A563 (ASTM A563M) heavy-hex carbon steel.
    c. Plate Washers: ASTM A36/A36M carbon steel.
    d. Washers: ASTM F436 (ASTM F436M) hardened carbon steel.
    e. Finish: Hot-dip zinc coating, ASTM F2329, Class C.

16. Headed Anchor Rods: ASTM F1554, Grade 36 or 50.

    a. Configuration: Straight.
    b. Nuts: ASTM A563 (ASTM A563M) heavy-hex carbon steel.
    c. Plate Washers: ASTM A36/A36M carbon steel.
    d. Washers: ASTM F436 (ASTM F436M) hardened carbon steel.
    e. Finish: Hot-dip zinc coating, ASTM F2329, Class C.

17. Threaded Rods: ASTM A307, Grade A.

    a. Nuts: ASTM A563 (ASTM A563M) hex carbon steel.
    b. Washers: ASTM A36/A36M carbon steel.
    c. Finish: As required by exposure.

I. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

1. Clean and prepare in accordance with SSPC-SP2.
2. Coat with manufacturer's standard primer. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil (0.025 mm).

    a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil (0.013 mm) on each side.

2.5 METAL ROOF PANELS

A. Standing-Seam, Trapezoidal-Rib, Metal Roof Panels: Formed with raised trapezoidal ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.

1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.024-inch (0.61-mm) nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

a. Exterior Finish: Two-coat fluoropolymer.
b. Color: As selected by Architect from manufacturer's full range.

2. Clips: One-piece fixed to accommodate thermal movement.
3. Joint Type: Panels snapped together.
4. Panel Coverage: 24 inches (610 mm).
5. Panel Height: 3 inches (76 mm).
6. Uplift Rating: UL 90.

B. Finishes:

1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.6 METAL WALL PANELS

A. Concealed-Fastener, Flush-Profile, Metal Wall Panels: Formed with vertical panel edges and a single wide recess, centered between panel edges with flush joint between panels; with 1-inch-(25-mm-) wide flange for attaching interior finish; designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps.

1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.024-inch (0.61-mm)] [0.030-inch (0.76-mm)] nominal uncoated steel thickness. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

a. Exterior Finish: Fluoropolymer.
b. Color: selected by Architect from manufacturer's full range.

2. Panel Coverage: 16 inches (406 mm).
3. Panel Height: 3 inches (76 mm).

B. Finishes:

1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

2.7 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
2. Clips: Manufacturer's standard, formed from steel sheet, designed to withstand negative-load requirements.
3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from steel sheet.
4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
6. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch (25-mm) standoff; fabricated from extruded polystyrene.

C. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure

strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

D. Flashing and Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.018-inch (0.46-mm) nominal uncoated steel thickness, prepainted with coil coating; finished to match adjacent metal panels.

1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
2. Opening Trim: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, [0.018-inch (0.46-mm)] [0.030-inch (0.76-mm)] nominal uncoated steel thickness, prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

E. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

F. Materials:

1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.

    a. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM sealing washer.
    b. Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with EPDM sealing washers bearing on weather side of metal panels.
    c. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
    d. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

2. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
4. Metal Panel Sealants:

    a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
    b. Joint Sealant: ASTM C920; one part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and

remain weathertight; and as recommended by metal building system manufacturer.

2.8 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

1. Make shop connections by welding or by using high-strength bolts.
2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

1. Make shop connections by welding or by using non-high-strength bolts.
2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.9 SOURCE QUALITY CONTROL

A. Special Inspection: Owner will engage a qualified special inspector to perform source quality control inspections and to submit reports.

1. Accredited Manufacturers: Special inspections will not be required if fabrication is performed by an IAS AC472-accredited manufacturer approved by authorities having jurisdiction to perform such Work without special inspection.

a. After fabrication, submit copy of certificate of compliance to authorities having jurisdiction, certifying that Work was performed according to Contract requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.

1. Engage land surveyor to perform surveying.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written instructions and drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.

1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.

    a. Joint Type: Snug tightened or pretensioned as required by manufacturer.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.

1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
2. Locate and space wall girts to suit openings such as doors and windows.
3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Steel Joists: Install joists, and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.

3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Joist Installation: Bolt joists to supporting steel framework using carbon-steel bolts unless otherwise indicated.
5. Joist Installation: Bolt joists to supporting steel framework using high-strength structural bolts unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.
6. Joist Installation: Weld joist seats to supporting steel framework.
7. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod and cable bracing to avoid sag.
2. Locate interior end-bay bracing only where indicated.

J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 METAL PANEL INSTALLATION, GENERAL

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.

1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.

D. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.

    a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.

2. Install metal panels perpendicular to structural supports unless otherwise indicated.
3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Locate metal panel splices over structural supports with end laps in alignment.
6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

E. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

F. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.

1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

1. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.

1. Install clips to supports with self-drilling or self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.

C. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. When two rows of metal panels are required, lap panels 4 inches (102 mm) minimum.
4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
7. Install screw fasteners in predrilled holes.
8. Install flashing and trim as metal wall panel work proceeds.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), noncumulative; level, plumb, and on location lines; and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.7 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil-canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

C. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.8 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.

B. Product will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 CLEANING AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

C. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 133419

SECTION 210000 - GENERAL REQUIREMENTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic Fire Protection Requirements specifically applicable to Division 21 sections, in addition to Division 01 - General Requirements.

1.2 RELATED DOCUMENTS

A. Basic and supplemental requirements common to Fire Protection.

B. THE UNIFORM GENERAL CONDITIONS, SUPPLEMENTARY GENERAL CONDITIONS, and Division 01 of the specifications apply to the work specified in this section.

C. All work covered by this section of these specifications shall be accomplished in accordance with all applicable provisions of the Contract Documents and any addenda or directives which may be issued herewith, or otherwise.

1.3 GENERAL

A. The Contractor shall execute all work herein after specified or indicated on accompanying drawings. Contractor shall provide all equipment necessary and usually furnished in connection with such work and systems whether or not mentioned specifically herein or on the Drawings.

B. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation and thereby to provide an integrated satisfactory operating installation

C. The Fire Protection Drawings are necessarily diagrammatic by their nature, and are not intended to show every connection in detail or every pipe in its exact location. These details are subject to the requirements of standards referenced elsewhere in these specifications, and structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be organized and laid out so that it will be concealed in furred chases, above suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed or where no ceilings exist. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted. All work shall be NFPA compliant and compliant with Insurance Underwriter requirements and guidelines.

D. When the Fire Protection drawings do not give exact details as to the elevation of pipe the Contractor shall physically arrange the systems to fit in the space available at the elevations intended with proper grades for the functioning of the system involved. Piping is generally

intended to be installed true and square to the building construction, The Drawings do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas, unless there is no ceiling.

1.4 DEFINITIONS

A. These definitions are included to clarify the direction and intention of these Specifications. The list given here is not by any means complete. For further clarification as required, contractor shall contact the designated Owner's representative.

1. Concealed / Exposed: Concealed areas are those that cannot be seen by the building occupants. Exposed areas are all areas that are exposed to view by the building occupants, including under counters, inside cabinets and closets, plus all mechanical rooms.

2. General Requirements: The provisions of requirements of other Division 01 sections apply to entire work of contract and, where so indicated, to other elements that are included in project. Basic contract definitions are included in the General Conditions.

3. Indicated: The term "indicated" is a cross reference to graphic representations, notes or schedules on drawings, to other paragraphs or schedules in the specifications, and to similar means of recording requirements on contract documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used in lieu of "indicated," it is for the purpose of helping reader locate the cross reference, and no limitation of location is intended except as specifically noted.

4. Directed, requested, etc.: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted," and "permitted" mean "directed by Architect/Engineer," "requested by Architect/Engineer" and similar phrases. However, no such implied meaning will be interpreted to extend Architect's/Engineer's responsibility into Contractor's area of construction supervision and job safety.

5. Approve: Where used in conjunction with Architect's/Engineer's response to submittals, requests, applications, inquiries, reports and claims by Contractor, the meaning of term "approved" will be held to limitations to Architect's/Engineer's responsibilities and duties as specified in General and Supplementary Conditions. In no case will "approval" by Architect/Engineer be interpreted as a release of Contractor from responsibilities to fulfill requirements of contract documents or to extend Architect's/Engineer's responsibility into Contractor's area of construction supervision and job safety.

6. As required: Where "as required" is used in these specifications or on the drawings, it shall mean "that situations exist that are not necessarily described in detail or indicated that may cause the contractor certain complications in performing the work described or indicated. These complications entail the normal coordination activities expected of the Contractor where multiple trades are involved and new or existing construction causes deviations to otherwise simplistic approaches to the work to be performed. The term

shall not be interpreted to permit an option on the part of the Contractor to achieve the end result."

7. Furnish: The term "furnish" is used to mean "supply and deliver to project site, ready for unloading, unpacking, assemble, installation, and similar operations. Where "furnish" applies to work for which the installation is not otherwise specified, "furnish" in such case shall mean "furnish and install."

8. Install: The term "install" is used to describe operations at Project Site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

9. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use.

1.5 PERMITS, UTLILITY CONNECTIONS AND INSPECTIONS

A. General: Refer to Division 01 for construction phasing and time increments.

B. Fees and Costs: If, during the course of the construction, a need arises to buy utilities, the Contractor shall pay all fees attendant thereto. If city or privately owned utility piping or electrical cable needs to be extended, relocated, or terminated, the Contractor will pay all permits and construction/inspection fees associated with that particular work.

C. All work performed on this project is under the authority of the State of Texas, therefore no local construction fees or construction permits will be required except as may be required for new service taps, or new or modified connections to city controlled services. If inspections by city personnel are specifically required by this document, then the Contractor is responsible for any fees or permits in connection to those requirements.

D. Compliance: The Contractor shall comply in every respect with all requirements of National Fire Protection Association, local Fire Department regulations and utility company requirements. In no case does this relieve the Contractor of the responsibility of complying with these specifications and drawings where specified conditions are of higher quality than the requirements of the above-specified authorities. Where requirements of the specifications and drawings are more lenient than the requirements of the above authorities having jurisdiction, the Contractor shall make installations in compliance with the requirements of the above authorities with no extra compensation.

E. Fire hydrant flow test shall be witnessed by a representative of Fort Bend County W.C. & I.D. No. 2 (Phone No: 281-499-1031).

1.6 CONTRACT DRAWINGS

A. All dimensional information related to new structures shall be taken from the appropriate drawings. All dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the site.

B. The interrelation of the specifications, the Drawings, and the Schedules are as follows: The Specifications determine the nature and setting of the several materials, the Drawings establish the quantities, dimensions and details, and the Schedules give the performance characteristics. If the Contractor requires additional clarification, he shall request it in writing, following the contractually prescribed information flow requirements.

C. Should the drawings or specifications conflict within themselves, or with each other, the better quality, or greater size or quantity of work or materials shall be performed or furnished.

1.7 ALLOWANCES

A. Cash Allowance: Refer to Division 01 of the Construction Documents for information and requirements.

1.8 SUBMITTALS

A. Refer to Division 01, UGC, and supplemental UGCs for specification requirements pertaining to timeliness of submission and review, quantity, and format. Each specification section describes the content of the submittals and any submittals which must be approved prior to submission of others.

B. Proposed Products List: Include Products specified in the following sections:

1. Section 21 05 29 – Fire Protection Supports and Sleeves

2. Section 21 05 53 – Fire Protection Piping and Equipment Identification

3. Section 21 08 00 – Fire Protection Systems Commissioning

4. Section 21 10 00 – Water Based Fire Suppression Systems

5. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories clearly marked and/or highlighted, with non-applicable information or data clearly noted in a single submittal.

C. Mark dimensions and values in units to match those specified.

D. Submit fabrication drawings whenever (1) equipment proposed varies in physical size and arrangement from that indicated on the Drawings, thus causing rearrangement of equipment space, (2) where tight spaces require extreme coordination between ductwork, piping, conduit, and other equipment, (3) where called for elsewhere in these specifications; and (4) where specifically requested by the Architect/Engineer. Fabrication drawings shall be made at no additional charge to the Owner or the Architect/Engineer.

1.9 SUBSTITUTION OF MATERIALS AND EQUIPMENT

A. Refer to General Conditions for substitution of materials and equipment.

B. General: Within thirty days after the date of Contract award or work order, whichever is later, and before purchasing or starting installation of materials or equipment, the Contractor shall submit for review, a complete list of suppliers, contractors and manufacturers for all materials and equipment that will be submitted for incorporation into the project. The list shall be arranged in accordance with the organization of the specifications. This initial list shall include the manufacturer's name and type or catalog number as required to identify the quality of material or equipment proposed. This list will be reviewed by the Engineer and the Owner and will be returned to the Contractor with comments as to which items are acceptable without further submittal data and which items will require detailed submittal data for further review and subsequent approval. The initial list shall be submitted as herein specified. Materials and equipment requiring detailed submittal data shall be submitted with sufficient data to indicate that all requirements of these specifications have been met and samples shall be furnished when requested. All manufacturers' data used as part of the submittal shall have all inapplicable features crossed out or deleted in a manner that will clearly indicate exactly what is to be furnished.

C. It is not the intent of the drawings and/or specifications to limit products to any particular manufacturer nor to discriminate against an "APPROVED EQUAL" product as produced by another manufacturer. Some proprietary products are mentioned to set a definite standard for acceptance and to serve as a reference in comparison with other products. When a manufacturer's name appears in these specifications, it is not to be construed that the manufacturer is unconditionally acceptable as a provider of equipment for this project. The successful manufacturer or supplier shall meet all of the provisions of the appropriate specification(s).

D. The specified products have been used in preparing the drawings and specifications and thus establish minimum qualities with which substitutes must at least equal to be considered acceptable. The burden of proof of equality rests with the Contractor. The decision of the Architect/Engineer is final.

E. When requested by the Architect/Engineer, the Contractor shall provide a sample of the proposed substitute item. In some cases, samples of both the specified item and the proposed item shall be provided for comparison purposes.

F. Timeliness: The burden of timeliness in the complete cycle of submittal data, shop drawings, and sample processing is on the Contractor. The Contractor shall allow a minimum of six (6) weeks' time frame for review of each submission by the office of the design discipline involved after receipt of such submissions by that design discipline. The Contractor is responsible for allowing sufficient time in the construction schedule to cover the aforementioned cycles of data processing, including time for all resubmittal cycles on unacceptable materials, equipment, etc. covered by the data submitted. Construction delays and/or lack of timeliness in the above regard are the responsibility of the Contractor and will not be considered in any request for scheduled construction time extensions and/or additional costs to the Owner.

G. All equipment installed on this project shall have local representation, local factory authorized service, and a local stock of repair parts.

H. Acceptance of materials and equipment will be based on manufacturer's published data and will be tentative subject to the submission of complete shop drawings indicating compliance with the contract documents and that adequate and acceptable clearances for entry, servicing, and maintenance will exist. Acceptance of materials and equipment under this provision shall not be construed as authorizing any deviations from the specifications, unless the attention of the Architect/Engineer has been directed in writing to the specific deviations. Data submitted shall not contain unrelated information unless all pertinent information is properly identified.

I. Certification: The Contractor shall carefully examine all data forwarded for approval and shall sign a certificate to the effect that the data has been carefully checked and found to be correct with respect to dimensions and available space and that the equipment complies with all requirements of the specifications.

J. Physical Size of Equipment: Space is critical; therefore, equipment of larger sizes than shown, even though of specified manufacturer, will not be acceptable unless it can be demonstrated that ample space exists for proper installation, operation, and maintenance.

K. Materials and Equipment Lists: Eight (8) copies of the list of materials and equipment, the name of manufacturer, trade name, type, and catalog number shall be submitted to the Architect/Engineer. The lists shall be accompanied by eight (8) sets of pictorial and descriptive data derived from the manufacturers' catalogs, sales literature, or incorporated in the shop drawings.

L. Should a substitution be accepted, and should the substitute material prove defective, or otherwise unsatisfactory for the service intended within the guarantee period, this material or equipment shall be replaced with the material or equipment specified at no additional cost to the Owner.

1.10 MATERIALS AND WORKMANSHIP

A. All materials, unless otherwise specified, shall be new, free from all defects, suitable for the intended use, and of the best quality of their respective kinds. Materials and equipment shall be installed in accordance with the manufacturer's recommendations and the best standard practice for the type of work involved. All work shall be executed by mechanics skilled in their respective trades, and the installations shall provide a neat, precise appearance. Materials and/or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the job site but shall be replaced with new materials and/or equipment.

B. The responsibility for the furnishing of the proper equipment and/or material and seeing that it is installed as intended by the manufacturer, rests entirely upon the Contractor who shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

1.11 FLAME SPREAD PROPERTIES OF MATERIALS

A. Materials and adhesives incorporated in this project shall conform to NFPA Standard 255, "Method of Test of Surface Burning Characteristics of Building Materials" and NFPA 90. The classification shall not exceed a flame spread rating of 25 for all materials, adhesives, finishes, etc., specified for each system, and shall not exceed a smoke developed rating of 50.

1.12 REGULATORY REQUIREMENTS

A. The "Authority Having Jurisdiction" over the project described by these documents is the Owner, as an Agency of the State of Texas. As such, it is required that the installation shall meet the minimum standards prescribed in the latest editions of the following listed codes and standards, which are made a part of these specifications. All referenced codes and standards shall be those current at the date of issue of the design documents.

B. National Fire Protection Association Standards (NFPA)

1. NFPA No. 13, Sprinkler System, Installation, 2013 edition.

2. NFPA No. 70, National Electrical Code, 2017 edition.

3. NFPA No. 72D, Proprietary Signaling Systems, 2013 edition.

4. NFPA No. 101, Life Safety Code, 2015 edition.

5. NFPA No. 291, Recommended Practice for Fire Flow Testing and Marking of Hydrants, current edition.

C. American National Standards Institute (ANSI)

D. American Society of Testing Materials (ASTM): All current editions of applicable manuals and standards

E. American Water Works Association (AWWA): All current editions of applicable manuals and standards.

F. National Electrical Manufacturers' Association (NEMA): All current editions of applicable manuals and standards.

G. International Building and Fire Codes, 2015 edition with City of Stafford, Texas amendments.

H. City of Stafford, Texas Fire Department as may be applicable to construction on this site.

I. Texas Occupational Safety Act: All applicable safety standards.

J. Occupational Safety and Health Act (OSHA).

K. ADA and ANSI Standards: All work shall be in accord with all regulations and requirements of the Standards and Specifications for Handicapped and Disabled for the Construction of Public

Buildings and Facilities in the State of Texas Usable by Physically Handicapped and Disabled persons, ANSI Standards and the requirements of the American Disabilities Act.

L. Refer to Specification sections hereinafter bound for additional Codes and Standards.

M. All materials and workmanship shall comply with all applicable state and national codes, specifications, and industry standards. In all cases where Underwriters Laboratories, Inc. has established standards for a particular type material, such material shall comply with these standards. Evidence of compliance shall be the UL "label" or "listing" under Re-Examination Service.

N. The Contract Documents are intended to comply with the aforementioned rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately notify the Architect/Engineer in writing of said discrepancies and apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with said regulations shall be paid for as covered by Division 01 of these Contract Documents, providing no work of fabrication of materials has been accomplished in a manner of noncompliance. Should the Contractor fabricate and/or install materials and/or workmanship in such a manner that does not comply with the applicable codes, rules and regulations, the Contractor who performed such work shall bear all costs arising in correcting these deficiencies to comply with said rules and regulations

1.13 GENERAL MATERIAL AND EQUIPMENT REQUIREMENTS

A. Storage at Site: The Contractor shall not receive material or equipment at the job site until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage.

B. Capacities shall be not less than those indicated but shall be such that no component or system becomes inoperative or is damaged because of startup or other overload conditions.

C. Conformance with Agency Requirements: Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriters Laboratories, Inc., or constructed and/or tested in accordance with the standards of the American Society of Mechanical Engineers or the Air Moving and Conditioning Association, the Contractor shall submit proof that the items furnished under this section of the specifications conform to such requirements. The label of the Underwriters Laboratories, Inc., applied to the item will be acceptable as sufficient evidence that the items conform to such requirements. The ASME stamp or the AMCA label will be acceptable as sufficient evidence that the items conform to the respective requirements.

D. Nameplates: Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection.

E. Prevention of Rust: Standard factory finish will be acceptable on equipment specified by model number; otherwise, surfaces of ferrous metal shall be given a rust inhibiting coating. The treatment shall withstand 200 hours in salt spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show

no signs of wrinkling or cracking and no signs of rust creepage beyond 1/8" on either side of the scratch mark. Where rust inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable unless a specific coating is specified except that coal tar or asphalt type coating will not be acceptable unless so stated for a specific item. Where steel is specified to be hot dip galvanized, mill galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-26915.

F. Protection from Moving Parts: Belts, pulleys, chains, gears, couplings, projecting set screws, keys, and other rotating parts shall be fully enclosed or properly guarded for personnel protection.

G. Verification of Dimensions: The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and become thoroughly familiar with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Architect/Engineer of any discrepancy before performing any work. Adjustments to the work required in order to facilitate a coordinated installation shall be made at no additional cost to the Owner or the Architect/Engineer.

1.14 PROJECT/SITE CONDITIONS

1. Install Work in locations shown on drawings, unless prevented by Project conditions.

2. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other sections. Obtain permission of Owner before proceeding.

1.15 MANUFACTURER'S RECOMMENDATIONS

A. The manufacturer's published directions shall be followed in the delivery, storage, protection, installation, testing and piping of all equipment and material. The Contractor shall promptly notify the Architect/Engineer, in writing, of any conflict between the requirements of the Contract Documents and the manufacturer’s directions, and shall obtain the Architect/Engineer's instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer’s directions or such instructions from the Architect/Engineer, he shall bear all costs arising in connection with the deficiencies.

1.16 SPACE AND EQUIPMENT ARRANGEMENT

A. The size of Fire Protection equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space. Fabrication drawings shall be prepared when required by the Architect/Engineer or Owner to indicate a suitable arrangement.

B. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.

1.17 LARGE APPARATUS

A. Any large piece of apparatus that is to be installed in any space in the building, and that is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly, completely protected from damage as hereinafter specified.

1.18 PROTECTION

A. The Contractor shall at all times take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of the work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the incomplete building with tarpaulins or other protective covering; the installation of electric heaters in electrical switchgear and similar equipment to prevent moisture damage. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.

B. Take particular care not to damage the building structure in performing work. All finished floors, step treads, and finished surfaces shall be covered to prevent any damage by workers or their tools and equipment during the construction of the building.

C. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final inspection must be cleaned of rust and repainted as specified elsewhere in these specifications.

1.19 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

A. Each trade, subcontractor, and/or Contractor must work in harmony with the various other trades, subcontractors and/or Contractors on the job as may be required to facilitate the progress to the best advantage of the job as a whole. Each trade, subcontractor, and/or Contractor must pursue its work promptly and carefully so as not to delay the general progress of the job. This Contractor shall work in harmony with Contractors working under other contracts on the premises.

1.20 ELECTRICAL WIRING OF MOTORS AND EQUIPMENT

A. The Contractor shall note that the electrical design and Drawings are based on the equipment scheduled and indicated on the Drawings, and should any mechanical equipment be provided

requiring changes to the electrical design, the required electrical changes shall be made at no cost to the Owner.

B. The electrical trades shall provide all interconnecting wiring for the installation of all power. The electrical trades shall provide all disconnect switches as required for proper operation, as indicated on the drawings or required by applicable code. All combination starters, individual starters, and other motor starting apparatus not specifically scheduled or specified as provided by the equipment manufacturer under the scope of Division 23, shall be provided under the scope of Division 21.

C. Provide complete wiring diagrams indicating power wiring and interlock wiring. Diagrams shall be submitted to the Architect/Engineer for review within thirty (30) days after the submittals for equipment have been reviewed. Diagrams shall be based on accepted equipment and shall be complete full phase and interlock control drawings, not a series of manufacturer's individual diagrams. After these diagrams have been reviewed by the Architect/Engineer, copies shall be transmitted to the electrical trades by the Contractor.

1.21 SUPERVISION

A. Each Contractor and subcontractor shall keep a competent superintendent or foreman on the job at all times. (Refer to the Uniform General Conditions for additional information concerning supervision.)

B. It shall be the responsibility of each superintendent to study all drawings and familiarize himself with the work to be done by other trades. He shall coordinate his work with other trades and before material is fabricated or installed, make sure that his work will not cause an interference with another trade. Where interferences are encountered, they shall be resolved at the job site by the superintendents involved. Where interferences cannot be resolved without major changes to the drawings, the matter shall be referred to the A/E for ruling.

1.22 SITE OBSERVATION

A. Site observation by the Architect/Engineer is for the express purpose of verifying compliance by the Contractor with the Contract Documents, and shall not be construed as construction supervision nor indication of approval of the manner or location in which the work is being performed as being a safe practice or place.

1.23 INSTALLATION METHODS

A. Where to Conceal: All pipes shall be concealed in pipe chases, walls, furred spaces, or above the ceilings of the building unless otherwise indicated.

B. Where to Expose: In mechanical rooms, janitor's closets tight against pan soffits in exposed "Tee" structures, or storage spaces, but only where necessary, piping may be run exposed. All exposed piping shall be run in the most aesthetic, inconspicuous manner, and parallel or perpendicular to the building lines.

C. Support: All piping shall be adequately and properly supported from the building structure by means of hanger rods or clamps to walls as herein specified.

D. Maintaining Clearance: Where limited space is available above the ceilings below concrete beams or other deep projections, pipe shall be sleeved through the projection where it crosses, rather than hung below them in a manner to provide maximum above floor clearance. Sleeves shall be as herein specified. Approval shall be obtained from the Architect/Engineer for each penetration.

E. All pipe shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All pipes run exposed in machinery and equipment rooms shall be installed parallel to the building lines, except that piping shall be sloped to obtain the proper pitch. Piping run in furred ceilings, etc., shall be similarly installed, except as otherwise shown. All pipe openings shall be kept closed until the systems are closed with final connections.

1. All piping not directly buried in the ground shall be considered as "interior piping."

2. Prior to the installation of any ceiling material, gypsum, plaster, or acoustical board, the Contractor shall notify the construction inspector so that arrangement can be made for an inspection of the above ceiling area about to be "sealed" off. The Contractor shall give as much advance notice as possible no less than 5 working days or as agreed by the Project Manager.

3. All above ceiling areas will be subject to a formal inspection before ceiling panels are installed, or installation is otherwise concealed from view. All mechanical and electrical work at and above the ceiling, including items supported by the ceiling grid shall be complete and installed in accordance with contract requirements, including power to other powered items. Adequate lighting shall be provided to permit thorough inspection of all above ceiling items. The inspection will include representatives of the following: General Contractor and each Subcontractor having work above the ceiling, Architect/Engineer and Owner's Construction Manager. Areas to be included and time of inspection shall be coordinated with the Construction Inspector.

4. The purpose of this inspection is to verify the completeness and quality of the installation of the air conditioning systems, the electrical systems, the plumbing systems, and any other special above ceiling systems such as pneumatic tube, vacuum systems, fire sprinkler piping and cable tray systems. The ceiling supports (tee bar or lath) shall be in place so that access panel and light fixture locations are identifiable and so that clearances and access provisions may be evaluated.

5. No ceiling materials may be installed until the resulting deficiency list from this inspection is worked off and the Construction Inspector has given approval.

1.24 RECORDS FOR OWNER

A. The Contractor shall maintain a set of "blueline" prints in the Field Office for the sole purpose of recording "installed" conditions. Daily note all changes made in these drawings in connection

with the final installation including exact dimensioned locations of all new underground utilities, services and systems and all uncovered existing active and inactive piping outside the building.

B. At contract completion, the Contractor shall provide an electronic file of the revised drawings. The Contractor shall transfer the information from the "blueline" prints maintained as described above, and turn over this neatly marked set of reproducible drawings representing the "as installed" work to the Architect/Engineer for verification and subsequent transmittal to the Owner. The Contractor shall refer to Division 01 of these Specifications, and to the Uniform General Conditions, for additional information. These Drawings shall include as a minimum:

1. Addendum written Drawing changes.

2. Addendum supplementary Drawings.

3. Accurate, dimensioned locations of all underground utilities, services and systems.

4. Identification of equipment work shown on Alternates as to whether alternates were accepted and work actually installed.

5. Change Order written Drawing changes.

6. Change Order supplementary Drawings.

C. Electronic Media

1. The Contractor shall submit three (3) compact discs containing all the Drawings in AutoCAD 2017 or 2018 format.

D. "As installed" plans shall bear a stamp, "stick-on decal" or lettered title block generally located in lower right hand corner of drawing entitled "AS INSTALLED DRAWING" with Company name of the installing trade Subcontractor and with a place for the date and the name of the responsible company representative.

E. In addition to the above, the Contractor shall accumulate during the progress of the job the following data, in duplicate, prepared in a neat brochure or packet folder and turn over to the Architect/Engineer for review, and subsequent delivery to the Owner.

1. All warranties and guarantees and manufacturers' directions on equipment and material covered by the Contract.

2. Two (2) sets of operating instructions for heating and cooling and other mechanical and electrical systems. Operating instructions shall also include recommended preventative maintenance and seasonal changeover procedures.

3. Valve tag charts and diagrams specified herein.

4. Approved wiring diagrams and control diagrams representing "as installed" conditions.

5. Copies of approved shop drawings.

6. Any and all other data and/or drawings required as submittals during construction.

7. Repair parts list of all major items and equipment including name, address and telephone number of local supplier or agent.

7. All of the above data shall be submitted to the Architect/Engineer for approval, and shall be corrected as instructed by the Architect/Engineer prior to submission of the final request for payment.

1.25 CUTTING AND PATCHING

A. General: Cut and patch walls, floors, etc., resulting from work in existing construction or by failure to provide proper openings or recesses in new construction.

B. Methods of cutting: Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Architect/Engineer. Impact type equipment shall not be used except where specifically acceptable to the Architect/Engineer. Openings in precast concrete slabs for pipes shall be core drilled to exact size.

C. Restoration: All openings shall be restored to "as new" condition under the appropriate specification section for the materials involved, and shall match remaining surrounding materials and/or finishes.

D. Masonry: Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Architect/Engineer.

E. Plaster: All mechanical work in areas containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.

F. Special Note: No cutting, boring, or excavating that will weaken the structure shall be undertaken.

1.26 ROOF PENETRATIONS AND FLASHING

A. Pipe, sleeves, pitch pockets, and flashings compatible with the roofing installation shall be provided and installed by a qualified contractor for all roof penetrations. This shall be the responsibility of the General Contractor.

1.27 EXCAVATION, TRENCHING AND BACKFILL

A. Excavation (See Divisions 00 and 01 for special requirements related to excavation and trenching.):

1. The subcontractors shall perform all excavations of every description, for their particular installations and of whatever substances encountered, to the depths indicated on the drawings and/or required for the installation of piping. All exterior lines shall be installed with a minimum cover of 24," unless otherwise indicated. Generally, more cover shall be provided if grade will permit. All excavation materials not required for backfill or fill shall be removed and wasted as acceptable to the Construction Inspector. All excavations shall be made only by open cut. The banks of trenches shall be kept as nearly vertical as possible and where required, shall be properly sheeted and braced. Trenches shall be not less than 12" wider nor more than 16" wider than the outside edges of the pipe to be laid therein, and shall be excavated true to line so that a clear space not less than 6" nor more than 8" in width is provided on each side of the pipe.

2. The bottom of trenches shall be accurately graded to provide proper fall and uniform bearing and support for each section of the pipe on undisturbed soil or 2" of sand fill at every point along its entire length, except for portions of the pipe sections where it is necessary to excavate for bell holes and for the proper sealing of pipe joints. Bell holes shall be dug after the trench bottom has been graded. Where inverts are not shown, grading shall be determined by the International Fire Code for the service intended and the size used. Bell holes for pipe joints shall be 12" in depth below the trench bottom and shall extend from a point 6" back of the face of the bell. Such bell holes shall be of sufficient width to provide ample room to complete the pipe joint . Bell holes for sewer tile and water pipe shall be excavated only to an extent sufficient to permit accurate work in the making of the joints and to ensure that the pipe, for a maximum of its length, will rest upon the prepared bottom of the trench. Depressions for joints other than bell-and-spigot shall be made in accordance with the recommendations of the joint manufacturer for the particular type of joint used. Special pipe beds shall be provided as specified hereinafter.

3. The lower 4" of the pipe trenches measuring from an overhead line set parallel to the grade line of the sewer shall be excavated only a few feet in advance to the pipe laying, by workers especially skilled in this type of work. Where damage is likely to result from withdrawing sheeting, the sheeting shall be left in place. Except at locations where excavation of rock from the bottom of trenches is required, care shall be taken not to excavate below the depths required. Where rock excavation is required, the rock shall be excavated to a minimum over depth of 6" below the trench depths specified. The over depth rock excavation and all excess trench excavation shall be backfilled with sand. Whenever wet or otherwise unstable soil is incapable of properly supporting the pipe is encountered in the trench bottom, such soil shall be removed to a depth and for the trench lengths required, and then backfilled to trench bottom grade, as hereinafter specified, with sand.

4. All grading in the vicinity of excavation shall be controlled to prevent surface ground water from flowing into the excavations. Any water accumulated in the excavations shall be removed by pumping or other acceptable method. During excavation, material suitable for backfilling shall be stacked in an orderly manner a sufficient distance back from edges of trenches to avoid overloading and prevent slides or cave-ins. Material unsuitable for backfilling shall be wasted and removed from the job site as directed by the Construction Inspector.

5. All shoring and sheeting required to perform and protect the excavations and to safeguard employees and/or adjacent structures shall be provided.

6. Excavate as required under the building in order that all piping, etc., shall clear the ground a minimum of 12" for a distance of 24" on either side. Edges of such excavations shall slope at an angle of not over 45 degrees with the horizontal unless otherwise approved by the Construction Inspector. The bottom of such excavation shall be graded to drain in a manner acceptable to the Construction Inspector.

7. Trenches for water lines inside the building shall be properly excavated, following, in general, the procedures set out for exterior lines. Where floors are to be poured over these lines, they shall be backfilled, tamped and settled with water. Where no flooring is to cover the lines, they shall be backfilled to form a level grade.

8. All surplus materials removed in these trenching operations becomes the property of the Contractor, and shall be disposed of at the expense of the Contractor, at a legal disposal site, off of the campus.

B. Backfilling

1. Trenches shall not be backfilled until all required tests are performed and until the piping, utilities systems, etc., as installed are certified by the Owner's inspector to conform to the requirements specified hereinafter. The trenches shall be carefully backfilled with sand to a depth of 12 inches above the top of the pipe. The next layer and subsequent layers of backfill may be excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel, soft shale, or other approved materials free from large clods of earth or stones larger than 1-1/2" in diameter, flooded until the pipe has cover of not less than one foot. The remainder of the backfill material shall then be thrown into the trenches, moistened, and tamped or flooded in one-foot layers. Blasted rock, broken concrete or pavement, and large boulders shall not be used as backfill material. Any trenches improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and mounded over, and smoothed off.

2. Backfill under concrete slabs-on-fill shall be as specified above, shall be gravel, or shall be other such materials more suitable for the application. Installation and compaction shall be as required for compatibility with adjacent materials.

3. Opening and Re-closing Pavement and Lawns: Where excavation requires the opening of existing walks, streets, drives, other existing pavement, or lawns, such surfaces shall be cut as required to install new lines and to make new connections to existing lines. The sizes of the cut shall be held to a minimum, consistent with the work to be accomplished. After the installation of the new work is completed and the excavation has been backfilled and flooded, the area shall be patched, using materials to match those cut out. The patches shall thoroughly bond with the original surfaces and shall be level with them, and shall meet all the requirements established by the authorities having jurisdiction over such areas.

4. Excavation in Vicinity of Trees: All trees including low hanging limbs within the immediate area of construction shall be adequately protected to a height of at least 5 ft. to prevent damage from the construction operations and/or equipment. All excavation within the outermost limb radius of all trees shall be accomplished with extreme care. All roots located within this outermost limb radius shall be brought to the attention of the Construction Inspector before they are cut or damaged in any way. The Construction Inspector will give immediate instructions for the disposition of it. All stumps and roots encountered in the excavation, which are not within the outermost limb radius of existing trees, shall be cut back to a distance of not less than 18" from the outside of any concrete structure or pipeline. No chips, parts of stumps, or loose rock shall be left in the excavation. Where stumps and roots have been cut out of the excavation, clean compacted dry bank sand shall be backfilled and tamped.

1.28 OPERATION PRIOR TO COMPLETION

A. When any piece of Fire Protection equipment is operable and it is to the advantage of the Contractor to operate the equipment, he may do so, providing that he properly supervises the operation, and has the Project Manager's written permission to do so. The warranty period shall, however, not commence until the equipment is operated for the beneficial use of the Owner, or date of substantial completion, whichever occurs first.

B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, properly adjust and complete all deficiency list items prior to being started, commissioned and before final acceptance by the Owner. The date of acceptance and performance certification will be the same date.

1.29 CHECKING AND TESTING MATERIALS AND/OR EQUIPMENT

A. Check inspections shall include fire sprinkler piping, equipment, overall fire protection system controls, and such other items hereinafter specified or specifically designated by the Architect/Engineer.

B. Contractor shall fill out and submit a "Material and test certificate" in compliance with NFPA 13 – 10.10.0 AND receive fire marshal sign-off prior to 100% payment of underground portion of work.

C. Contractor shall fill out and submit a "Material and test certificate" per NFPA 13 – 16.1 AND receive fire marshal sign-off prior to payment of 100% for above ground work.

D. Third party inspections shall be completed prior to final payment.

E. Contractor shall perform work as required to comply with third party inspections.

1.30 COOPERATION AND CLEANUP

A. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the job site in a clean and safe condition. At the end of each day's work, each trade shall properly store all of his tools, equipment and materials and shall clean his debris from the job. Upon the completion of the job, each trade shall immediately remove all of his tools, equipment, any surplus materials and all debris caused by that portion of the work.

1.31 CLEANING AND PAINTING

A. All equipment and piping, etc., furnished and installed in exposed areas under Division 21 of these specifications and as hereinafter specified shall be cleaned, prepared, and painted according to the following specification. In the event of a conflict between the specifications referenced, the provisions of this specification shall prevail only for Division 21 work.

B. All purchased equipment shall be delivered to the job with a suitable factory protective finish with the colors hereinafter specified. The following materials shall not be painted: copper, galvanized metal, stainless steel, fiberglass, PVC, and PVDF.

C. Before painting, materials and equipment surfaces shall be thoroughly cleaned of cement, plaster, and other foreign materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metalwork shall be carefully brushed down with the steel brushes to remove rust and other spots and left smooth and clean.

D. Color of finish painting shall be painted in accordance with The Stafford Municipal School District Standard Color Schedule for machinery spaces using Pratt and Lambert, Inc.'s "Effector" enamel, or approved equal. Two (2) coats shall be applied with a light tint first coat and deep color for final coat. Colors shall be as follows:

ITEM	COLOR	"P and L" PAINT NUMBER
Fire Protection Equipment and Piping	Safety Red	R131R (Vibrant Red)

1. Note that the paint specified above is included for purposes of establishing a QUALITY THAT shall be used on this Project. The proposed paint shall be submitted, and alternatives will be considered using the submittal procedures specified in this document.

E. Jacketing on insulation shall not be painted.

F. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible due to the painting operation.

G. Scope of painting for Division 21 Work in areas other than those defined as "exposed" is as follows:

1. All uncovered steel pipe, supports, exposed pipe and hanger rod threads, and hangers in underfloor spaces shall be cleaned and painted with two (2) coats of Tropical Paint Co. No. 77-black asphaltic emulsion. Galvanized steel and copper lines in these spaces shall not be painted.

2. All canvas finishes including those underfloor and in concealed spaces shall be painted with one sizing coat if not already sized, containing mildew resistant additive and Arabol adhesive prior to any other specified finish paint.

3. All fire protection piping shall be painted whether concealed or exposed, in all areas of the project without exception. Fire protection piping shall be painted safety red. These "safety" colors shall be as defined by OSHA.

4. If insulated, the piping shall be primed, only, prior to insulation, and the insulation jacketing shall be painted as specified for piping. The requirements of this paragraph are "primary" and have priority over any conflicting Specification or instruction, should a conflict in the Construction Documents exist.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. All equipment installed shall have local representation, local factory authorized service, and a local stock of repair parts.

C. Responsibility for furnishing proper equipment and/or material and ensuring that equipment and/or material is installed as intended by the manufacturer, rests entirely upon the Contractor. Contractor shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

D. All materials, unless otherwise specified, shall be new, free from all defects, suitable for the intended use and of the best quality of their respective kinds. Materials and equipment shall be installed in accordance with the manufacturer's recommendations and the best standard practice for the type of Work involved. All Work shall be executed by mechanics skilled in their respective trades, and the installations shall provide a neat, precise appearance. Materials and/or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the job Site but shall be replaced with new materials and/or equipment.

E. Materials and equipment manufactured domestically are preferred when possible. Materials and equipment that are not available from a domestic manufacturer may be by a non-domestic manufacturer provided they fully comply with Contract Documents.

F. Prevention of Rust: Standard factory finish will be acceptable on equipment specified by model number; otherwise, surfaces of ferrous metal shall be given a rust inhibiting coating.

2.2 NAMEPLATES

A. Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Inspection.

B. Nameplates shall be black laminated rigid phenolic with white core. Nameplate minimum size shall be 1 inch high by 3 inches long with 3/16-inch-high engraved white letters.

C. Nameplate Fasteners: Fasten nameplates to the front of equipment only by means of stainless steel self-tapping screws. Stick-ons or adhesives will not be allowed unless the NEMA enclosure rating is compromised, then only epoxy adhesive shall be used to attach nameplates.

D. Nameplate Information: In general, the following information is to be provided for the types of electrical components or enclosures supplied with equipment.

1. Individual Starters, Contactors, Disconnect Switches, and Similar Equipment: Identify the device, and voltage characteristics source and load served.

2.3 WALL, FLOOR AND CEILING PLATES (ESCUTCHEONS)

A. Except as otherwise noted, provide stainless steel or chrome plated brass floor and ceiling plates around all pipes passing exposed through walls, floors or ceilings, in any spaces except underfloor and plenum spaces.

B. Plates shall be sized to fit snugly against the outside of the pipe or against the insulation on lines that are insulated and positively secured to such pipe or insulation.

C. For finished ceiling installation, secure escutcheons to ceiling with escutcheon fasteners.

D. Plates will not be required for piping where pipe sleeves extend ¾-inch or more above finished floor.

2.4 ROOF PENETRATIONS AND FLASHING

A. Pipe sleeves, pitch pockets and flashings compatible with the roofing installation shall be provided and installed for all roof penetrations by a contractor qualified in such Work. Installation shall comply with the Contract Documents and with FM General Data Sheets 1-28, 1-29, 1-31 & 1-49 along with the FM approval guide.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cooperate with trades of adjacent, related or affected materials or operations, and with trades performing continuations of this Work in order to effect timely and accurate placing of Work and to coordinate, in proper and correct sequence, the Work of such trades.

B. The size of equipment indicated on the Drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine that the equipment proposed will fit in the space. Fabrication Drawings shall be prepared when required by the Architect/Engineer or Owner to indicate a suitable arrangement.

C. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.

D. Space Requirements:

1. Consider space limitations imposed by contiguous Work in location of equipment and material. Do not provide equipment or material which is not suitable in this respect.

2. Make changes in material and equipment locations of up to five (5) feet, to allow for field conditions prior to actual installation, and as directed by the Architect/Engineer at no additional cost to the Owner.

E. Contractor shall note that the electrical design and Drawings are based on the equipment scheduled and indicated on the Drawings. Should any equipment be provided requiring changes to the electrical design, the required electrical changes shall be made at no cost to the Owner.

3.2 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer’s published recommendations, as shown on the drawings and stated in the specifications.

C. Piping may be run exposed in rooms typically without ceilings such as mechanical rooms, janitor's closets, tight against pan soffits in exposed "tee" structures, or storage spaces, but only where necessary. Shutoff and isolation valves shall be easily accessible.

D. All pipe, conduits, etc., shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts, pipes and conduits run exposed in machinery and equipment rooms shall be installed parallel to the building lines, except that piping shall be sloped to obtain the proper pitch. Piping and ducts run in furred

ceilings, etc., shall be similarly installed, except as otherwise shown. All pipe openings shall be kept closed until the systems are closed with final connections.

E. Prior to the installation of any ceiling material, gypsum, plaster or acoustical board, the Contractor shall notify Project Manager so that arrangement can be made for an inspection of the above-ceiling area about to be "sealed" off. The Contractor shall provide written notification to the Owner at least five (5) calendar days prior to the inspection.

F. Precedence of Materials:

1. The Specifications determine the nature and setting of materials and equipment. The Drawings establish quantities, dimensions and details.

2. If interference is encountered, the following installation precedence of materials shall guide the Contractor to determine which trade shall be given the "Right of Way":
   a. Building lines
   b. Structural members
   c. Structural support frames supporting ceiling equipment
   d. Soil and drain piping
   e. Vent piping
   f. Supply, return and outside air ductwork
   g. Exhaust ductwork
   h. Condensate piping
   i. Fire protection piping
   j. Domestic water (cold and hot, softened, treated)
   k. Refrigerant piping
   l. Electrical conduit

3. Coordinate fire protection system with other trade systems as required to maintain system right-of-ways.

3.3 TESTING

A. When any piece of equipment is operable and it is to the advantage of the Contractor to operate the equipment, Contractor may do so, provided that Contractor properly supervises the operation, and has the Project Manager’s written permission to do so. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner, or date of Substantial Completion, whichever occurs first.

B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean and properly adjust, and complete all deficiency list items before final acceptance by the Owner. The date of acceptance and performance certification will be the same date.

C. The Contractor shall execute, at no additional cost to the Owner, any tests required by the Owner or the National Fire Protection Association (NFPA), ASTM, etc. standards listed. The Contractor shall provide all equipment, materials and labor for making such tests. The Owner will pay reasonable amounts of fuel and electrical energy costs for system tests. Fuel and

electrical energy costs for system adjustment and tests, which follow Substantial Completion by the Owner, will be borne by the Owner.

D. Notify the Project Manager and the Architect/Engineer in writing at least five (5) calendar days or as agreed by the Project Manager prior to each test and prior to other Specification requirements requiring Owner and Architect/Engineer to observe and/or approve tests.

E. All tests shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel performing, observing and inspecting, description of the test and extent of system tested, test conditions, test results, specified results and other pertinent data. Data shall be delivered to the Architect/Engineer as specified under "Requirements for Final Acceptance." The Contractor or Contractor's authorized job superintendent shall legibly sign all Test Log entries.

F. Maintain Log of Tests as hereinafter specified.

G. See Specifications hereinafter for additional tests and requirements.

H. Refer to Commissioning Specification Sections for additional Start-up, pre-functional and operational checkout, and for functional performance test procedures.

3.4 TRAINING

A. Operating and Maintenance Manuals and instruction shall be provided as specified under the Division 01 Section entitled "Project Closeout Procedures."

B. Specific training and operating instructions for individual equipment components shall be as specified in the individual Specification Sections.

END OF SECTION 210000

SECTION 210529 - FIRE PROTECTION HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Fastener systems.
5. Equipment supports.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.

2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. NFPA Compliance: Comply with NFPA 13 and NFPA 14.

D. UL Compliance: Comply with UL 203.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.

2. Galvanized Metallic Coatings: Pre-galvanized or hot-dip galvanized.

3. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. B-line, an Eaton business.
   b. Flex-Strut Inc.
   c. Unistrut; Part of Atkore International.

2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.

3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.

4. Channels: Continuous slotted carbon-steel channel with inturned lips.

5. Channel Width: Selected for applicable load criteria.

6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

8. Metallic Coating: Hot-dip galvanized.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Not allowed.

B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Hilti, Inc.
   b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
   c. MKT Fastening, LLC.

2. Indoor Applications: Zinc-coated or stainless steel.

3. Outdoor Applications: Stainless steel.

2.6 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.7 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout, suitable for interior and exterior applications.

1. Properties: Non-staining, non-corrosive, and non-gaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal strut systems.

D. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Section 099000 "Painting and Coating."

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780/A780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.

2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.

3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.

4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.

5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3.

6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.

7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.

9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

I. Hanger-Rod Attachments: Comply with NFPA requirements.

J. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. C-Clamps (MSS Type 23): For structural shapes.

3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

K. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

L. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

M. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 210529

SECTION 210553 - FIRE PROTECTION PIPING AND EQUIPMENT IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 THE FOLLOWING SECTIONS ARE TO BE INCLUDED AS IF WRITTEN HEREIN:

A. Section 21 00 00 – General Requirements for Fire Suppression.

B. Section 21 05 29 – Fire Protection Supports and Sleeves.

1.3 SECTION INCLUDES

A. Nameplates

B. Tags

C. Pipe Markers

1.4 RELATED SECTIONS

A. Section 09 91 00 – Painting: Identification painting.

1.5 REFERENCES

A. ASME A13.1 – Scheme for the Identification of Piping Systems.

B. IFC - International Fire Code, 2015 edition.

C. NFPA 13 - Sprinkler System, Installation, 2013 edition.

1.6 SUBMITTALS

A. Submit under provisions of Section 21 00 00.

B. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for fire suppression equipment, piping and valve identification.

1. Equipment Label Schedule: Provide a schedule of all equipment to be labeled with the proposed content for each label.

2. Access Panel and Door Markers: Provide a schedule of all panels and doors to be labeled with the proposed content for each label.

3. Pipe Label Schedule: Provide a schedule of each piping systems indicating a proposed nomenclature and location of all pipe markers.

4. Valve Chart and Schedule: Provide a proposed valve numbering scheme and schedule for each piping system. Tabulate valve number, room or space location, function, valve manufacturer's name and model number, piping system, system abbreviation as shown on tag, normal-operating position (open, closed, or modulating), and variations for identification. Mark valves intended for emergency shut-off and similar special uses.

5. Warning Tags: Provide a schedule of all equipment to be labeled with the proposed content for each label.

C. Product Data: Provide manufacturers' catalog literature for each product required, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.

D. Samples: Submit two (2) of each type of label, tag, etc., of the approximate size specified of implied in the Specification.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

1.7 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

1.8 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 21 00 00.

B. Record actual locations of tagged valves and update schedules accordingly.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five (5) years documented experience

B. Installer Qualifications: Company specializing in performing Work of this section with minimum five (5) years documented experience.

C. ASME Standards: Comply with ASME A13.1 for color scheme, lettering size, length of color field, and viewing angles of identification devices.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging with labels clearly identifying product name and manufacturer until ready for installation.

B. Storage: Store materials in clean, dry area indoors until ready for installation.

C. Handling: Protect materials and finish from damage during handling and installation.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. Make it possible for the personnel operating and maintaining the equipment and systems in this project to readily identify the various pieces of equipment, valves, piping, etc., by marking them. All items of equipment such as fire pumps, etc., are to be clearly marked using engraved nameplates as specified. Use equipment identification numbers that appear on the design documents and/or equipment identification numbers furnished by the Owner’s Designated Representative.

C. General: Provide manufacturer's standard products of categories and types required for each application specified. For each identification type, provide all products from same manufacturer with same text, style, color, shape, and other identification features.

1. Provide nameplates with the unit number on all mechanical equipment.

2. Access panel and door markers for standpipes, hose and fire extinguisher cabinets, fire and smoke dampers, etc.

3. Provide pipe identification labels including direction-of-flow arrows and with service indicated. All labels shall have background colors matched with specific service designation.

4. Provide valve tag numbers on all valves.

5. Warning tags at motors and equipment controlled by automatic starters, etc.

2.2 MANUFACTURERS

A. Equipment Tags, Valve Tags, and Markers:

1. Marking Services, Inc.

2. Seton, owned by Brady Corporation.

3. Brady Corporation

4. Graphic Products, Inc.

5. Brimar Industries.

6. Craftmark.

2.3 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness:
   a. Indoors: Multilayer, multicolor, plastic labels for fire suppression piping and equipment engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
   b. Outdoors: Chemically resistant plastic with printed graphics protected by a chemical and UV resistant top laminate.

2. Letter Color: White

3. Background Color: Red

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 1 by 3 inches.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds (2/3) to three-fourths (3/4) the size of principal lettering.

7. Fasteners: Stainless-steel self-tapping screws.

B. Label Content: Nomenclature on the label is to include the name of the item, its mark number, area, space, or equipment served, and other pertinent information. Use equipment identification numbers that appear on the design documents and/or equipment identification numbers furnished by the Owner.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

D. All scheduled equipment shall be identified with an Equipment Tag.

2.4 ACCESS PANEL AND DOOR MARKERS

A. Material and Thickness: 1/16-inch- thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification.

B. Letter Color: White

C. Background Color: Red

D. Fasteners: Self-tapping, stainless steel screws or contact-type, permanent adhesive.

2.5 VALVE CHART

A. The Contractor shall prepare and install, in a suitable glazed anodized aluminum frame, typewritten valve charts giving the number, location, function and area or rooms served for each line valve installed under this contract.

B. Each valve shall be numbered on these charts in accordance with the system of which it is a part of and its location.

2.6 VALVE TAGS

A. Provide and install identification tags lettered and numbered to correspond to the information shown on the charts described above.

B. Valve tags shall conform to ANSI A13.1.Valve Tags (Indoors): Stamped or engraved with 1/4 inch letters for piping abbreviation and 1/2 inch numbers.

1. Tag Material: Brass, 0.032 inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Background Color: Natural brass.

3. Letter Color: Black.

4. Tag Size: 1-1/2 inches, round.

5. Fasteners: Brass S-Hooks and Jack Chain.

C. Valve Tags (Outdoors):

1. Material: Chemically resistant plastic with printed graphics protected by a chemical and UV resistant top laminate, and having stainless steel grommet protected predrilled holes with for attachment hardware.

2. Background Color: Red.

3. Letter Color: White.

4. Tag Size: Minimum 1-1/2 inches.

5. Fasteners: Stainless steel S-Hooks and stainless steel Jack Chain.

2.7 PIPE LABELS (INDOOR PIPING)

A. Provide labels for above ground piping located indoors, and not exposed to sunlight or a harsh environment.

B. Pipe labels shall pre-printed, color-coded, with lettering indicating service, and showing flow direction in conformance with ANSI A13.1 as indicated below.

Pipe Contents	Label Abbreviation	Label Colors (Background/Text)
Fire Suppression Water	FIRE	Red/White
Wet Sprinklers	WET FIRE	Red/White

C. Lettering shall be sub-surface printed and protected from direct contact by a layer of plastic. Markers with surface printed lettering will not be accepted.

D. Arrow markers must have same ANSI background colors as their companion pipe markers, or be incorporated into the pipe identification marker.

E. Plastic Labels for Pipe O.D. less than 8 inches: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around full circumference pipe or pipe covering and to attach to pipe without fasteners or adhesive in contact with the pipe surface.

F. Pipe Labels for Pipe O.D. 8 inches and Over: Strap-on, semi rigid plastic to cover partial circumference of pipe and to attach to pipe with nylon ties.

G. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

H. Pipe markers and arrow markers also shall be provided for all piping systems.

2.8 PIPE LABELS (OUTDOOR PIPING)

A. Provide labels for above ground piping located outside, and exposed to sunlight or a harsh environment, the following product is specified.

B. Pre-printed, color-coded, with lettering indicating service, and showing flow direction.

C. Pipe markers shall be constructed of printed 5 mil polyester and top laminated with ultraviolet and chemical resistant plastic film that is engineered to provide maximum durability of the printed legend. Markers shall be pre-coiled to wrap entirely around the circumference of pipe up to 10 inch outside diameter, and self-sealed with a strip of clear ultraviolet and chemical resistant plastic film. Coiled markers shall seal to themselves, and not the pipe surface.

D. Pipe Labels for pipe O.D. up to 10 inches: Shall be labeled with a single piece, pre-printed marker that wraps entirely around the circumference of the pipe, overlaps and seals to itself rather than adhere to the pipe surface.

E. Pipe Labels for pipe O.D. 10 inches and greater: Shall be constructed of printed 5 mil polyester and top laminated with clear ultraviolet and chemical resistant plastic film that is pre-applied to an acrylic-faced, co-extruded ABS plastic carrier. Carrier shall have pre-formed legs running the entire length of the part to ensure marker remains straight and aligned with pipe. Flow direction shall be identified by application of a separate arrow label of same construction. Carriers shall be affixed to piping by means of two (2) stainless steel straps that wrap entirely around the circumference of the pipe.

F. Underground Plastic Pipe markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.9 CEILING TACKS

A. Description: Steel with 3/4 inch or 7/8" diameter color coded head.

B. Color code: Red.

2.10 CEILING GRID TAG FOR EQUIPMENT LOCATED ABOVE LAY-IN CEILING

A. Description: 3/4" x variable length vinyl label, 3.0 mil self-adhesive vinyl similar to Graphic Products, Inc. DuraLabel Pro™. Label color shall be black text on a white background.

B. All scheduled equipment above finish lay-in ceiling shall be identified with an Equipment Tag.

C. All ceiling grid tags shall be installed prior to the ceiling cover inspection.

2.11 WARNING SIGNS AND LABELS

D. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

E. Letter Color: White.

F. Background Color: Red.

G. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

H. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

I. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds (2/3) to three-fourths (3/4) the size of principal lettering.

J. Fasteners: Stainless-steel self-tapping screws.

K. Label Content: Include caution and warning information, plus emergency notification instructions.

2.12 WARNING TAGS

A. Material: Reprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

B. Size: 3 by 5-1/4 inches minimum.

C. Fasteners: Brass grommet and wire.

D. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

E. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Install identifying devices after completion of coverings and painting.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulates.

B. For pipe markers that are pre-coiled or strap-on type and do not adhere directly to the piping, no surface preparation is necessary.

3.3 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer's published recommendations.

3.4 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of fire suppression equipment.

B. Locate equipment labels where accessible and visible.

3.5 ACCESS PANEL AND DOOR MARKERS INSTALLATION

A. Install or permanently fasten markers on access panels and door for fire suppression equipment.

B. Locate labels where accessible and visible.

3.6 VALVE TAGS INSTALLATION

A. Contractor(s) shall provide and install valve tags on all valves installed within this Project, except check valves and valves within factory-fabricated equipment units..

L. List tagged valves in a valve schedule.

3.7 PIPE LABEL INSTALLATION

A. Piping runs throughout the Project including those above lift-out ceilings, underfloor and those exposed to view when access doors or access panels are opened shall be identified by means of

pipe markers. Concealed areas, for purposes of this identification section, are those areas that cannot be seen except by demolition of the building elements. In addition to pipe markers, arrow markers shall be used to indicate direction of flow.

B. As a minimum, locate pipe markers as follows:

1. Provide a pipe marker at each valve to indicate proper identification of pipe contents. Where several valves exist on one (1) header, it is necessary to mark only the header.

2. Every 20 feet in exposed and concealed areas on all piping systems. Provide at least one (1) pipe marker in each room on all piping systems.

3. At each branch or riser takeoff on piping systems.

4. Provide a pipe marker and an arrow marker at every point of pipe entry or exit where the pipe penetrates a wall, floor, service column or enclosure.

5. At access doors, manholes and similar access points that permit view of concealed piping.

6. Near major equipment items and other points of origination and termination.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Provide an arrow marker with each pipe marker pointing away from the pipe marker to indicate direction of flow.

D. Provide a double-ended arrow marker when flow can be in either or both directions.

E. Install plastic tape, and pipe markers completely around pipe in accordance with manufacturer’s instructions.

F. Locate markers on the two (2) lower quarters of the pipe where view is unobstructed.

G. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

3.8 WARNING TAGS INSTALLATION

M. Write required message on, and attach warning tags to, equipment and other items where required.

3.9 CEILING TACKS INSTALLATION

A. Mark location of equipment or valves located above ceilings with identifying "buttons" to help in identification for maintenance.

3.10 CEILING GRID TAGS INSTALLATION

A. Provide ceiling grid tags to locate valves or other concealed equipment above T-bar type panel ceilings. Locate in corner of grid closest to equipment.

3.11 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 210553

SECTION 210800 - COMMISSIONING OF FIRE PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes commissioning process requirements for Fire Protection systems, assemblies, controls, and equipment.

B. This project will have selected building systems commissioned. The equipment and systems to be commissioned are specified “SECTION 01 91 00 - GENERAL COMMISSIONING REQUIREMENTS”.

C. The scope of commissioning shall include the third party inspections, site verification of entire system, witness and verification of the “material and test certificates”

1.2 RELATED SECTIONS

A. SECTION 01 91 00 - COMMISSIONING GENERAL REQUIREMENTS

B. SECTION 22 08 00 – COMMISSIONING OF PLUMBING SYSTEMS

C. SECTION 23 08 00 – COMMISSIONING OF HVAC SYSTEMS

D. SECTION 26 08 00 – COMMISSIONING OF ELECTRICAL SYSTEMS

E. SECTION 28 08 00 – COMMISSIONING OF FIRE ALARM SYSTEMS

1.3 DEFINITIONS

A. Refer to section 01 91 00 - GENERAL COMMISSIONING REQUIREMENTS

1.4 SUBMITTALS

A. Certificate of Readiness, signed by the Contractor, certifying that systems, assemblies, equipment, components, and associated controls are ready for testing.

B. Manufacturer’s completed start-up reports for equipment and systems.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Reference Project Specification Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for details of contractor’s responsibilities related to commissioning.

B. Perform commissioning tests at the direction of the CxA.

C. Attend commissioning meetings.

D. Provide information requested by the CxA for functional testing and for final commissioning documentation.

E. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

F. Functional testing of systems will be carried out solely by contractor's personnel, under the direction of CxA. Provide experienced personnel, familiar with the systems being installed under this project.

1.6 CXA'S RESPONSIBILITIES

A. Reference Project Specification Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS.

B. CxA will direct commissioning testing. Commissioning provider shall coordinate and provide, licensed, third party inspection prior to final payment. Inspection to include flow test and overhead inspection.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL TESTING REQUIREMENTS

A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in Division 21 Sections. Provide submittals, test data, inspector record, and certification to the CxA.

B. Reference Project Specification Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for detailed requirements of commissioning of Mechanical systems.

C. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

D. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

E. Tests will be performed using design conditions whenever possible.

3.2 SYSTEM START-UP

A. Contractor is solely responsible for system start-up. CxA may, at his discretion, witness start up procedures, but will not perform any Functional Testing of systems until Contractor has completed start-up and resolved all operating deficiencies, and has so certified.

3.3 TESTING PREPARATION

A. Certify that Fire Protection systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that testing, adjusting, and balancing procedures for Fire Protection systems have been completed and submitted, discrepancies corrected, and corrective work approved.

C. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

D. Inspect and verify the position of each device and interlock identified on checklists.

E. Check safety cutouts, alarms, and interlocks with life-safety systems during each mode of operation.

3.4 FUNCTIONAL TESTING / GENERAL

A. Reference Project Specification Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for detailed requirements of commissioning of Plumbing systems.

B. Provide measuring instruments to record test data as directed by the CxA.

3.5 PIPING SYSTEMS

A. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in Division 22 piping Sections. Plumbing Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Include sequence of testing and testing procedures, description of equipment for flushing operations, drawings for each pipe sector, showing the physical location of each designated pipe test section, minimum flushing water velocity, and chemical treatment plan.

3.6 DEFERRED TESTING

A. Initial commissioning will be done as soon as contract work is completed, though building may not be at full occupancy and equipment may not be at full loading.

B. If adequate load may be artificially placed upon heating or cooling equipment, CxA, at his discretion, may perform functional testing during non-peak load periods. If testing cannot be carried out under these conditions to adequately verify system performance, testing will be deferred until such time as conditions are more satisfactory.

1. Contractor is to provide services of personnel and participate in deferred or seasonal testing process in the same manner as he would in non-seasonal testing.

2. If tests cannot be completed because of a deficiency outside the scope of the Plumbing system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

3.7 RE-TESTING

A. Reference Project Specification Section 01 91 00 GENERAL COMMISSIONING REQUIREMENTS for detailed requirements of re-testing of Plumbing systems.

3.8 SYSTEMS TO BE COMMISSIONED

A. Reference Project Specification Section 01 91 00 COMMISSIONING GENERAL REQUIREMENTS for list of Fire Protection systems to be commissioned.

END OF SECTION 210800

SECTION 211000 - WATER BASED FIRE SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall provide all components required for the complete installation of automatic sprinkler systems as hereinafter specified and indicated on the Drawings.

B. System Layout: The fire sprinkler areas, piping, head locations, etc. as indicated is only for Contractor's reference as to areas to be protected and possible piping routes. If header or manifold sizes are given in the drawings, then the sizes given shall be the minimum sizes installed. Actual number, spacing and location of heads, size and routes of piping shall be provided in accordance with the applicable Specifications and acceptable Shop Drawings. All layouts, head spacing, coverage, etc., as may be required by the referenced authorities and/or Architectural and Structural conditions shall be made without increase in cost to the Owner or the Architect/Engineer. Modifications to head spacing, pipe routes, etc. shall be closely coordinated with the work of all other trades. The Fire Sprinkler Subcontractor shall be responsible for the design and installation of the fire sprinkler system as described herein and on the project drawings. The piping of the system shall be sized used the "hydraulic" method, as included in NFPA Standard No. 13. Piping sized using the "schedule" method is unacceptable.

1.2 THE FOLLOWING SECTIONS ARE TO BE INCLUDED AS IF WRITTEN HEREIN:

A. Section 21 00 00 – General Requirements for Fire Suppression

B. Section 21 05 29 – Fire Protection Supports and Sleeves

C. Section 21 05 53 – Fire Protection Piping and Equipment Identification

1.3 SECTION INCLUDES

A. Pipe, fittings, valves, and connections for sprinkler system.

1.4 RELATED SECTIONS

A. Section 31 23 16.13 – Trenching

B. Section 09 91 00 - Painting

1.5 REFERENCES

A. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.

B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300.

C. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.

D. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.

E. ANSI/ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings.

F. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-welding and Threaded.

G. ANSI/ASME B16.25 - Buttwelding Ends.

H. ANSI/ASME B36.10 - Welded and Seamless Wrought Steel Pipe.

I. ANSI/ASME Boiler and Pressure Vessel Code (BPVC), Sec IX - Welding and Brazing Qualifications.

J. ANSI/ASTM A135 - Electric-Resistance-Welded Steel Pipe.

K. ANSI/ASTM A47 - Malleable Iron Castings.

L. ANSI/ASTM B32 - Solder Metal.

M. ANSI/AWS A5.8 - Brazing Filler Metal.

N. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings.

O. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast.

P. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.

Q. ASTM A120 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated (Galvanized) Welded and Seamless, for Ordinary Uses.

R. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

S. ASTM A795 - Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

T. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.

U. IFC - International Fire Code, 2015 edition with City of Stafford, Texas amendments.

V. NFPA 13 - Installation of Sprinkler Systems, 2013 edition.

W. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances

X. NFPA 51B - Standard for Fire Prevention During Welding, Cutting, and Other Hot Work.

Y. UL - Fire Protection Equipment Directory.

Z. City of Stafford, Texas, Fire Department Standards.

AA. State of Texas, State Fire Marshal Rules.

BB. All hose threads, coupling types, etc., utilized in the fire protection systems shall conform to the standards and requirements of the City of Stafford, Texas Fire Department.

1.6 SUBMITTALS

A. Submit under provisions of Section 21 00 00.

B. Shop Drawings:

1. Prior to detailed submission, submit preliminary layout showing head locations within coordinated ceiling grid and inspector's test station locations for review by Architect/Engineer.

2. Submit shop drawings and obtain approval from all authorities prior to material purchasing, fabrication of any piping or installation of any components of the fire protection systems. Include detailed plans showing all piping, elevations of piping above finished floors, pipe sizes, hangers, supports, sprinkler heads, valves, siamese connections, concrete thrust block details, inspector’s test locations, system drains, etc. Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

3. Hydraulic calculations: Submit flow test results and comprehensive hydraulic data sheets complying with NFPA 13. Verification of the adequacy of water pressure and other pertinent water supply data shall be the responsibility of the design engineer.

4. Sprinkler heads shall be shown on Drawings and specifically identified by the style or series designation as published in the appropriate agency listing or approval.

5. Design systems under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State of Texas. All design submittal documents and shop drawings, including drawings and hydraulic calculations, shall bear the Responsible Engineer’s signed and dated seal. Include all costs for obtaining approval from a Professional Engineer licensed in the State of Texas.

C. Product Data: Provide data on pipe materials, pipe fittings, sprinkler heads, valves, fire hose cabinets, flow switches, tamper switches, all other components and accessories. , Include manufacturer’s catalogue information, code and standards compliance, performance ratings rough-in details, weights, support requirements, and piping connections.

D. Samples: Submit one (1) of each style of sprinkler head specified.

E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds requirements specified, and suggested by listed codes.

F. Certification of Installation: Provide a letter of certification stating that the installed and tested fire protection systems comply with the requirements of NFPA. The certification letter is to be authored, sealed, dated and signed by a licensed Fire Protection Engineer experienced in design and installation of this work and licensed in the state of Texas. Include all costs for obtaining approval from the licensed Fire Protection Engineer.

G. Provide certificate of compliance from authority have jurisdiction indicating approval of field acceptance tests.

H. Project Record Documents

1. Submit under provisions of Section 21 00 00.

2. Record actual locations of sprinkler heads and deviations of piping from drawings. Indicate drain and test locations.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 21 00 00.

B. Maintenance Instructions: Include installation instructions, spare parts lists, procedures, and treatment programs.

1.8 QUALITY ASSURANCE

A. Sprinkler Systems: Perform work to NFPA 13.

B. Welding Materials and Procedures: Perform to ASME BPVC, Section IX.

C. Equipment and Components: Bear FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

D. Maintain one (1) copy of each document on site.

E. Qualifications of the Installer: The system shall be installed by a firm regularly engaged in the design and installation of automatic sprinkler systems in accordance with requirements of the National Fire Protection Association and Fire Protection and the Texas Department of Insurance Fire Sprinkler Rules, or by an authorized agent of such firm. Evidence to support the above requirements may be required and any proposed installer who cannot show suitable experience will be rejected.

F. Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State of Texas. All design submittal documents and shop drawings shall bear the Responsible Engineer’s signed and dated seal.

G. All parts of fire protection piping systems shall conform to all provisions of Underwriters' Laboratories requirements. All equipment shall bear the Underwriters' Laboratories label of approval.

H. Determine volume and pressure of incoming water supply from residual pressure water flow test.

1.9 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be new, undamaged, and free of rust.

B. Deliver, store, protect, and handle products to site under provisions of Section 21 00 00.

C. Deliver and store valves in shipping containers with labeling in place.

D. Inspect shipments for possible damage during transit. Do not use damaged materials in any part of the system.

E. Provide temporary protective coating on cast iron and steel valves. fittings and valves not packaged within containers. Maintain in place until installation.

F. Protect all materials that are to be installed within this Project from exposure to rain, freezing temperatures and direct sunlight. EXCEPTION: Materials manufactured for exterior locations.

G. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Section 21 00 00.

B. The Contractor shall provide spare heads equal to one percent (1%) of the total number of heads installed under the Contract, but not less than ten (10).

C. The heads shall be packed in a suitable wall mounted metal storage cabinet and shall be representative of, and in proportion to, the number of each type and temperature rating heads installed. The cabinet shall be located where directed by the Construction Inspector.

D. In addition to the spare heads, the Contractor shall provide not less than one (1) special sprinkler head wrench for each type of head.

1.11 WARRANTY

A. The complete system shall be warranted in writing against defects in materials or Workmanship under normal use and service for a period of one (1) year after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. All piping, materials and equipment used in the installation of sprinkler system shall be new and listed as approved by the Underwriters' Laboratories, Inc., List of Inspected Fire Protection Equipment and Materials and the Factory Mutual Testing Laboratories List of Approved Equipment, Fire Protection Devices and Devices Involving Fire Hazard and shall be the latest design of the manufacturer.

C. Pressure ratings of pipe, fittings, valves, gauges and all other water carrying appurtenances shall be suitable for the anticipated system pressures in which they are installed.

D. The installing Contractor shall identify piping, fire department connections, valves and hydraulic design information in accordance with applicable NFPA Standards.

2.2 UNIONS

A. Provide and install unions at proper points to permit removal of pipe and various equipment and machinery items without injury to other parts of the system. No unions will be required in welded lines. Unions 2 inch and smaller shall be Class 300 AAR threaded malleable iron unions with iron to brass seats, and 2-1/2 inch and larger shall be ground flange unions. Companion flanges on lines at various items for equipment machines and pieces of apparatus shall serve as unions to permit removal of the particular items.

2.3 FLANGES

A. All 150 lb. and 300 lb. ANSI flanges shall be weld neck and shall be domestically manufactured, forged carbon steel, conforming to ANSI B16.5 and ASTM A181 Grade I or II or A105-71 as made by Tube Turns or Hackney-Ladish Company. Slip on flanges shall not be used. Each fitting shall be stamped as specified by ANSI B16.9 and, in addition, shall have the laboratory control number stenciled on each fitting for ready reference as to physical properties and chemical composition of the material. Complete test reports may be required for any fitting selected at random.

B. Flanges which have been machined, remarked, painted or otherwise produced domestically from imported forges will not be acceptable. Flanges shall have the manufacturer's trademark permanently identified in accordance with MSS SP-25. Contractor shall submit data for firm certifying compliance with these Specifications.

C. Bolts used shall be carbon steel bolts with semi-finished hexagon nuts of American Standard Heavy dimensions. All thread rods will not be an acceptable for flange bolts.

D. Flat faced flanges shall be furnished to match 125 lb cast iron flanges on pumps, check valves, strainers, etc. with full flange gaskets. Bolting of raised face flanges to flat faced flanges is not allowed.

2.4 FLANGE GASKETS

A. Gaskets shall be placed between the flanges of all flanged joints.

B. Gaskets shall be ring form gaskets fitting within the bolt circle of their respective flanges. Gaskets shall be 1/16" thick asbestos free material recommended for service by Anchor Seals, Garlock, or John Crane. The inside diameter of such gaskets shall conform to the nominal pipe size and the outside diameter shall be such that the gasket extends outward to the studs or bolts employed in the flanged joint.

C. Spares: Contractor shall provide ten (10) spare gaskets for every flange size and rating.

2.5 WALL, FLOOR AND CEILING PLATES

A. See Section 21 00 00.

2.6 SLEEVES, INSERTS, AND FASTENINGS

A. General: All openings through all floors, walls, and roofs, etc., regardless of material for the passage of piping, etc., shall be sleeved. Refer to Specification Section 21 05 29.

2.7 UNDERGROUND FIRE PROTECTION PIPING

A. Acceptable Manufacturers: Pipe and joints shall be as manufactured in the United States by American Cast Iron Pipe Company, Tyler Pipe (a Division of McWane), U.S. Pipe Company, McWane Cast Iron Pipe Company, or Engineer accepted equivalent.

B. Pipe

1. ANSI A21.50 (AWWA C150) and ANSI A21.51 (AWWA C151) cement mortar lined ductile iron, supplied in 16 ft. laying lengths.

2. Thickness
   a. Piping 4" and Smaller: Class 51.
   b. Piping 6" and Larger: Class 50.

C. Fittings

1. Class 250 AWWA C110, cement mortar lined, ductile or gray iron, standard thickness.

2. Tappings in ductile iron pipe shall be made with dual compression seal tapping sleeve, similar and Architect/Engineer accepted equivalent to U.S. Pipe Model T-28.

3. Joints

4. Ductile Iron Pipe to Ductile Iron Pipe: Unless noted otherwise on the Drawings, all joints shall be restrained mechanical joints.

5. Ductile Iron Pipe to Steel Iron Pipe: ANSI/AWWA C110 flanged fittings adequate for 250 psi working pressure. Provide with dielectric flange insulating kit with insulating sleeves and washers for each bolt.

6. Pipe to Valve: ANSI/AWWA C110 flanged fittings adequate for 250 psi working pressure.

7. Bolts: High strength, Type 316 stainless steel tee head bolts with hexagon nuts.

8. Gaskets: ANSI A21.11 / AWWA C111 ethylene propylene diene monomer (EPDM) suitable for 220°F.

D. Coating: Pipe and fittings shall be cement mortar lined. Coat pipe and fittings outside with the manufacturer's standard asphaltic sealcoat in accordance with the latest revision of ANSI Standard A21.4 (AWWA C104) suitable for domestic water service.

E. Casing: Unless otherwise noted on the Drawings, all ductile iron pipe, fittings, etc., shall be encased in 8 mils thick polyethylene tubing in accordance with the latest revision of ANSI Standard A21.5 (AWWA C105).

F. Ductile iron piping, fittings, and joints shall be suitable for the minimum working pressure and sizes indicated on the Drawings, in Type 4 laying conditions with 2 to 15 feet of cover, and as required for freeze protection, unless otherwise indicated on the Drawings.

2.8 ABOVE GROUND FIRE PROTECTION PIPING

A. All pipe used for fire protection fire sprinkler systems shall be Schedule 40 black steel pipe conforming to ASTM A795 or ASTM A53. All piping 2-1/2" and larger shall be welded, unless otherwise indicated herein.

B. Use of mechanically coupled grooved piping, when approved by Stafford MSD, shall be “roll” grooved type; cut grooved pipe is not permitted.

C. Schedule 10 and “thin wall” fire sprinkler pipe is not permitted.

D. Fittings:

1. Piping 2" and Smaller: Class 150 malleable iron threaded fittings conforming to ASME B16.3.

2. Piping 2-1/2" and Larger: Welding type steel fittings conforming to ASTM A234 and ANSI B16.9. In lieu if welding type fittings, grooved type fittings may be used on sprinkler systems. Pipe size changes shall be performed through the use of reducing tees or reducers designed for that purpose. The use of bushings is explicitly prohibited.

3. Grooved end couplings 2-1/2" and larger shall be Victaulic Style 07 “Zero-Flex” Rigid Coupling, with EPDM gasket (minimum 700 psi working pressure) for use with roll grooved piping. Products by Victaulic and Anvil are acceptable, or Engineer-approved equal. Reducing type couplings, outlet couplings, “T” outlet fittings, cut-in style fittings, snap joint couplings, and flange adapter type fittings are not acceptable. Provide grooved fittings similar to standard weld fittings.

4. Extra heavy "Thread-o-lets" shall be used at each point of departure from the riser to the fire hose or valve cabinet. A "Thread-o-let" shall be installed below the level of the valve in the cabinet and a minimum of two (2) threaded ells shall be used to provide a swing joint connection from the riser to the valve in the cabinet.

2.9 VALVES

A. General:

1. All shutoff valves shall be UL listed and FM approved for fire protection service.

2. Similar types of valves shall be the product of one manufacturer; i.e., all butterfly valves shall be of the same manufacture, all ball valves shall be of the same manufacture, etc.

3. All valves used to control the flow of water to and within sprinkler systems shall be listed indicating type complete with electric supervisory switches. Coordinate wiring with the Electrical Contractor.

B. Shutoff valves for sizes 2 inch and smaller:

1. Two (2) piece bronze ball valve, bubble-tight shutoff, full port, blow-out proof stem, chrome plated brass ball and silicon bronze stem, threaded end connections, conforming to MSS SP-110.

2. One (1) piece, butterfly valve, full port, threaded ends, bronze housing and body, stainless steel disc. EPDM disc seal and slow closing.

3. All valves shall be furnished with two (2) factory mounted internal supervisory switches.

C. Shut off valves for sizes over 2 inch:

1. Butterfly valves lug type with EPDM molded in seat liner, ductile iron disc, stainless steel stem, manual gear operator, conforms to MSS SP-67 and MSS SP-25, with integral supervisory switch. Where a grooved piping system is allowed, grooved end type butterfly valves may be used, consisting of ductile iron body and disc EPDM seats, stainless steel stem. Valves shall be equipped with internal supervisory switch.

2. Gate valves – OS&Y (Outside Yoke and Stem) resilient wedge, epoxy coated interior and exterior, ASTM A536 ductile iron valve body, bonnet and resilient wedge, ASTM B150 stem and flanged ends.

D. Check valves for sizes 2 inch and smaller:

1. Horizontal swing, bronze body, conforming to MSS SP-80, threaded ends and rubber disc.

E. Check valves for sizes over 2 inch:

1. Iron body swing-check, bronze disc, seat ring and hinge pin, UL listed and FM approved, flanged ends, renewable seats and disc, tapped 3/4 inch for ball drip assembly.

F. Standard of Quality for Fire Protection Valves:

Size	Type	Class	Manufacturer
2" and Smaller	Ball	300	Nibco No. KT-505-W-8, Stockham No. T-255-FB-P-UL
2" and Smaller	Butterfly	175	Milwaukee No. BB-SC02
2-1/2" and Larger	Butterfly (lug)	250	Nibco No. LD3510-8
2-1/2" and Larger	Butterfly (grooved)	300	Nibco No. GD-4765-8N
2 " and Smaller	Check	200	Nibco No. KT-403-W
2-1/2" and Larger	Check	175	Nibco No. F-908-W
2-1/2" and Larger	Check (grooved)	250	Nibco No. G-917 W

2.10 WET PIPE FIRE SPRINKLER SYSTEM

A. System Description:

1. System to provide coverage for entire building.

2. Provide system to the NFPA 13 occupancy requirements listed below, unless otherwise noted. Refer to “FP” drawings for locations of design densities of specific rooms and areas.

Location	System Type/Hazard
Administrative and Meeting Rooms	Light Hazard
Mechanical Equipment Rooms	Ordinary Hazard, Group 1
Electrical Equipment Rooms	Ordinary Hazard, Group 1
General Storage Areas	Ordinary Hazard, Group 1

3. Interface system with building fire and smoke alarm system.

4. Systems subject to freezing shall utilize antifreeze liquid. DRY PIPE SYSTEMS ARE NOT ALLOWED.

2.11 SPRINKLER HEADS

A. Acceptable Manufacturers: Victaulic, Grinnell (Tyco), Viking, Star or Reliable.
   a. Suspended Ceilings and Gypsum Board or Plaster Ceilings:

   2. Type: Concealed pendant type, flexible concealed pendant, quick response.
      a. Finish: Factory finished (no field painting) cover plate, color to match ceiling finish. Exception: Provide chrome plated or alternate color cover plates where directed by Architect.
      b. Flexible sprinklers are permitted only in drop ceilings. Flexible sprinkler piping shall have UL-listed braided, angular corrugated flexible sprinkler hose. Hose shall have a minimum 2 in. bend radius and hose shall not have any bend connection restrictions without affecting hydraulics and safety of the material.
      c. Escutcheon Plate Finish: Standard white or chrome plated as selected by Architect.

   3. Operating Element: Fusible solder link or glass bulb type temperature rated for specific area hazard.

   4. Model: Sprinklers manufactured by Reliable, Victaulic or approved equal.
      a. Exposed Area Type (for areas such as mechanical rooms, electrical rooms, etc.):

   5. Type: Standard upright or pendent type with guard, quick response.

   6. Head Finish:
      a. Conditioned spaces: Bronze.
      b. Non-conditioned Spaces/Exterior: Corrosion resistant material (i.e. PTFE or Electroless Nickel PTFE).

   7. Operating Element: Fusible solder link or glass bulb type temperature rated for specific area hazard.

   8. Model: GFR with appropriate wire guard as manufactured by Reliable or approved equal.
      a. Extended coverage sprinkler heads are not to be used.
      b. Sprinkler heads in elevator hoistways and elevator equipment rooms to be 200 degree F rated.
      c. Use only quick response sprinkler heads.

B. Cold Rooms (≤ 42°F) and Areas Below Heated Ceiling/Soffit Spaces Susceptible to Freezing: Provide dry pendant type with chrome finish and two-piece escutcheon. (Areas include but not limited to; walk-in freezers, exterior overhangs, canopies.)

C. Elevator Equipment Rooms: Provide 212°F intermediate temperature classified heads.

D. Water Alarm:

   1. A water motor alarm shall be connected to each alarm valve and shall discharge to a brass alarm gong located on the exterior of the building as directed by the Architect. Alarm gong finish to be selected by the Architect.

2. The alarm valves shall be Underwriters' Laboratories approved, wet type, connected to water supply and indicated on the Shop Drawings. Each alarm valve shall be provided with a circuit closer. Valves shall conform to the equipment of NFPA 13, complete with retarding chamber and pressure switch.

E. Water Flow Alarm Switch:

1. Provide, where indicated on the Drawings, McDonnell UL approved line size flow switches.

2. Flow switch shall be provided with delay, adjustable up to 90 seconds (60 to 90 seconds in Austin). See Division 26 for electrical signal connection by others to these flow switches.

2.12 FIRE DEPARTMENT SIAMESE CONNECTIONS

A. At the points designated on the accompanying Drawings, install Siamese fittings required for fire protection purposes. From a point on the incoming water supply line, the Contractor shall extend water line for fire protection purposes to Siamese connections.

B. Provide 2-way wall type Siamese connection equal to Potter Roemer No. 5750 series double clapper flush type Siamese connections with 2-1/2” outlets having threads complying with the requirements of the Fire Department of the City of Stafford, Texas. They shall have proper caps with pin type lugs attached to the body of the Siamese connections with substantial chains. The plate fitting against the building shall have raised letters reading "AUTOMATIC SPRINKLER". All external surfaces shall be chromium plated polished surfaces or as directed by Architect.

C. Provide 2 way free standing type Siamese shall be equal to Potter-Romer No. 5760 series cast brass body with 2-1/2" outlets and escutcheon. They shall have proper caps with pin type lugs attached to the body of connection with substantial chains. "AUTOMATIC SPRINKLER" is to be cast on head of connection. All external surfaces shall be chromium plated polished surfaces or as directed by Architect.

D. Provide hose threads complying with the requirements of the local Fire Department.

E. Products manufactured by Potter Roemer, Elkhart Brass or Larsen’s will be acceptable.

PART 3 - EXECUTION

3.1 PREPARATION - ALL SYSTEMS

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Flush entire system of foreign matter prior to installation of sprinkler heads.

3.2 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. Install all materials and products in accordance with manufacturer's published recommendations. Use tools manufactured for the installation of the specific material or product.

C. Sprinkler Systems

1. Install piping in accordance with NFPA 13 for sprinkler systems and NFPA 24 for service mains. Note that the piping sizes indicated in the plans are the minimum acceptable. The Qualified Contractor shall provide proper sizes, materials and installation as required in the appropriate NFPA Standard.

2. Note that the use of piping bushings for any purpose is explicitly prohibited.

3. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient. See Sections 21 00 00 and 21 05 29 for additional requirements.

4. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

5. Locate concealed valves, switches and alarm connections in accessible location, and coordinate size and location of access panels/doors with General Contractor.

6. Install valves with stems upright, not inverted. All valves shall be located such that the removal of their bonnets is possible. Valves placed in horizontal lines shall be installed with their valve stems inclined at an angle of a minimum of 30 degrees above the horizontal position. Valves shall be installed as nearly as possible to the locations indicated in the Construction Drawings. Any change in valve location must be so indicated on the Record Drawings. Remove protective coatings after installation.

7. Provide drain valves at main shut-off valves, low points of piping and apparatus. Provide Fire Department test station, piped to drain.

8. Locate outside alarm gong on building wall as indicated on the Drawings.

9. Place pipe runs to conserve building space, and to minimize obstructions with other work. Group piping whenever practical at common elevations. Coordinate closely with work of other trades to avoid conflicts and provide all required offsets, piping, auxiliary drains, etc. to properly install system.

10. Place piping in concealed spaces above finished ceilings. Run piping as high as possible, but a minimum of 12 inches above ceilings or proposed ceilings. Locate piping to avoid obstructing other work, including required service access to equipment furnished by other Divisions.

11. Heads shall be located in a symmetrical pattern related to ceiling features such as grid, beams, light fixtures, diffusers, etc., and where applicable, heads shall be located symmetrically with the ceiling grid, centered in two (2) directions.

12. Provide concealed sprinkler heads in 'public' areas such as corridors, student restrooms, commons, activity areas, locker rooms, etc. Apply paper cover to ensure concealed sprinkler head and cover plates do not receive field paint finish.

13. Provide semi-recessed sprinkler heads at classrooms, office and other staff occupied spaces.

14. Provide exposed sprinkler heads at all areas open to structure.

15. Provide wire guards on heads in all mechanical rooms, gymnasiums, and other areas where heads are subject to damage.

16. Sprinkler drop piping below ceiling configuration should be return bend (NFPA 13, Section 8.15.19) or flexible sprinkler drops shall be oriented such that the branch line connection is facing up.

17. Arm-overs greater than 24 inches shall be supported.

18. Install and connect fire pumps in accordance with Section 21 30 00 and NFPA 13.

19. Locate Fire Department Connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of Fire Department wrench handle.

20. Inspector's test valves shall be installed for each sprinkler control valve assembly equipped with a flow switch and piped to an acceptable location as defined below. Design installation of inspector's test drain to accommodate the flow of discharge water under full flow conditions with pump running. The test drain is to be closed-pipe with a sight glass located to verify flow. Discharge piping to a remotely located sanitary drain, sump, or equivalent, in accordance with NFPA requirements and not requiring the addition of a hose to accommodate flow within the building. Locate test/drain valves and sight glasses inside stairwells, wherever practicable. Test drain shall not be piped to mop sinks.

21. All black steel piping shall be primed and painted red at factory/fabrication shop. Do not paint threads or fittings.

3.3 WELDED PIPING

A. Welding of pipe/fittings in normally occupied buildings is prohibited. Offsite welding is acceptable. Should welding be required in a normally occupied building for connecting to an existing welded system, obtain written approval from the Owner and comply with NFPA 51B.

B. All welding materials, procedures, qualifications and records shall comply with applicable NFPA requirements.

3.4 SYSTEM CLEANING AND FLUSHING

A. Cleaning, flushing and inspection shall be done in accordance with NFPA requirements.

B. The installing Contractor shall complete and sign the appropriate Contractor's Material and Test Certificates included within NFPA 13 and 14. Tests and signing of test certificates shall be witnessed by Owner's Construction Inspector or designee.

3.5 ZONING

A. All flow switches and tamper switches shall relay their activation to each annunciator panel and the main fire alarm panel.

B. Sprinkler system zoning shall coincide with building smoke compartmentalization unless noted otherwise on Contract Drawings. As a minimum, each floor level shall be a separate zone.

3.6 ACCEPTANCE TESTING

A. Pre-Acceptance Test: Prior to acceptance of the installation, subject the system to the test procedures as described by National Fire Protection Association Standards Nos. 13 and 24. Test pressures to be 200 psig minimum and are to be performed with all attached appurtenances. The duration of the test(s) to be a minimum of two (2) hours.

   a. Acceptance Testing: AHJ requires 48 hours advance notice for this test. Upon completion of the installation, subject the system to the test procedures as described by National Fire Protection Association Standards Nos. 13 and 24 and provide the Owner with a Contractor's material and test certificate for aboveground or underground piping as required therein. Test pressures to be 200 psig minimum and are to be performed with all attached appurtenances. The duration of the test(s) to be a minimum of two (2) hours. Completely flush new piping system after completion of test. Prior to acceptance testing provide a set of complete shop drawings to verify installation.

3.7 SIGNAGE AND IDENTIFICATION POINTS

   a. Install durable signage to indicate location of all shut-off and test valves. Locate signage in a commonly occupied/traveled location (e.g. hallway). Securely attach signage utilizing chains or other suitable methods. Provide signage with white letters and red background.
   b. Install identification point signage for all hidden water flow switches. Identification tags to be white letters on a red background. Locate in areas visible from hallways.

3.8 TRAINING

A. Contractor shall provide for the service of a competent, trained and experienced agent to instruct and acquaint the Owner with the proper functioning, operation and maintenance of the fire protection systems and all installed components.

END OF SECTION 211000

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Coordinate with Commissioning Requirements indicated in Section 019100. This contractor is responsible to comply with all requirements for the above section.

1.2 PLUMBING SYSTEM CRITERIA

A. Domestic hot water temperature shall be limited to 110^{o} F. except for water supplied to kitchen. Kitchens shall have a water supply temperature of 140^{o} F.

B. Gas piping on roofs shall be supported by manufactured free standing pipe supports.

C. Water and gas lines under drives and walkways shall be sleeved with schedule to PVC, at least two pipe sizes larger than the supply line.

D. The design of the roof drainage systems shall incorporate roof drains and overflows. The overflow system shall be piped independently and connected vertically to the roof drain down spout. The overflows shall be located in locations readily visible. (*Discharge overflow above grade if required by local Authority having jurisdiction).

E. Lavatories serving students shall have single, self closing faucets. Learning Center sinks shall have single faucets with goose necks. All sinks to include cold, tempered and hot water not to exceed 105

F. In each science learning center/wet lab, provide a red emergency shut off button to shutdown water, gas and electricity in event of an emergency. Locate this button in the teacher's workstation and away from exit door.

1.3 SUMMARY

A. Design a complete plumbing system including all sanitary, waste and vent piping, storm piping, gas piping and all equipment necessary for a complete system and in accordance with all local jurisdictions and codes.

B. All materials and distribution, and utilization equipment shall be UL Listed.

C. All equipment and materials shall be new, unused and of United States Domestic manufacture.

D. Provide hot and cold and tempered water isolation valves at every supply pipe to each restroom or restroom bank.

E. Isolation valves shall be accessible in all restrooms. The contractor shall provide a minimum of 2 feet accessible pipe chase for maintenance.

F. All cleanouts shall be accessible. Any room that has a plumbing fixture shall have an accessible isolation valve.

G. A record shall be kept of all permits and inspections and submitted to the Master Plumber. In addition, a list of all equipment and devices will be provided.

H. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Concrete bases.
11. Supports and anchorages.

I. Related Sections:

1. Section 013300 Submittals.
2. Section 01524 Construction Waste Management
3. Section 01352 LEED Requirements
4. Section 01611 Environmental Management
5. Section 01570 Pollution Prevention and Control

1.4 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.

2. CPVC: Chlorinated polyvinyl chloride plastic.

3. PE: Polyethylene plastic.

4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.

2. NBR: Acrylonitrile-butadiene rubber.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.

2. Dielectric fittings.

3. Mechanical sleeve seals.

4. Escutcheons.

B. Welding certificates.

C. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
   b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.6 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.8 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.5 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.6 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.

2. CPVC Piping: ASTM F 493.

3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

4. PVC to ABS Piping Transition: ASTM D 3138.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.7 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:
   a. Cascade Waterworks Mfg. Co.
   b. Dresser Industries, Inc.; DMD Div.
   c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
   d. JCM Industries.
   e. Smith-Blair, Inc.
   f. Viking Johnson.

2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.

3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.

4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:
   a. Eslon Thermoplastics.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:
   a. Thompson Plastics, Inc.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC PVC CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:
   a. NIBCO INC.
   b. NIBCO, Inc.; Chemtrol Div.

E. Flexible Transition Couplings for Underground Non-pressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:
   a. Cascade Waterworks Mfg. Co.
   b. Fernco, Inc.
   c. Mission Rubber Company.
   d. Plastic Oddities, Inc.

2.8 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F

D. Coordinate subparagraph and associated subparagraphs below with Part 2 "Manufacturers" Article. Retain "Available" for nonproprietary and delete for semiproprietary specifications.

1. Manufacturers:
   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Eclipse, Inc.
   d. Epco Sales, Inc.

e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.

E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:
a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.

F. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:
a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F

1. Manufacturers:
a. Calpico, Inc.
b. Lochinvar Corp.

H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:
a. Perfection Corp.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc.
d. Victaulic Co. of America.

2.9 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Carbon steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.10 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Under-deck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.11 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With set screw set screw or spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.12 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:
   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type with spring clips.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
   f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   h. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
   i. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips.
   j. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
   b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
   c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
      1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire stop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.

3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

5. PVC Nonpressure Piping: Join according to ASTM D 2855.

6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.

2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5. Install anchor bolts to elevations required for proper attachment to supported equipment.

6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 GROUTING

A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 220500

220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 Section "Sprinklers Systems" for fire-suppression piping.
3. Section 013300 Submittals.
4. Section 01524 Construction Waste Management
5. Section 01352 LEED Requirements
6. Section 01611 Environmental Management
7. Section 01570 Pollution Prevention and Control

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for “The Valve and Fittings Industry Inc”.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.

2. Thermal-hanger shield inserts.

3. Powder-actuated fastener systems.

4. Pipe positioning systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.

2. Metal framing systems. Include Product Data for components.

3. Pipe stands. Include Product Data for components.

4. Equipment supports.

C. Welding certificates.

D. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:

a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
   b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

2. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.5 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. Carpenter & Paterson, Inc.
3. Globe Pipe Hanger Products, Inc.
4. Grinnell Corp.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.6 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.7 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Available Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.8 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig-minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. Engineered Products, Inc.
2. Insulation Carpenter & Paterson, Inc.
3. ERICO/Michigan Hanger Co.
4. PHS Industries, Inc.
5. Pipe Shields, Inc.
6. Rilco Manufacturing Company, Inc.

C. Value -Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.9 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:
   a. Hilti, Inc.
   b. ITW Ramset/Red Head.
   c. Masterset Fastening Systems, Inc.
   d. MKT Fastening, LLC.
   e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated stainless steel, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:
   a. B-Line Systems, Inc.; a division of Cooper Industries.
   b. Empire Industries, Inc.
   c. Hilti, Inc.
   d. ITW Ramset/Red Head.
   e. MKT Fastening, LLC.
   f. Powers Fasteners.

2.10 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. All piping on roof shall be supported by roof mounted pipe hangers. No wood is allowed.

C. All Pipe support system on roof shall be sized / designed by manufacturer and installed by this contractor. The pipe support system shall be suitable for the insulated chilled water and hot water piping system as indicated on drawings. Pipe support system must be provided with the fallowing requirements:

1. Bottom of the pipe must be 18” above roof finished level.

2. Pipe support spacing shall be based on the maximum roof load of 2.5 # / sq-inch. Contractor must size the pedestal base area for each support in coordination with the required support spacing such that the total load on roof does not exceed 2.5 # / sq-inch.

3. Submit the proposed scheme to the engineer for approval before material procurement or installation of any work.

4. Contractor is responsible to price all the support system at the project bid stage.

5. Contractor is responsible to coordinate all the support system with the roofing drawings of this package.

6. Provide expansion loops and floating support system in accordance with requirements.

7. The support channels and plate frames indicated on the drawings are the required minimum standards. Support system vendor must verify the loads on each section and upgrade as necessary.

D. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Manufacturers:
   a. ERICO/Michigan Hanger Co.
   b. MIRO Industries.
   c. PHP Systems

E. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

1. Manufacturers:
   a. MIRO Industries (or equal).
   b. PHP Systems

F. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1. Manufacturers:
   a. ERICO/Michigan Hanger Co.
   b. MIRO Industries.
   c. Portable Pipe Hangers.

2. Base: Plastic.

3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

G. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1. Manufacturers:
   a. Portable Pipe Hangers.
   b. MIRO Industries.
   c. Portable Pipe Hangers

2. Bases: One or more plastic.

3. Vertical Members: Two or more protective-coated-steel channels.

4. Horizontal Member: Protective-coated-steel channel.

5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

H. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.11 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

1. C & S Mfg. Corp.

2. HOLDRITE Corp.; Hubbard Enterprises.

3. Samco Stamping, Inc.

2.12 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.13 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.

3. Carbon or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.

4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated stationary pipes, NPS 3/4 to NPS 8.

7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 8.

8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.

9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated stationary pipes, NPS 1/2 to NPS 2.

10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 8.

11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated stationary pipes, NPS 3/8 to NPS 3.

12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.

17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.

19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5. Steel Weld less Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6. C-Clamps (MSS Type 23): For structural shapes.

7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.

4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.

6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.

8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
   a. Horizontal (MSS Type 54): Mounted horizontally.
   b. Vertical (MSS Type 55): Mounted vertically.
   c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

2. Field fabricated from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Fiberglass Pipe Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Each metal framing system in paragraph below requires calculation and detail.

E. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

F. Each fiberglass strut system in first paragraph below requires calculation and detail.

G. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.

H. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

I. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

J. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

K. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.

L. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

M. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

N. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

O. Install lateral bracing with pipe hangers and supports to prevent swaying.

P. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

Q. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

R. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

S. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.
    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inch long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.

6. Insert Material: Length at least as long as protective shield.

7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

B. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

C. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529

220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 RELATED SECTIONS:

A. Section 013300 Submittals.

B. Section 01524 Construction Waste Management

C. Section 01352 LEED Requirements

D. Section 01611 Environmental Management

E. Section 01570 Pollution Prevention and Control

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

F. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
   b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.5 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel rivets or self-tapping screws.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: White.

3. Background Color: Black.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.5 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.6 PIPE LABELS

A. Do not use pipe labels or plastic tapes for bare pipes conveying fluids at temperatures of 125 deg F (52 deg C) or higher.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

C. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

2.7 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.

2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.

3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.8 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: Brass, 0.032-inch Stainless steel, 0.025-inch Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link or beaded chain; or S-hook wire-link chain beaded chain S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.9 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.

2. Fasteners: Reinforced grommet and wire or string.

3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulates.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09.

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels color-coded bands or rectangles complying with ASME A13.1 on each piping system.

1. Identification Paint: Use for contrasting background.

2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Pipe Label Color Schedule:

1. Domestic Water Piping:
   a. Background Color: Blue.
   b. Letter Color: Black.

2. Sanitary Waste and Storm Drainage Piping:
   a. Background Color: Blue.
   b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Other valve-tag sizes, shapes, colors, and letter colors may be available if required.

2. Valve-Tag Size and Shape:
   a. Cold Water: 1-1/2 inches, round.
   b. Hot Water: 1-1/2 inches, round.
   c. Low-Pressure Compressed Air: 1-1/2 inches, round.

3. Select contrasting valve-tag color and letter color in two subparagraphs below for each service. Retain "Natural" option for brass or stainless-steel valve tags.

4. Valve-Tag Color:
   a. Cold Water: Natural.
   b. Hot Water: Natural.

5. Letter Color:
   a. Cold Water: Black.
   b. Hot Water: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

220700 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:
   a. Cellular glass.
   b. Flexible elastomeric.
   c. Mineral fiber.
   d. Phenolic.
2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied jackets.
9. Tapes.
10. Securements.
11. Corner angles.

B. Related Sections include the following:

1. Section 013300 Submittals.
2. Section 01524 Construction Waste Management
3. Section 01352 LEED Requirements

4. Section 01611 Environmental Management

5. Section 01570 Pollution Prevention and Control

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. LEED Submittal:

1. Product Data for Credit EQ 4.1: For adhesives and sealants, including printed statement of VOC content.

C. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

2. Detail attachment and covering of heat tracing inside insulation.

3. Detail insulation application at pipe expansion joints for each type of insulation.

4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.

5. Detail removable insulation at piping specialties, equipment connections, and access panels.

6. Detail application of field-applied jackets.

7. Detail application at linkages of control devices.

8. Detail field application for each equipment type.

D. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Sample Sizes:
   a. Preformed Pipe Insulation Materials: 12 inches long by NPS 2.
   b. Sheet Form Insulation Materials: 12 inches square.
   c. Jacket Materials for Pipe: 12 inches long by NPS 2.
   d. Sheet Jacket Materials: 12 inches square.
   e. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

E. Qualification Data: For qualified Installer.

F. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

G. Field quality-control reports.

H. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
   b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Piping Mockups:
   a. One 10-foot section of NPS 2 straight pipe.
   b. One each of a 90-degree threaded, welded, and flanged elbow.
   c. One each of a threaded, welded, and flanged tee fitting.
   d. One NPS 2 or smaller valve, and one NPS 2-1/2 or larger valve.
   e. Four support hangers including hanger shield and insert.
   f. One threaded strainer and one flanged strainer with removable portion of insulation.
   g. One threaded reducer and one welded reducer.
   h. One pressure temperature tap.
   i. One mechanical coupling.

2. Equipment Mockups: One tank or vessel.

3. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.

4. Notify Architect seven days in advance of dates and times when mockups will be constructed.

5. Obtain Architect's approval of mockups before starting insulation application.

6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

8. Demolish and remove mockups when directed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 INSULATION MATERIALS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Armstrong World Industries, Inc.

2. Certainteed Corp.

3. Knauf Fiber Glass GmbH.

4. Owens-Corning Fiberglas Corp.

5. Pittsburgh Corning Corp.

6. FGH Fabricators, Inc.

B. Adhesives shall be as manufactured by Minnesota Mining, Arabol, Benjamin-Foster, Armstrong, or Insulmastic, Inc., and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

2.5 PIPING INSULATION MATERIALS

A. Fiberglass Piping Insulation: ASTM C 547, Class 1 unless otherwise indicated. (Indoor locations).

B. Foam Glass Insulation: ASTM C552-07, class 1 for all outdoor installation / applications.

C. Jackets for Piping Insulation: ASTM C 921, Type I (vapor barrier) for piping with temperatures below ambient, Type II (water vapor permeable) for piping with temperatures above ambient. Type I may be used for all piping at Installers option.

1. Encase pipe fittings insulation with one-piece pre-molded 16 MIL aluminum fitting covers, fastened as per manufacturer's recommendations.

2. Encase exterior piping insulation with 16 MIL aluminum jacket with "Z" closures for weather-proof construction.

D. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.

E. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated. White all service jacket "ASJ" vapor barrier with dual self-seal strips for all insulation except flexible unicellular.

2.6 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Insulco, Division of MFS, Inc.; Triple I.
   b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. P. K. Insulation Mfg. Co., Inc.; Thermal-V-Kote.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Insulco, Division of MFS, Inc.; SmoothKote.
   b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
   c. Rock Wool Manufacturing Company; Delta One Shot.

2.7 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-96.
b. Foster Products Corporation, H. B. Fuller Company; 81-33.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:
a. Aeroflex USA Inc.; Aeroseal.
b. Armacell LCC; 520 Adhesive.
c. Foster Products Corporation, H. B. Fuller Company; 85-75.
d. RBX Corporation; Rubatex Contact Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Polystyrene Adhesive: Solvent- or water-based, synthetic resin adhesive with a service temperature range of minus 20 to plus 140 deg F.

1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-96.
b. Foster Products Corporation, H. B. Fuller Company; 97-13.

F. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:
a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. ITW TACC, Division of Illinois Tool Works; S-90/80.
d. Marathon Industries, Inc.; 225.
e. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Dow Chemical Company (The); 739, Dow Silicone.
   b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
   c. P.I.C. Plastics, Inc.; Welding Adhesive.
   d. Speedline Corporation; Speedline Vinyl Adhesive.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.8 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Childers Products, Division of ITW; CP-35.
   b. Foster Products Corporation, H. B. Fuller Company; 30-90.
   c. ITW TACC, Division of Illinois Tool Works; CB-50.
   d. Marathon Industries, Inc.; 590.
   e. Mon-Eco Industries, Inc.; 55-40.
   f. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.

5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Childers Products, Division of ITW; CP-30.
   b. Foster Products Corporation, H. B. Fuller Company; 30-35.
   c. ITW TACC, Division of Illinois Tool Works; CB-25.
   d. Marathon Industries, Inc.; 501.
   e. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.

3. Service Temperature Range: 0 to 180 deg F.

4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.

5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide the following:
   a. Childers Products, Division of ITW; Encacel.
   b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
   c. Marathon Industries, Inc.; 570.
   d. Mon-Eco Industries, Inc.; 55-70.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.

3. Service Temperature Range: Minus 50 to plus 220 deg F.

4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.

5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide the following:
   a. Childers Products, Division of ITW; CP-10.
   b. Foster Products Corporation, H. B. Fuller Company; 35-00.
   c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
   d. Marathon Industries, Inc.; 550.
   e. Mon-Eco Industries, Inc.; 55-50.
   f. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.

3. Service Temperature Range: Minus 20 to plus 200 deg F.

4. Solids Content: 63 percent by volume and 73 percent by weight.

5. Color: White.

2.9 PLUMBING PIPING SYSTEM INSULATION

A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, buried piping, fire protection piping, and pre- insulated equipment.

2.10 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Domestic hot-water pump insulation shall be one of the following:
   a. Cellular Glass: 2 inches thick.
   b. Phenolic: 1 inch thick.

D. Domestic cold water, and domestic hot-water hydro-pneumatic tank insulation shall be one of the following:
   a. Cellular Glass: 1-1/2 inches thick.
   b. Flexible Elastomeric: 1 inch thick.
   c. Mineral-Fiber Pipe and Tank: 1 inch thick.

E. Domestic hot-water storage tank insulation shall be one of the following, of thickness to provide an R-value of 12.5:

   1. Cellular glass.

   2. Mineral-fiber pipe and tank.

   3. Phenolic.

2.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

   1. Drainage piping located in crawl spaces.

   2. Underground piping.

   3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

2.12 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

   1. NPS 1 and Smaller: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.

   2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.

B. Domestic Hot water and Re-circulated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
   a. Cellular Glass: 1-1/2 inches thick.
   b. Flexible Elastomeric: 1 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
   a. Cellular Glass: 1-1/2 inches thick.
   b. Flexible Elastomeric: 1 inch thick.

C. Storm water and Overflow:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Cellular Glass: 1-1/2 inches thick.
   b. Flexible Elastomeric: 1 inch thick.

D. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Cellular Glass: 1-1/2 inches thick.
   b. Flexible Elastomeric: 1 inch thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Flexible Elastomeric: 3/4 inch thick.
   b. Polyolefin: 3/4 inch thick.

F. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Cellular Glass: 1-1/2 inches thick.
   b. Flexible Elastomeric: 1 inch thick.

G. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Cellular Glass: 1-1/2 inches thick.
   b. Flexible Elastomeric: 1 inch thick.

2.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

D. Piping, Exposed:

1. PVC, Color-Coded by System: 20 mils 30 mils thick.

2. Aluminum, Smooth 0.024 inch thick.

2.14 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Aluminum, Smooth with Z-Shaped Locking Seam: 0.024 inch thick.

D. Piping, Exposed:

1. Aluminum, Smooth with Z-Shaped Locking Seam: 0.024 inch thick.

2.15 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 220700

221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Encasement for piping.
3. Specialty valves.
4. Flexible connectors.
5. Water meters.
6. Escutcheons.
7. Sleeves and sleeve seals.
8. Wall penetration systems.

B. Related Sections:

1. Section 013300 Submittals.
2. Section 01524 Construction Waste Management
3. Section 01352 LEED Requirements
4. Section 01611 Environmental Management
5. Section 01570 Pollution Prevention and Control

1.3 SUBMITTALS

A. Product Data: For the following products:

1. Specialty valves.
2. Transition fittings.
3. Dielectric fittings.
4. Flexible connectors.
5. Backflow preventers and vacuum breakers.
6. Escutcheons.
7. Sleeves and sleeve seals.
8. Water penetration systems.

B. Water Samples: Specified in "Cleaning" Article.

C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Fire-suppression-water piping.
2. Domestic water piping.
3. Natural Gas piping.

D. Field quality-control reports.

E. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.
3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal’s Standard GS-11.

b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11

c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.

a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61 for potable domestic water piping and components.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 WATER SUPPLY SYSTEM:

A. A complete system of hot and cold water supply to all plumbing fixtures and mechanical equipment shall be supplied and installed as shown on the Drawings. The water supply system shall be installed using the materials and methods as specified in the following paragraphs.

B. UNDERGROUND WATER PIPING SYSTEMS:

1. Pipe: All pipe used for underground water piping mains shall be Class 52 centrifugally cast, close grained cast iron pipe or Class 50 DUCTILE iron pipe arranged with bell and spigot mechanical joints.

2. Valve Boxes:
   a. For each underground valve installed by the Contractor, the Contractor shall provide and install a two-piece, screw adjustable type valve box. These valve boxes shall be designed for heavy roadway service and they shall have a deep socket type of cover which prevents their being accidentally knocked out of position.

C. The word "WATER" shall appear on each cover. The installation of these members shall be such that by the use of the adjustable screw type bodies the tops are just flush with the finished grade. These valve boxes shall be Tyler Pipe Industries #6850, or approved equal.

1. Lead: It is forbidden that lead in any form be used in any water system other than waste. If lead is used in the fabrication or installation of any water system other than waste, then ALL of the installed equipment and material, which may have come in contact with the

lead, shall be marked with bright red or orange spray paint, and shall be removed from the project site. The system(s) shall then be restored and reinstalled using ALL NEW MATERIALS.

D. IRRIGATION PROVISIONS:

1. Furnish and install capped and/or valved water lines under paving, through retaining walls in paved plaza areas and as indicated on Drawings for connections and extensions under work of Section Irrigation (Sprinkler) System.

E. BUILDING ENTRANCE:

1. A metallic sleeve shall be inserted in the forms of the building wall through which the water service enters the building. The interior diameter of such sleeve shall be four inches (4") greater than the exterior diameter of the water service.

2. The water service pipe from within the building shall be extended to a point five feet outside the building wall through this sleeve. The position of the water service in this sleeve shall be concentric and the intervening space shall be packed in a flexible manner to avert the flow of water from outside of the building into the basement.

3. The interior pipe extended outside the building shall be provided with a protective wrapping of "Tape Coat" SP warmed with hand torch. This protective tape shall be applied with "half lap" coverage in strict accordance with the manufacturer's published instructions. The cast iron pipe connected to the pipe extending from the building wall shall contain two caulked joints within four feet of the union of the cast iron pipe and the interior pipe from the building.

2.5 REQUIREMENTS OF INTERIOR WATER PIPING SYSTEMS:

A. All piping shall have reducing fittings used for reducing or increasing where any change in the pipe sizes occurs. No bushing of any nature shall be allowed in piping.

B. All exposed chrome plated, polished or enameled connections from fixtures shall be put up with special care, showing no tool marks or threads at fittings, and supported by neat racks or hangers with round head screws of same material and finish.

C. Wade Shok-stop, or approved equal, sealed air chambers shall be provided in all water branches to fixtures, sized in accordance with manufacturer's recommendations, concealed, accessible, and located so as to protect each group of plumbing fixtures.

D. The fabrication of copper pipe and fittings shall in every detail conform to the recommendations and instructions of the fitting manufacturer. The tools used shall be the tools adapted to that specific purpose.

2.6 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper shall be used for all domestic cold, hot water and hot water return piping up to and including 4" for above grade applications.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.

2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

B. Interior domestic water piping of 6” and larger shall be schedule 40 galvanized steel to ASTM A53.

2.7 DUCTILE-IRON PIPE AND FITTINGS (FOR UNDERGROUND USE)

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Standard-Pattern, Mechanical-Joint Fittings: AWWA C110, ductile or gray iron.

2. Compact-Pattern, Mechanical-Joint Fittings: AWWA C153, ductile iron.
   a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Standard-Pattern, Push-on-Joint Fittings: AWWA C110, ductile or gray iron.
   a. Gaskets: AWWA C111, rubber.

2. Compact-Pattern, Push-on-Joint Fittings: AWWA C153, ductile iron.
   a. Gaskets: AWWA C111, rubber.

C. Plain-End, Ductile-Iron Pipe: AWWA C151.

1. Grooved-Joint, Ductile-Iron-Pipe Appurtenances:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Anvil International.
      2) Shurjoint Piping Products.
      3) Star Pipe Products.
      4) Victaulic Company.
   b. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.

c. Grooved-End, Ductile-Iron-Pipe Couplings: AWWA C606 for ductile-iron-pipe dimensions. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

2.8 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.9 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.10 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.

2. Pressure rating at least equal to pipes to be joined.

3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Cascade Waterworks Manufacturing.
   b. Dresser, Inc.; Dresser Piping Specialties.
   c. Ford Meter Box Company, Inc. (The).
   d. JCM Industries.

e. Romac Industries, Inc.
f. Smith-Blair, Inc; a Sensus company.
g. Viking Johnson; c/o Mueller Co.

D. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Charlotte Pipe and Foundry Company.
   b. Harvel Plastics, Inc.
   c. Spears Manufacturing Company.

2. Description: CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert and one solvent-cement-socket or threaded end.

2.11 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. EPCO Sales, Inc.
   d. Hart Industries International, Inc.
   e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   f. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Description:
   a. Pressure Rating: 150 psig at 180 deg F.
   b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Capitol Manufacturing Company.
   b. Central Plastics Company.
   c. EPCO Sales, Inc.
   d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:
   a. Factory-fabricated, bolted, companion-flange assembly.

b. Pressure Rating: 150 psig.
c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.

2. Description:
   a. Non-conducting materials for field assembly of companion flanges.
   b. Pressure Rating: 150 psig.
   c. Gasket: Neoprene or phenolic.
   d. Bolt Sleeves: Phenolic or polyethylene.
   e. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Calpico, Inc.
   b. Lochinvar Corporation.

2. Description:
   a. Galvanized-steel coupling.
   b. Pressure Rating: 300 psig at 225 deg F.
   c. End Connections: Female threaded.
   d. Lining: Inert and noncorrosive, thermoplastic.

2.12 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber-Booth.

2. Triplex.

3. Mercer Rubber Co.

4. Metraflex, Inc.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.

2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.

3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.

2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.

3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.13 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. Split Casting, Cast Brass: Polished, chrome-plated or rough-brass finish with concealed hinge and setscrew.

C. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.14 SLEEVES

A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.

B. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.15 SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.

2. Calpico, Inc.

3. Metraflex, Inc.

4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Stainless steel.

3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.16 WALL PENETRATION SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. SIGMA.

B. Description: Wall-sleeve assembly, consisting of housing and gland, gaskets, and pipe sleeve.

1. Carrier-Pipe Deflection: Up to 5 percent without leakage.

2. Housing: Ductile-iron casting with hub, water stop, anchor ring, and locking devices. Include gland, bolts, and nuts.

3. Housing-to-Sleeve Gasket: EPDM rubber.

4. Housing-to-Carrier-Pipe Gasket: AWWA C111, EPDM rubber.

5. Pipe Sleeve: ASTM A 53/A 53M, Schedule 40, zinc-coated steel pipe.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Provide shut-off valve for each battery of fixtures located above ceiling near each bathroom.

C. All buried piping shall be buried a minimum of 30” below finished grade including domestic water.

D. Install underground ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105.

E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

F. Install shutoff valve immediately upstream of each dielectric fitting.

G. Valves 2-½" and smaller shall be cast brass with stainless steel ball and stem; 3" and larger shall be gate valves.

H. Butterfly valves are not acceptable for any plumbing applications.

I. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

J. Install domestic water piping level and plumb.

K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping adjacent to equipment and specialties to allow service and maintenance.

N. Install piping to permit valve servicing.

O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

P. Install piping free of sags and bends.

Q. Install fittings for changes in direction and branch connections.

R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

S. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

T. Install thermostats in hot-water circulation piping. Comply with requirements of the latest International Energy Code.

U. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

3.2 TESTING AND STERILIZATION

A. All water piping systems shall be properly tested to assure their being absolutely tight. In the case of pipes which are to be insulated, these tests shall be completed and the piping system proven to be absolutely tight before any insulation is applied. Wherever pipes are placed so that they will ultimately be concealed, these tests shall be conducted and the absolute tightness of each piping system shall be demonstrated before the system is concealed.

B. The procedure of these tests shall consist of subjecting a piping system to a hydrostatic pressure per Section 23 00 00. During the test period, all pipe, fittings and accessories in the particular piping system which is being tested shall be carefully inspected. If leaks are detected, such leaks shall be stopped by means designated by the Owner's duly authorized representative and the hydrostatic test shall again be applied. This procedure shall be repeated until, for an entire twenty-four hour period, no leaks can be found while the system being tested is subjected to the pressure mentioned above.

C. Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five (5) days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period. Even though the completion of these tests is satisfactory, there is a continuing responsibility for the ultimate, proper, and satisfactory operation of such piping systems and their accessories.

D. After completion of the testing, the entire cold and hot water piping systems, with attached equipment, shall be thoroughly sterilized with a solution containing not less than 50 parts per million of available chlorine. The chlorinating materials shall be either liquid chlorine conforming to U. S. Army Specification No. 4-1 or calcium hypochlorite or chlorinated lime conforming to the requirements of Federal Specification O-C-114. The sterilizing solution shall be allowed to remain in the system for a period of eight (8) hours during which time all valves and faucets shall be opened and closed several times. After sterilization, the solution shall be flushed from the system with clean water until the residual chlorine content is not greater than 0.2 parts per million.

E. The sterilization process shall be conducted as required by the specifications above, and upon completion of the process, the Health Department shall test and certify the cleanliness of the water piping system. The Plumbing Subcontractor shall pay all costs and charges incidental to this test and certification.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

G. Copper-Tubing Grooved Joints: Roll groove end of tube. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for roll-grooved joints.

H. Ductile-Iron-Piping Grooved Joints: Cut groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join ductile-iron pipe and grooved-end fittings according to AWWA C606 for ductile-iron-pipe, cut-grooved joints.

I. Steel-Piping Grooved Joints: Cut or roll groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

J. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

A. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller. Use butterfly for piping NPS 2-1/2 and larger.

B. Butterfly valves are not acceptable for any plumbing applications.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.

2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.5 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.

2. Individual, Straight, Horizontal Piping Runs:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer than 100 Feet If Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements for plumbing fixture for connection sizes.
3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Re-inspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for re-inspection.

4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.

2. Open shutoff valves to fully open position.

3. Open throttling valves to proper setting.

4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
   a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
   b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.

6. Remove and clean strainer screens. Close drain valves and replace drain plugs.

7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.

8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Fill and isolate system according to either of the following:
      1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow it to stand for 24 hours.
      2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow it to stand for three hours.
   c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
   d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.

2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use gate, ball valves with flanged ends for piping NPS 2-1/2 and larger.

2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use globe or ball valves with flanged ends for piping NPS 2-1/2 and larger.

3. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.

4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Coordinate with Commissioning Requirements indicated in Section 019100. This contractor is responsible to comply with all requirements for the above section.

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated water mixing valves.
6. Strainers.
7. Hose bibbs.
8. Wall hydrants.
9. Drain valves.
10. Water hammer arresters.
11. Air vents.
12. Trap-seal primer valves.
13. Trap-seal primer systems.

B. Related Sections:

1. Section 013300 Submittals.
2. Section 01524 Construction Waste Management

3. Section 01352 LEED Requirements

4. Section 01611 Environmental Management

5. Section 01570 Pollution Prevention and Control

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

E. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal’s Standard GS-11.
   b. Submit manufacturer’s certification that products comply with Green Seal’s Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.

a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 MAINTENANCE

A. Provide twelve (12) months maintenance of all materials and equipment under this section. Cost of the twelve (12) month normal and preventive maintenance shall be included within this scope of work.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
    a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Ames Co.
    b. FEBCO; SPX Valves & Controls.
    c. J. R. Smith Corporation.
    d. Watts Industries, Inc.; Water Products Div.
    e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1001.

3. Size: NPS 1/4 to NPS 3, as required to match connected piping.

4. Body: Bronze.

5. Inlet and Outlet Connections: Threaded.

6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Legend Valve.
    b. MIFAB, Inc.
    c. Prier Products, Inc.
    d. Watts Industries, Inc.; Water Products Div.
    e. Woodford Manufacturing Company.
    f. Zurn Plumbing Products Group; Light Commercial Operation.

2. Standard: ASSE 1011.

3. Body: Bronze, non-removable, with manual drain.

4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.

5. Finish: Chrome or nickel plated.

2.5 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. FEBCO; SPX Valves & Controls.
   b. Watts Industries, Inc.; Water Products Div.
   c. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1013.

3. Operation: Continuous-pressure applications.

4. Pressure Loss: 5 psi maximum, through middle 1/3 of flow range.

5. Size: As indicated on drawings.

6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.

7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

8. Configuration: Designed for horizontal, straight through flow.

9. Accessories:
   a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
   b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Reduced-Pressure-Detector, Fire-Protection Backflow-Preventer Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ames Co.
   b. FEBCO; SPX Valves & Controls.
   c. Watts Industries, Inc.; Water Products Div.
   d. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1047 and FMG approved or UL listed.

3. Operation: Continuous-pressure applications.

4. Pressure Loss: 7 psig maximum, through middle 1/3 of flow range.

5. Size: As indicated on plans.

6. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.

7. End Connections: Flanged.

8. Configuration: Designed for horizontal, straight through flow.

9. Accessories:
   a. Valves: Outside screw and yoke gate-type with flanged ends on inlet and outlet.
   b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
   c. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

2.6 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong International, Inc.
   b. Flo Fab Inc.
   c. ITT Industries; Bell & Gossett Div.
   d. NIBCO INC.
   e. Taco, Inc.
   f. Watts Industries, Inc.; Water Products Div.

2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.

3. Body: bronze,

4. Size: Same as connected piping, but not larger than NPS 2.

5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.7 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Armstrong International, Inc.
   b. Honeywell Water Controls.

c. Powers; a Watts Industries Co.
d. Symmons Industries, Inc.
e. Watts Industries, Inc.; Water Products Div.
f. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1017.

3. Pressure Rating: 125 psig.

4. Type: Thermostatically controlled water mixing valve.

5. Material: Bronze body with corrosion-resistant interior components.

6. Connections: Threaded inlets and outlet.

7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

2.8 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.

2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.

3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

4. Screen: Stainless steel with round perforations, unless otherwise indicated.

5. Perforation Size:
a. Strainers NPS 2 and Smaller: 0.020 inch.
b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Factory-installed, hose-end drain valve.

B. Icemaker Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Acorn Engineering Company.
b. IPS Corporation.
c. LSP Products Group, Inc.
d. Plastic Oddities; a division of Diverse Corporate Technologies.

2. Mounting: Recessed.

3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.

4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.

5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.9 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.

2. Body Material: Bronze.

3. Seat: Bronze, replaceable.

4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.

5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.

6. Pressure Rating: 125 psig.

7. Vacuum Breaker: Integral non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011.

8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.

9. Finish for Service Areas: Chrome or nickel plated.

10. Finish for Finished Rooms: Chrome or nickel plated.

11. Operation for Equipment Rooms: Wheel handle or operating key.

12. Operation for Service Areas: Operating key.

13. Include operating key with each operating-key hose bibb.

14. Include wall flange with each chrome- or nickel-plated hose bibb.

2.10 WALL HYDRANTS

A. Non-freeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company.

b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Light Commercial Operation.

2. Standard: ASME A112.21.3M for concealed outlet, self-draining wall hydrants.

3. Pressure Rating: 125 psig.

4. Operation: Loose key.

5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.

6. Inlet: NPS 3/4 or NPS 1.

7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

8. Box: Deep, flush mounting with cover.

9. Box and Cover Finish: Polished nickel bronze.

10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

11. Nozzle and Wall-Plate Finish: Polished nickel bronze.

12. Operating Keys(s): One with each wall hydrant.

2.11 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.

2. Pressure Rating: 400-psig minimum CWP.

3. Size: NPS 3/4.

4. Body: Copper alloy.

5. Ball: Chrome-plated brass.

6. Seats and Seals: Replaceable.

7. Handle: Vinyl-covered steel.

8. Inlet: Threaded or solder joint.

9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.

2. Pressure Rating: Class 125.

3. Size: NPS 3/4.

4. Body: ASTM B 62 bronze.

5. Inlet: NPS 3/4 threaded or solder joint.

6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.12 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. AMTROL, Inc.
b. Josam Company.
c. MIFAB, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.

3. Type: Metal bellows.

4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.13 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.

2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.

3. Float: Replaceable, corrosion-resistant metal.

4. Mechanism and Seat: Stainless steel.

5. Size: NPS 3/8 minimum inlet.

6. Inlet and Vent Outlet End Connections: Threaded.

2.14 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. MIFAB, Inc.
   b. PPP Inc.
   c. Sioux Chief Manufacturing Company, Inc.
   d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   e. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1018.

3. Pressure Rating: 125 psig minimum.

4. Body: Bronze.

5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.

6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.

7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.

2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.

3. Do not install bypass piping around backflow preventers.

4. Backflow preventer shall be certified by Contractor.

5. Provide a floor drain within six (6) feet of each backflow preventer.

B. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

C. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.

2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each control valve, solenoid valve, and pump.

G. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.

1. Install shutoff valve on outlet if specified.

2. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

H. Install freeze-resistant yard hydrants with riser pipe set in concrete or pavement. Do not encase canister in concrete.

I. Install water hammer arresters in water piping according to PDI-WH 201.

J. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

K. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

L. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

M. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Reduced-pressure-principle backflow preventers.
3. Reduced-pressure-detector, fire-protection backflow-preventer assemblies.
4. Primary, thermostatic, water mixing valves.
5. Primary water tempering valves.
6. Hose stations.
7. Supply-type, trap-seal primer valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each pressure vacuum breaker reduced-pressure-principle backflow preventer double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

221316 - SANITARY WASTE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections:

1. Section 013300 Submittals.
2. Section 01524 Construction Waste Management
3. Section 01352 LEED Requirements
4. Section 01611 Environmental Management
5. Section 01570 Pollution Prevention and Control

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. LLDPE: Linear, low-density polyethylene plastic.

D. NBR: Acrylonitrile-butadiene rubber.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

G. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

2. Sanitary Sewer, Force-Main Piping: 100 psig.

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Field quality-control inspection and test reports.

C. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
   b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-DWV" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.5 SANITARY SOIL, WASTE AND VENT PIPING, WITHIN BUILDING (UNDERGROUND APPLICATION)

A. PVC Pipe (Below Grade): Schedule 40 PVC, conform to ASTM D-1785 Soil and Waste Vent piping. Fittings shall be compatible material with solvent cement type joints.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311 drain, waste, and vent pipe patterns with solvent-cemented joints.

2.6 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS (ABOVE GROUND APPLICATION)

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.

C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
    a. Manufacturers:
        1) ANACO.
        2) Fernco, Inc.
        3) Ideal Div.; Stant Corp.
        4) Mission Rubber Co.
        5) Tyler Pipe; Soil Pipe Div.

2.7 SPECIAL PIPE FITTINGS

A. Flexible, Non-pressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:
    a. Dallas Specialty & Mfg. Co.
    b. Fernco, Inc.
    c. Mission Rubber Co.

2. Sleeve Materials:
   a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
   b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

B. Shielded Non-pressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:
   a. Cascade Waterworks Mfg. Co.
   b. Mission Rubber Co.

C. Rigid, Unshielded, Non-pressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.

1. Manufacturers:
   a. ANACO.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless cast-iron soil pipe and fittings and sovent stack fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.

C. Aboveground soil and waste piping NPS 6 and larger shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hub less cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hub less-coupling joints.

D. Aboveground, vent piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.

2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.

3. Copper DWV tube, copper drainage fittings, and soldered joints.
   a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.

E. Underground, soil, waste, and vent piping NPS 6 and smaller shall be the following:

1. Cellular-core, Sewer and Drain Series, schedule 40 PVC pipe; PVC socket fittings; and solvent-cemented joints.

3.2 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 22.

B. Basic piping installation requirements are specified in Division 22.

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

F. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

G. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 2 and smaller; 1 percent downward in direction of flow for piping NPS 3 and larger.

2. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow.

3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

M. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Join hub less cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hub less-coupling joints.

C. PVC Non pressure Piping Joints: Join piping according to ASTM D 2665.

3.4 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.

2. Install individual, straight, horizontal piping runs according to the following:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer than 100 Feet, if indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.

2. NPS 3: 60 inches with 1/2-inch rod.

3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.

4. NPS 6: 60 inches with 3/4-inch rod.

5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.

2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

7. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

8. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

9. Prepare reports for tests and required corrective action.

3.7 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.8 PROTECTION

A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 221316

221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Trench drains.
4. Roof flashing assemblies.
5. Through-penetration fire-stop assemblies.
6. Miscellaneous sanitary drainage piping specialties.
7. Flashing materials.

B. Related Sections:

1. Section 013300 Submittals.
2. Section 01524 Construction Waste Management
3. Section 01352 LEED Requirements
4. Section 01611 Environmental Management
5. Section 01570 Pollution Prevention and Control

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

1. Show fabrication and installation details for frost-resistant vent terminals.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

D. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal’s Standard GS-11.
   b. Submit manufacturer’s certification that products comply with Green Seal’s Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
    a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.
    g.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.

3. Size: Same as connected drainage piping

4. Body Material: Cast-iron soil pipe test tee as required to match connected piping.

5. Closure: Countersunk plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Josam Company; Josam Div.
    b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    c. Tyler Pipe; Wade Div.
    d. Watts Drainage Products Inc.

e. Zurn Plumbing Products Group; Light Commercial Operation.

2. Standard: ASME A112.36.2M for adjustable housing cast-iron soil pipe with cast-iron ferrule heavy-duty, adjustable housing threaded, adjustable housing cleanout.

3. Size: Same as connected branch.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.

3. Size: Same as connected drainage piping.

4. Body: Hub less, cast-iron soil pipe test tee as required to match connected piping.

5. Size: Same as connected branch.

6. Body: PVC.

7. Closure Plug: PVC.

8. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

2.5 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Josam Company; Josam Div.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Zurn Plumbing Products Group; Light Commercial Operation.

2. Standard: ASME A112.6.3.

3. Pattern: Sanitary drain.

4. Body Material: Gray iron.

B. Wall Box:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Durgo, Inc.
   b. Oatey.
   c. RectorSeal.
   d. Studor, Inc.

2. Description: White plastic housing with white plastic grille, made for recessed installation. Include bottom pipe connection and space to contain one air-admittance valve.

3. Size: About 9 inches wide by 8 inches high by 4 inches deep.

2.6 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Acorn Engineering Company; Elmdor / Stoneman Div.
   b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of from pipe, with galvanized-steel boot reinforcement and counter flashing fitting.

1. Open-Top Vent Cap: Without cap.

2. Low-Silhouette Vent Cap: With vandal-proof vent cap.

3. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.7 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Fires top Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.

3. Size: Same as connected soil, waste, or vent stack.

4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.

5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.

6. Special Coating: Corrosion resistant on interior of fittings.

2.8 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.

2. Size: Same as connected waste piping.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.

2. Size: Same as connected waste piping.
   a. NPS 2: 4-inch- minimum water seal.
   b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.

2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.

2. Body: Bronze or cast iron.

3. Inlet: Opening in top of body.

4. Outlet: Larger than inlet.

5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.

2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counter flashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.

2. Size: Same as connected stack vent or vent stack.

H. Frost-Resistant Vent Terminals:

1. Description: Manufactured or shop-fabricated assembly constructed of copper, lead-coated copper, or galvanized steel.

2. Design: To provide 1-inch enclosed air space between outside of pipe and inside of flashing collar extension, with counter flashing.

I. Expansion Joints:

1. Standard: ASME A112.21.2M.

2. Body: Cast iron with bronze sleeve, packing, and gland.

3. End Connections: Matching connected piping.

4. Size: Same as connected soil, waste, or vent piping.

2.9 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz/sq. ft.

2. Vent Pipe Flashing: 8 oz/sq. ft.

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 75 feet for piping NPS 4 and smaller and 100 feet for larger piping.

4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.

2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
   a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
   b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
   c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

H. Install through-penetration firestop assemblies in plastic stacks at floor penetrations.

I. Assemble open drain fittings and install with top of hub 2 inches above floor.

J. Install deep-seal traps on floor drains and other waste outlets, as required.

K. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.

2. Size: Same as floor drain inlet.

L. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

M. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

N. Install vent caps on each vent pipe passing through roof.

O. Install frost-resistant vent terminals on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

P. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

Q. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

3.2 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled Neutralization tanks and their installation, including piping and electrical connections, and to assist in testing.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

230500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Coordinate with Commissioning Requirements indicated in Section 019113. This contractor is responsible to comply with all requirements for the above section.

1.2 SUMMARY

A. This Section includes the following:

B. Related Sections:

1. Section 013300 Submittals.
2. Section 01524 Construction Waste Management
3. Section 01352 LEED Requirements
4. Section 01611 Environmental Management
5. Section 01570 Pollution Prevention and Control

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

G. The following are industry abbreviations for rubber materials:

1.4 SUBMITTALS

A. Product Data: For the following:

B. Welding certificates.

C. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
   b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

D. Prepare Coordination / Installation Shop drawings to a scale of 1/4"=1'0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 SCOPE OF SERVICES

2.5 APPILCABLE CODES

A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.

B. Arrange with the serving utility companies for the connection of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.

C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements of the following nationally accepted codes and standards:

D. Where differences existing between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Engineer in writing of all differences.

E. When directed in writing by the Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, correct the deficiencies, and complete the work at no additional cost to the Owner.

F. Contractor will comply will all current (date of permit) Fort Bend County and State of Texas Building Codes and ordinances for construction.

2.6 DRAWINGS & SPECIFICATIONS

A. These Specifications are intended to supplement the Drawings and it will not be the province of the Specifications to mention any part of the work which the Drawings are competent to fully explain in every particular and such omission is not to relieve the Contractor from carrying out portions indicated on the Drawings only.

B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least 7 working days prior to bid opening date for issuance of an addendum.

C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is equal to the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturers' standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.

D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.

E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equal capacity, construction, and performance. However, under no circumstances shall any substitution by made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing 10 days prior to the bid date without fail.

F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

G. Wherever a definite material or manufacturer's product is specified and the Specification states that products of similar design and equal construction from the specified list of manufacturers may be substituted, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.

H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUAL" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUAL" product, material or method may be used if it complies with the specifications and is submitted for review to the Engineer as outline herein. Where permission to use substituted or alternative equipment on the project is granted by the Owner or Engineer in writing, it shall be the responsibility of the Contractor or Subcontractor involved to verify that the equipment will fit in the space available which includes allowances for all required Code and maintenance clearances, and to coordinate all equipment structural support, plumbing and electrical requirements and provisions with the Mechanical (HVAC) and Plumbing Design Documents and all other trades.

I. Coordinate with Division 1 requirements for substitution, unless noted otherwise the Contractors wishing to substitute products, materials or methods from those indicated or specified, shall submit such requests to the Owner or Engineer in writing and within THIRTY (30) WORKING DAYS OF NOTIFICATION OF CONTRACT AWARD. Requests for permission to utilize alternates or substitutions will not be considered after that time, unless the Specified item is unavailable or will adversely effect to completion of the Project. Claims submitted for consideration will require notarized letters from all parties involved and will be considered only if the Contractor has been timely in his delivery for review of all required equipment and material submittals. Owner or Engineer will investigate such requests for substitution and if acceptable will issue a letter allowing the substitution.

J. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.

K. Requests shall be bound and shall consist of three (3) sets of descriptive literature and performance data covering each item of equipment or material. The submittal shall include the following:

L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with above and if accepted, will issue a letter allowing the substitutions. The Engineer shall be the sole authority to approve or disapprove any and all substitutions.

M. Where equipment other than that used in the design as specified or shown on the Drawings is substituted (either from an approved manufacturers list or by submittal review), it shall be the responsibility of the substituting Contractor to coordinate space requirements, building provisions and connection requirements with his trades and all other trades and pay all

additional costs to other trades, the Owner, the Architect or Engineer, if any, due to the substitutions.

2.7 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Special Project Requirements, in addition to the requirements specified in Division 15, indicate the following installed conditions.

B. The Contractor shall maintain a set of clearly marked black line record "AS-BUILT" prints on the job site on which he shall mark all work details, alterations to meet site conditions and changes made by "Change Order" notices. These shall be kept available for inspection by the Owner, Architect or Engineer at all times.

C. Contractor Startup and Commissioning Verification - the system will provide a secure page for each integrated system allowing the contractor responsible for each phase to sign on and certify the status of each piece of equipment.

D. Refer to Division 1 for additional requirements concerning record drawings. If the Contractor does not keep an accurate set of as-built drawings, the pay request may be altered or delayed at the request of the Architect. Mark the drawings with a colored pencil. Delivery of as built prints and re-producible is a condition of final acceptance.

E. The record prints shall be updated on a daily basis and shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents which are required for coordination. All dimensions shall include at least two dimensions to permanent structure points.

F. At the Engineer's option, the Contractor shall transfer all data from the record "AS-BUILT" prints to an electronic media such as AutoCAD latest release, in order to plot the reproducible media "AS-BUILT" drawings. Since data stored on electronic media can deteriorate undetected or be modified without the Engineer's knowledge, the AutoCAD electronic drawing files are provided without warranty or obligation on the part of the Engineer as to accuracy or information contained in the files. All information in the files shall be independently verified by the user. Any user shall agree to indemnify and hold the Engineer harmless from any and all claims, damages, losses, and expenses including but not limited to Attorney's fees arising out of the use of the AutoCAD drawing files. Engineer shall furnish to the Contractor electronic media files of Contract Documents for the Contractor to use for inputting of the data from the record "AS-BUILT" prints and the Contractor shall return the revised electronic files on CD ROM properly labeled to the Engineer and shall submit the plotted reproducible drawings and three (3) sets of black line prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The reproducible record "AS-BUILT" drawings shall have the Engineers Name and Seal removed or blanked out and shall be clearly marked and signed on each sheet as described in paragraph F. below.

G. of the work, the Contractor shall transfer all marks from the submit a set of clear concise set of reproducible record "AS-BUILT" drawings and shall submit the reproducible drawings with

corrections made by a competent draftsman and three (3) sets of black line prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The reproducible record "AS-BUILT" drawings shall have the Engineers Name and Seal removed or blanked out and shall be clearly marked and signed on each sheet.

2.8 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.9 JOINING MATERIALS

A. Refer to individual Division 23 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

2. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.10 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Eslon Thermoplastics.

B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Thompson Plastics, Inc.

C. Plastic-to-Metal Transition Unions: MSS SP-107, PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. NIBCO INC.

2. NIBCO, Inc.; Chemtrol Div.

2.11 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Capitol Manufacturing Co.

2. Central Plastics Company.

3. Eclipse, Inc.

4. Epco Sales, Inc.

5. Hart Industries, International, Inc.

6. Watts Industries, Inc.; Water Products Div.

7. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Capitol Manufacturing Co.

2. Central Plastics Company.

3. Epco Sales, Inc.

4. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Central Plastics Company.
4. Pipeline Seal and Insulator, Inc.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Calpico, Inc.
2. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Perfection Corp.
2. Precision Plumbing Products, Inc.
3. Sioux Chief Manufacturing Co., Inc.
4. Victaulic Co. of America.

2.12 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

2.13 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.14 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed set screw or spring clips, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.15 GROUT & FOUNDATION

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

B. Foundations and pads shall be constructed of reinforced concrete and shall be sized and reinforced as noted or detailed on the Drawings. As a minimum, pads shall be 6" thick, by width and length as required by item it is under, reinforced with 6 x 6 W2.9 x W2.9 Welded Wire mesh.

C. Support attachments, unless otherwise noted on shown, shall be securely attached to the items foundation, pad or building structure, per manufacturers recommendations and shall be approved by the Architect.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

2. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.

3. Insulated Piping: One-piece, stamped-steel type with spring clips.

4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

5. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.

6. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.

7. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.

8. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.

9. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.

10. Bare Piping in Equipment Rooms: One-piece, cast-brass type.

11. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.

12. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Steel Pipe Sleeves: For pipes smaller than NPS 6.

3. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

4. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
    1) Seal space outside of sleeve fittings with grout.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 230500

230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Related Sections:

1. Section 013300 Submittals.
2. Section 01524 Construction Waste Management
3. Section 01352 LEED Requirements
4. Section 01611 Environmental Management
5. Section 01570 Pollution Prevention and Control

1.2 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Coordinate with Commissioning Requirements indicated in Section 019113. This contractor is responsible to comply with all requirements for the above section.

1.3 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

1.4 WORK SPECIFIED ELSEWHERE

A. Painting

B. Automatic temperature controls.

C. Power control wiring to motors and equipment.

1.5 REFERENCES

A. AFBMA 9 – Load Ratings and Fatigue Life for Ball Bearings.

B. AFBMA 11 – Load Ratings and Fatigue Life for Roller Bearings.

C. ANSI/IEEE 112 – Test Procedure for Polyphase Induction Motors and Generators.

D. ANSI/NEMA MG 1 – Motors and Generators.

E. ANSI/NEMA MG 2 – Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors.

F. ANSI/NFPA 70 – National Electrical Code, 2017 Edition.

G. ANSI/UL 674 – Electric Motors and Generators for Use in Hazardous (Classified) Locations.

H. ANSI/UL 1004 – Electric Motors.

I. EISA - The Energy Independence & Securities Act 2007.

J. IECC – International Energy Conservation Code, 2015 edition with City of Yoakum, Texas amendments.

K. IMC – International Mechanical Code, 2015 edition with City of Yoakum, Texas amendments.

1.6 WARRANTY

A. Warrant the Work specified herein for one (1) year and motors for five (5) years beginning on data of Substantial Completion against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials or workmanship.

1.7 QUALITY ASSURANCE

A. Motors associated with variable frequency drives (VFD) shall be inverter-duty rated, and provided with grounded shaft or ceramic bearings to insulate shaft, and Class F 105 degrees C rise insulation. Ref. NEMA MG1 Part 31.

1.8 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 23 05 00.

B. Shop Drawings: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Product Data: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures variations, and accessories.

D. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:

a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
   b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

E. Motor Nameplate Information: Manufacturer's name, address, utility and operating data. Bandwidth: submit bandwidth requirements for all Ethernet connections to the Local Network.

F. Submit test results verifying nominal efficiency and power factor for motors 1 horsepower and larger.

G. Submit manufacturer's installation instructions under provisions of Section 23 05 00. Indicate setting, mechanical connections, lubrication, and wiring instructions.

H. Refer to Division 01 for additional requirements.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 23 05 00.

B. Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacture of electric motors for commercial use, and their accessories, with minimum three (3) years' documented product development, testing, and manufacturing experience.

1.11 REGULATORY REQUIREMENTS

A. Conform to the National Electrical Code.

1.12 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver products to site under provisions of Section 23 05 00. Deliver clearly labeled, undamaged materials in the manufacturers' unopened containers.

B. Time and Coordination: Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.

C. Storage:

1. Store and protect products under provisions of Section 23 05 00.

2. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof coverings. For extended outdoor storage, remove motors from equipment and store separately.

1.13 MAINTENANCE

A. Provide twelve (12) months maintenance of all materials and equipment under this Section. Cost of the twelve (12) month normal and preventive maintenance shall be included within this scope of work.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

B. Electrical Service: Refer to Drawing schedules for required electrical characteristics.

C. Approved Manufacturers: Provide motors by a single manufacturer as much as possible.

1. Baldor-Reliance.

2. General Electric ES Energy Saver®.

3. Siemens.

4. Marathon® manufactured by Regal-Beloit America, Inc.

5. U.S. Electrical – NEMA Premium Efficiency.

D. Motor Characteristics

1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

E. General: Comply with NEMA MG 1 unless otherwise indicated.

F. Temperature Rise: Match insulation rating.

G. Starting Capability: As required for service indicated five (5) starts minimum per hour.

H. Phases and Current: Verify electrical service compatibility with motors to be used.

1. Up to 1/2 hp: Provide permanent split, capacitor-start single phase with inherent overload protection.

2. 3/4 hp and larger: Provide NEMA MG 1, Design B, squirrel-cage induction polyphase.

3. Provide two (2) separate windings on 2-speed polyphase motors.

4. Name plate voltage shall be the same as the circuit's normal voltage, serving the motor.

I. Service Factor: 1.15 for polyphase; 1.35 for single phase.

J. Starting Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.

2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

K. Frames: U-frames 1.5 hp and larger.

L. Bearings: Provide sealed regreasable, shielded, anti-friction ball bearings; with top mounted Alemite lubrication fittings and bottom side drains minimum average life 100,000 hours typically, and others as follows:

1. Design for radial and thrust loading where applicable.

2. Permanently Sealed: Where not accessible for greasing.

3. Sleeve-Type with Oil Cups: Light duty fractional horsepower motors or polyphase requiring minimum noise level.

M. Enclosure Type: Provide enclosures as follows:

1. Concealed Indoor: Open drip proof (ODP).

2. Exposed Indoor: Guarded.

3. Outdoor Typical: Type II, TEFC.

4. Outdoor Weather Protected: Type II, TEFC.

N. Overload Protection: Built-in sensing device for stopping motor in all phase legs and signaling where indicated for fractional horse power motors.

O. Noise Rating: "Quiet" except where otherwise indicated.

P. Efficiency: Provide premium efficient motors as defined in NEMA MG 1 in accordance with minimum full load efficiency listed in the following table, when tested in accordance with IEEE Test Procedure 112A, Method B, including stray load loss measure.

Q. Thermal Protection:

1. Polyphase Motors: Comply with NEMA MG 1 requirements for thermally protected motors.

2. Single Phase Motors: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

R. Additional Requirements for Polyphase Motors

1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

2. Motors Used with Variable-Frequency Controllers:
   a. Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
   b. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
   c. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
   d. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

2.5 MOTOR EFFICIENCIES – NOMINAL, FULL LOAD, THREE PHASE

	Open Drip-Proof (ODP)			Totally Enclosed Fan-Cooled (TEFC)		
Motor HP	1200 rpm	1800 rpm	3600 rpm	1200 rpm	1800 rpm	3600 rpm
1	82.5	85.5	80.0	82.5	85.5	78.5
1.5	86.5	86.5	85.5	87.5	86.5	85.5
2	87.5	86.5	86.5	88.5	86.5	86.5

	Open Drip-Proof (ODP)			Totally Enclosed Fan-Cooled (TEFC)		
Motor HP	1200 rpm	1800 rpm	3600 rpm	1200 rpm	1800 rpm	3600 rpm
3	89.5	89.5	86.5	89.5	89.5	88.5
5	89.5	89.5	89.5	89.5	89.5	89.5
7.5	91.7	91.0	89.5	91.7	91.7	91.0
10	91.7	91.7	90.2	91.7	91.7	91.7
15	92.4	93.0	91.0	92.4	92.4	91.7
20	92.4	93.0	92.4	92.4	93.0	92.4
25	93.0	93.6	93.0	93.0	93.6	93.0
30	93.6	94.1	93.0	93.6	93.6	93.0
40	94.1	94.1	93.6	94.1	94.1	93.6
50	94.1	94.5	93.6	94.1	94.5	94.1
60	95.0	95.0	94.1	94.5	95.0	94.1
75	95.0	95.0	94.5	95.0	95.4	94.5
100	95.0	95.4	94.5	95.4	95.4	94.5
125	95.4	95.4	95.0	95.4	95.4	95.0
150	95.8	95.8	95.4	95.8	95.8	95.4
200	95.4	95.8	95.4	95.8	96.2	95.8

2.6 NEMA OPEN MOTOR SERVICE FACTORS

HP	3600 RPM	1800 RPM	1200 RPM	900 RPM
1/6	1.35	1.35	1.35	1.35
1/2	1.25	1.25	1.25	1.15
3/4	1.25	1.25	1.15	1.15
1	1.25	1.15	1.15	1.15
1.5 - 150	1.15	1.15	1.15	1.15

2.7 MOTOR CONTROLLERS (STARTERS)

A. All motor controllers (for equipment furnished under Division 23) shall be furnished under Division 26 and installed under Division 26 unless otherwise noted on the plans.

B. Motor starters shall be furnished as follows.

1. General: Motor starters shall be Schneider-Electric Class 8536 across-the-line magnetic type, full-voltage, non-reversing (FVNR) starter. All starters shall be constructed and tested in accordance with the latest NEMA standards, sizes and horsepower. IEC sizes are not acceptable. Starters shall be mounted in a general purpose dead front, painted steel enclosure and surface-mounted. Provide size and number of poles as shown and required by equipment served. Provide a two speed, two winding or two speed, single winding motor starter as required for two speed motors.

2. Contacts: Magnetic starters' contacts shall be double break solid silver alloy.

3. All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter shall have straight-through wiring.

4. Operating Coils: Operating coils shall be 120 volts and shall be of molded construction. When the coil fails, the starter shall open and shall not lock in the closed position.

5. Overload Relays: Provide manual reset, trip-free Class 20 overload relays in each phase conductor in of all starters. Overload relays shall be melting alloy type with visual trip indication. All 3 phase and single phase starters shall have one overload relay in each underground conductor. Relay shall not be field adjustable from manual to automatic reset. Provide 6 overload relays for two speed motor starters.

6. Pilot Lights: Provide a red running pilot light for all motor starters. Pilot lights shall be mounted in the starter enclosure cover. Pilot lights shall be operated from an interlock on the motor starter and shall not be wired across the operating coil.

7. Controls: Provide starters with HAND-OFF-AUTOMATIC switches. Coordinate additional motor starter controls with the requirements of Division 23. Motor starter controls shall be mounted in the starter enclosure cover.

8. Control Power Transformer: Provide a single-phase 480 volt control power transformer with each starter for 120 volt control power. Connect the primary side to the line side of the motor starter. The primary side shall be protected by a fuse for each conductor. The secondary side shall have one (1) leg fused and one (1) leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.

9. Auxiliary Contacts: Each starter shall have one (1) normally open and one (1) normally closed convertible auxiliary contact in addition to the number of contacts required for the "holding interlock", remote monitoring, and control wiring. In addition, it shall be possible to field-install three more additional auxiliary contacts without removing existing wiring or removing the starter from its enclosure.

10. Unit Wiring: Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for line and load power wiring and HVAC control wiring.

11. Enclosures: All motor starter enclosures shall be NEMA 1, general purpose enclosures or NEMA 3R if mounted exposed to high moisture conditions. Provide NEMA 4X when located near cooling towers.

12. Power Monitor: Provide a Macromatic PMPU phase failure and under-voltage relay, base and wiring required for starters serving motors 10 horsepower and larger. Set the under-voltage setting according to minimum voltage required for the motor to operate within its range.

C. Approved Manufacturers: Controller numbers are based on first named manufacturer. Provide one of the following manufacturer's.

1. ABB
2. Danfoss
3. Yaskawa

2.8 COMBINATION MOTOR STARTERS

A. General: Combination motor starters shall consist of a magnetic starter and a fusible or non-fusible disconnect switch in a dead front, painted steel NEMA 1 enclosure unless otherwise noted and shall be surface-mounted. Size and number of poles shall as shown and required by equipment served. Combination motor starters shall be as specified for motor starters in Paragraph 2.4.B, except as modified herein.

B. Disconnect Switch: Disconnect switches shall be as specified in Division 26.

C. Approved Manufacturers: Controller numbers are based on first named manufacturer. Provide one of the following manufacturer's.

1. Siemens.
2. Schneider Electric.
3. ABB.

2.9 VARIABLE FREQUENCY DRIVES

A. Manufacturers

1. General:
   a. All products provided under this section shall either be Pre-certified or certified prior to bid as described below. If for any reason the product listed is not appropriate to fully meet the project requirements, alternate products shall be certified and bid as described below.
   b. Acceptable Manufacturers
      1) ABB
      2) Danfoss
      3) Yaskawa

2. Additional Product Certification: In the event that additional or alternate products from the listed Manufacturer of the Pre-Certified product line listed above are needed to accomplish the requirements of this project, additional products and applications shall be certified following the procedures and requirements of the certification specifications.
   a. Any product that is not certified will not be accepted.
   b. Upon satisfactory completion of the certification, a registration number will be issued for each product.
   c. Include the registration number for each product in the submittal
   d. The Owner reserves the right to accept or reject any products at their sole discretion as deemed in their best interest.

B. Where shown on the Drawings, adjustable frequency drives shall have the following features:

1. The VFD shall be rated for 480 VAC (optional input voltages of 208-240 VAC). The VFD shall provide microprocessor-based control for three-phase induction motors. The controller's full load output current rating shall be based on 40°C ambient and 5 kHz switching frequency continuous and utilize dynamic noise control for motors.

2. The VFDs shall be of the Pulse Width Modulated (PWM) design converting the utility input voltage and frequency to a variable voltage and frequency output via a two-step operation. Adjustable Current Source VFDs are not acceptable. Insulated Gate Bipolar Transistors (IGBTs) shall be used in the inverter section. Bipolar Junction Transistors, GTOs or SCRs are not acceptable. The VFDs shall run at the above listed switching frequencies.

3. The VFD's shall have efficiency at full load and speed that exceeds 95% for VFDs below 15 Hp and 97% for drives 15 Hp and above. The efficiency shall exceed 90% at 50% speed and load.

4. The VFDs shall maintain the line side displacement power factor at no less than 0.96, regardless of speed and load.

5. The VFDs shall have a one (1) minute overload current rating of 150% and a two (2) second overload current rating of 250% for constant torque drives. The VFDs shall have a one (1) minute overload current rating of 110% for variable torque drives.

6. The VFDs shall be capable of operating of operating any NEMA design B squirrel cage induction motor, regardless of manufacturer, with a horsepower and current rating within the capacity of the VFD.

7. The VFD's shall have an integral EMI/RFI filter as standard.

8. The VFD's shall limit harmonic distortion reflected onto the utility system to a voltage and current level as defined by IEEE 519-2014 for general systems applications, by utilizing the standard 5% nominal impedance integral AC three-phase line reactor.

9. Any harmonic calculations shall be done based on the kVA capacity, X/R ratio and the impedance of the utility transformer feeding the installation, as noted on the drawings,

and the total system load. The calculations shall be made with the point of common coupling being the point where the utility feeds multiple customers.

10. Total harmonic distortion shall be calculated under worst-case conditions in accordance with the procedure outlined in IEEE standard 519-2014. Copies of these calculations are to be made available upon request. The contractor shall provide any needed information to the VFD supplier three (3) weeks prior to requiring harmonic calculations.

11. The system containing the VFDs shall comply with the 5% level of total harmonic distortion of line voltage and the line current limits as defined in IEEE 519-2014. If the system cannot meet the harmonic levels with the with the VFDs provided with the standard input line reactor or optional input isolation transformer, the VFD manufacturer shall supply either a 12-Pulse or an 18-pulse, multiple bridge rectifier ac to dc conversion section with phase shifting transformer or Matrix topology solution for all drives 50 Hp and above. This 18-pulse rectifier converter shall result in a multiple pulse current waveform that will more nearly approximate a true sine-wave to reduce voltage harmonic content on the utility line. The phase shifting transformer shall be of a single winding type to optimize its KVA rating and harmonic cancellation capability. Harmonic filters are not acceptable for drives 50 Hp and above.

12. The VFD's shall be able to start into a spinning motor. The VFDs shall be able to determine the motor speed in any direction and resume operation without tripping. If the motor is spinning in the reverse direction, the VFDs shall start into the motor in the reverse direction, bring the motor to a controlled stop, and then accelerate the motor to the preset speed.

13. Standard operating conditions shall be:
    a. Incoming Power: Three-phase, 208 - 240 / 380 - 500 / 525 - 690 Vac (+10% to -15%) and 50/60 Hz (+/-5 Hz) power to a fixed potential DC bus level.
    b. Frequency stability of +/-0.05% for 24 hours with voltage regulation of +/-1% of maximum rated output voltage.
    c. Speed regulation of +/- 0.5% of base speed.
    d. Load inertia dependent carryover (ride-through) during utility loss.
    e. Insensitive to input line rotation.
    f. Power loss ride through shall be adjustable through 2 seconds.
    g. Humidity: 0 to 95% (non-condensing and non-corrosive).
    h. Altitude: 0 to 3,300 feet above sea level.
    i. Ambient Temperature: -10 to 50°C (CT), -10 to 40°C (VT).
    j. Storage Temperature: -40 to 60°C.

14. Control Functions
    a. VFD programmable parameters shall be adjustable from a digital operator keypad located on the front of the VFD. The VFDs shall have a 5 line alphanumeric programmable display with status indicators. Keypads must use plain English words for parameters, status, and diagnostic messages. Keypads that are difficult to read or understand are not acceptable, and particularly those that use alphanumeric code and tables. Keypads shall be adjustable for contrast with large characters easily visible in normal ambient light.

b. The keypad shall include a Local/Remote pushbutton selection. Both start/ stop source and speed reference shall be independently programmable for Keypad, Remote I/O, or Field Bus.
c. The keypad shall have copy / paste capability.
d. Upon initial power up of the VFD, the keypad shall display a startup guide that will sequence all the necessary parameter adjustments for general start up.
e. Standard advanced programming and trouble-shooting functions shall be available by using a personal computer's RS-232 port and Windows™ based software. In addition, the software shall permit control and monitoring via the VFD's RS232 port. The manufacturer shall supply free website download for the required software. An easily understood instruction manual and software help screens shall also be provided. The computer software shall be used for modifying the drive setup and reviewing diagnostic and trend information as outlined in this Section.
f. The operator shall be able to scroll through the keypad menu to choose between the following:
    1) Monitor
    2) Operate
    3) Parameter setup
    4) Display parameter values
    5) Display current faults
    6) Fault history
    7) Keypad LCD contrast adjustment
    8) Information to indicate the standard software and optional features software loaded.
g. The following setups and adjustments, at a minimum, are to be available:
    1) Start command from keypad, remote or communications port
    2) Speed command from keypad, remote or communications port
    3) Motor direction selection
    4) Maximum and minimum speed limits
    5) Acceleration and deceleration times, two settable ranges
    6) Critical (skip) frequency avoidance
    7) Torque limit
    8) Multiple attempt restart function
    9) Multiple preset speeds adjustment
    10) Parameter for speed search to catch a spinning motor start or normal start selection
    11) Programmable analog output
    12) DC brake current magnitude and time
    13) PI process controller

15. The VFDs shall have the following system interfaces:
    a. Inputs – A minimum of six (6) programmable digital inputs, two (2) analog inputs and shall be provided with the following available as a minimum:
        1) Remote manual/auto
        2) Remote start/stop
        3) Remote forward/reverse
        4) Remote preset speeds
        5) Remote external trip

6) Remote fault reset
7) Process control speed reference interface, 4-20 mA dc
8) Potentiometer and 1-10 Vdc speed reference interface
9) RS232 programming and operation interface port

b. Provide a communications interface with all points and functions listed in this section connected to the BMS provided. A minimum of two (2) discrete programmable digital outputs, one (1) programmable open collector output, and one (1) programmable analog output shall be provided, with the following available at minimum.
   1) Programmable relay outputs with one (1) set of Form C contacts for each, selectable with the following available at minimum:
      a) Fault
      b) Run
      c) Ready
      d) Reversed
      e) Jogging
      f) At speed
      g) Torque Limit Supervision
      h) Motor rotation direction opposite of commanded
      i) Over temperature
   2) Programmable open collector output with available 24Vdc power supply and selectable with the following available at minimum:
      a) Fault
      b) Run
      c) Ready
      d) Reversed
      e) Jogging
      f) At speed
      g) Torque Limit Supervision
      h) Motor rotation direction opposite of commanded
      i) Over temperature
   3) Programmable analog output signal, selectable with the following available at minimum:
      a) Motor current
      b) Output frequency
      c) Frequency reference
      d) Motor speed
      e) Motor torque
      f) Motor power
      g) Motor voltage
      h) DC-bus voltage

16. Monitoring and Displays
   a. The VFD's display shall be a LCD type capable of displaying three (3) lines of text and the following thirteen (13) status indicators:
      1) Run
      2) Forward
      3) Reverse

4) Stop
5) Ready
6) Alarm
7) Fault
8) I/O terminal
9) Keypad
10) Bus/Comm
11) Local / Remote (LED)
12) Fault)

b. The VFD's keypad shall be capable of displaying the following monitoring functions at a minimum:
1) Output frequency
2) Frequency reference
3) Motor speed
4) Motor current
5) Motor torque
6) Motor power
7) Motor voltage
8) DC-bus voltage
9) Unit temperature
10) Voltage level of analog input
11) Current level of analog input
12) Digital inputs status
13) Digital and relay outputs status
14) Analog out

17. Protective Functions
a. The VFD shall include the following protective features at minimum:
1) Over current
2) Overvoltage
3) Inverter fault
4) Under voltage
5) Input phase loss
6) Output phase loss
7) Under temperature
8) Over temperature
9) Motor stalled
10) Motor under load
11) Logic voltage failure
12) Microprocessor failure

b. The VFD shall provide ground fault protection during power-up, starting, and running. VFD's with no ground fault protection during running are not acceptable.

18. Diagnostic Features
a. Ten (10) faults History
b. Record and log faults

19. Indicate the most recent first, and store up to ten (10) faults.

20. Additional features that must be included in the VFD:
    a. Thermal or magnetic only circuit breaker to provide a disconnect means. Operating handle shall protrude the door. The disconnect shall not be mounted on the door. The handle position shall indicate ON, OFF, and TRIPPED condition. The handle shall have provisions for padlocking in the OFF position with at least three (3) padlocks. Interlocks shall prevent unauthorized opening or closing of the VFD door with the disconnect handle in the ON position. This shall be defeat able by maintenance personnel.
    b. Three (3) contactor bypass shall include a drive input disconnect, an VFD input isolation contactor, bypass contactor and an VFD output contactor that is electrically and mechanically interlocked with the bypass contactor. This circuit shall include control logic, status lights and motor over current relays. The complete bypass system (Inverter-Off-Bypass) (Hand-Off-Auto with Inverter-Bypass) selector switch(s), and inverter/bypass pilot lights shall be packaged with the VFD. The unit may be set up for (Manual or Automatic) bypass operation upon an VFD trip.
    c. Fused space heaters with thermostat for oversize enclosures to minimize condensation potential upon drive shutdown.
    d. Motor over-current relay to provide motor over current sensing of a given level of load current.
    e. Motor filter for use on motor cable runs exceeding 100 feet for motors with a peak voltage insulation rating less than 1600 Vac. Motors without NEMA MG1, Part 31 construction shall be identified to bidders.
        1) The dV/dt filter shall be located at the VFD and shall reduce the dV/dt clamp any voltage overshoots of the VFD output. It will return the energy in the voltage overshoots to the VFD's dc bus. A power dissipative resistance device is not acceptable. Filter shall be a Eaton MotoR$_x$™ series.

21. The VFD manufacturer shall maintain, as part of a national network, engineering service facilities within 250 miles of project to provide start-up service, emergency service calls, repair work, service contracts, maintenance and training of customer personnel.

PART 3 - EXECUTION

3.1 FACTORY TESTING

A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA standards.

1. All printed circuit boards shall be functionally tested via automatic test equipment prior to unit installation.

2. After all tests have been performed, each VFD shall undergo a burn-in test. The drive shall be burned in at 100% inductive or motor load without an unscheduled shutdown.

3. After the burn-in cycle is complete, each VFD shall be put through a motor load test before inspection and shipping.

B. The manufacturer shall provide three (3) certified copies of factory test reports.

3.2 FIELD QUALITY CONTROL

A. Provide the services of a qualified manufacturer's employed Field Service Engineer to assist the Contractor in installation and start-up of the equipment specified under this section. Field Service personnel shall be factory trained with periodic updates and have experience with the same model of VFD's on the job site. Sales representatives will not be acceptable to perform this work. The manufacturer's service representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment, installation as specified in manufacturer's installation instructions, wiring, application dependent adjustments, communications setup and verification of proper VFD operation.

B. The following minimum work shall be performed by the Contractor under the technical direction of the manufacturer's service representative.

1. Inspection and final adjustments.

2. Operational and functional checks of VFDs and spare parts.

3. Provide cable and connector to the IP drop supplied by Controls Contractor.

4. Verify that the unit is properly configured for remote communication to the system.

5. The Contractor shall certify that he has read the drive manufacturer's installation instructions and has installed the VFD in accordance with those instructions.

C. The Contractor shall provide three (3) copies of the manufacturer's field start-up report before final payment is made.

3.3 MAINTNANCE / WARRANTY SERVICE

A. Warranty to commence twelve (12) months from the date of start-up, not to exceed 36 months from the date of shipment, and include all parts, labor, and travel time.

3.4 FIELD TESTING

A. The VFD manufacturer shall perform harmonic measurements at the point where the utility feeds multiple customers (PCC) to verify compliance with IEEE 519-2014. A report of the voltage THD and current TDD shall be sent to the engineer. The Contractor shall provide labor, material, and protection as needed to access the test points. The readings shall be taken with all drives and all other loads at full load, or as close as field conditions allow.

3.5 TRAINING

A. The Contractor shall provide a training session for up to two (2) Owner's representatives for one (1) workday with a maximum of two (2) trips at a job site location determined by the Owner. Training and instruction time shall be in addition to that required for start-up service.

B. The training shall be conducted by the manufacturer's qualified representative.

C. The training program shall consist of the following:

1. Instructions on the proper operation of the equipment.

2. Instructions on the proper maintenance of the equipment.

END OF SECTION 230513

230529 - SLEEVES, FLASHINGS, SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish and install supports, anchors and sleeves applicable to mechanical, plumbing, and fire protection systems, including:

1. Pipe, duct, and equipment hangers, supports, and associated anchors.
2. Equipment bases and supports.
3. Sleeves and seals.
4. Flashing and sealing equipment and pipe stacks.

1.2 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Provide hanger and support inserts and sleeves and coordinate placement into formwork.

1.3 RELATED SECTIONS

A. Section 230700 – HVAC Insulation.

B. Section 230716 – HVAC Equipment Insulation.

C. Section 013300 Submittals.

D. Section 01524 Construction Waste Management

E. Section 01352 LEED Requirements

F. Section 01611 Environmental Management

G. Section 01570 Pollution Prevention and Control

1.4 SUBMITTALS

A. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
   b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 MANUFACTURERS

A. Grinnell

B. Kindrof

C. Unistrut

D. Specified Technologies, Inc.

E. B-line

F. Power Strut

2.5 PIPE HANGERS AND SUPPORTS

A. Hangers for Non-Insulated Pipe Sizes 1/2 to 4-Inch: Provide malleable iron, adjustable swivel, split ring.

B. Hangers for Insulated Pipe Sizes 1/2 to 3 Inches and Non-Insulated Pipe Sizes 6 Inches and Over: Galvanized carbon steel, adjustable, clevis.

C. Supports for Single Hot Pipe Sizes 4 Inches and Over and Cold Pipe Sizes 4 Inches and Over; Carbon Steel Roller.

D. Multiple or Trapeze Hangers: Galvanized steel channels with welded spacers and hangers rods, cast iron roll and stand for sizes 4 inches and larger hot water piping and 4 inches and larger chilled water piping.

E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

F. Wall Support for Pipe Sizes to 4 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll.

G. Vertical Support: Steel riser clamp.

H. Floor Support for Pipe Sizes 4 Inches and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

I. Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

J. Design hangers without disengagement of supported pipe.

K. Copper Pipe Support and Hangers: Carbon steel ring, adjustable, copper plated.

L. Shield for Insulated Piping 2 Inches and Smaller: 18 gauge galvanized steel shield over insulation in 180-degree segments, minimum12 inches long at pipe support.

M. Shield for Insulated Piping 2-1/2 Inch and Larger (Except Cold Water Piping): Use pipe support inserts.

Galvanized steel shields in 180-degree segments in accordance with following table:

Pipe	Metal Gauge	Shield Length
2 1/2" to 5"	15	12"
6" to 12"	14	24"
Over 12"	12	24"

2.6 HANGER RODS

A. Steel, threaded on both ends or one on one end or continuous threaded. Galvanized or cadmium plated.

2.7 INSERTS

A. Provide malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms, size inserts to suit threaded hanger rods.

2.8 FLASHING

A. Metal Flashing: 26 gauge galvanized steel.

B. Flexible Flashing: 47 mil thick sheet butyl: compatible with roofing.

C. Caps: Steel, 22 gauge minimum; use 16 gauge at fire resistant elements.

2.9 EQUIPMENT BASE AND SUPPORTS

A. Provide 6" concrete pads and equipment bases for all outdoor equipment on grade, floor mounted equipment in main central plant area, areas with floor below grade, penthouse equipment rooms, floor mounted air handling units and where shown on Drawings.

B. Provide prefabricated curbs or roof mounted equipment with the equipment. Equipment curb must compensate for slopped roof deck as required to set equipment level.

2.10 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: Form with 16 gauge galvanized steel.

B. Sleeves for Pipes through Non-fire Rated Beams, Walls, Above Grade: Form with 18 gauge galvanized steel.

C. Sleeves for Pipes through Fire Rated and Fire Resistive Floors and Walls, and Fireproofing: Provide prefabricated fire rated sleeves including seals, UL listed; or provide Schedule 40 galvanized steel, sized for minimum 1 inch space between sleeve and carrier pipe.

D. Sleeves for Pipe through Floor Supporting Riser Piping: Standard weight galvanized steel pipe.

E. Sleeves for Pipes through Roof: Standard weight galvanized steel pipe.

F. Sleeves for Round Ductwork: Form with galvanized steel.

G. Sleeves for Rectangular Ductwork: Form with galvanized steel.

H. Provide fire-stop compound at all penetrations of floor slabs or firewalls such that fire rating integrity of barrier is not lessened.

I. Caulk: Caulk all sleeves water and airtight.

J. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping. Provide pipe sleeves one size larger that the pipe it serves, including insulation, except where “Link Seal” casing seals are used.

K. Sleeves Penetration Walls Below Grade: Provide “Link-Seal” and sleeve as manufactured by Thunderline Corporation, Wayne, Michigan, for all pipes passing through walls below grade.

2.11 FINISHES

A. Prime coat and paint exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

B. Provide galvanized hangers and supports for all piping and ductwork located in crawlspace, pipe shafts, and above suspended ceiling spaces.

C. Provide hanger rods, bolts, nuts, and all metal parts coated with the same material as hangers.

2.12 ANCHOR BOLTS

A. Provide galvanized anchor bolts for all equipment placed on concrete pads or on concrete slabs of the size and number recommended by the manufacturer of the equipment.

PART 3 - EXECUTION

3.1 PIPE HANGERS AND SUPPORTS

A. Support horizontal pipes as follows:

Pipe Size	Max. Hanger Spacing*	Hanger Diameter
1/2 to 1-1/4 inch	6’-0”	3/8”
1-1/2 to 2 inch	8’-0”	3/8”
2-1/2 to 3 inch	10’-0”	1/2”
4 to 6 inch	10’-0”	5/8”
8 to 12 inch	10’-0”	7/8”
14 inch and Over	14’-0”	1”

	C.I. Bell and Spigot (or No-Hug)	5’-0” and at Joints	
	*Comply with NFPA 13 for fire protection pipe hanger spacing. ** For PVC and Cast Iron pipes maximum hanger spacing shall not exceed 4 feet with 3/8” hanger rod and 5 feet with 5/8” hanger rod respectively.		

B. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.

C. Place a hanger within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with fiver feet maximum spacing between fingers.

F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide corrosion resistant hangers by Corr-Tech for all piping hangers in corrosive areas. Provide hanger rods, bolts, nuts and all metal parts coated with the same material as hangers.

3.2 LOW PRESSURE DUCT SUPPORT SCHEDULE

A. All horizontal ducts up to and including 40 inches in their greater dimension shall be supported by means of No. 18 U.S. gauge band iron hangers attached to the ducts by means of screws, rivets, or clamps and fastened to above inserts with toggle bolts, beam clamps or other approved means. Duct shall have at least one pair of supports 8' 0" on centers. Clamps shall be used to fasten hangers to reinforcing on sealed ducts.

B. Horizontal ducts larger than 40 inches in their greatest dimension shall be supported by means of hanger rods bolted to angle iron trapeze hangers. Duct shall have at least one pair of supports 8' 0" on centers according to the following:

Angle Length	Angle	Rod Diameter
4’ 0"	1-1/2" x 1-1/2" x 1/8"	1/4"
6' 0"	1-1/2" x 1-1/2" x 1/8"	1/4"
8' 0"	2" x 2" x 1/8"	5/16"
10' 0"	3" x 3" x 1/8"	3/8"

C. Vertical ducts shall be supported where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles for ducts up to 60." Above 60", the angles must be increased in strength and sized on an individual basis considering space requirements.

3.3 MEDIUM PRESSURE DUCT SUPPORT SCHEDULE

A. All horizontal rectangular ducts shall have duct hanger requirements as follows:

Minimum Hanger Size

Max. Duct Dimen.	Steel Rod	Galv. Steel Strap Width	Max. Spacing	Min.# Hngrs	Trapeze Size
0 through 18"	--	1" x 16 ga.	10'	2	--
19" through 36"	--	1" x 16 ga.	10'	2	--
37" through 60"	3/8"	1" x 16 ga.	8'	2	2" x 2" x 1/4"
61" through 120"	3/8"	1-1/2" x 12 ga.	8'	2	2" x 2" x 1/4"
121" through 240"	3/8"	--	4'	3	2-1/2" x 2-1/2" x 3/16"

B. All horizontal round ducts shall have ducts hangers spaced 10' 0" maximum with requirements as follows:

Duct Diameter	Min. Hanger Size	No. Hangers	Hanger Ring Size
Up through 18"	1" x 16 gauge	1	1" x 16 ga.
19" to 36"	1" x 12 gauge	1	1" X 12 ga.
37" to 50"	1-1/2" x 12 gauge	1	1-1/2" x 12 ga.
51" to 84"	1-1/2" x 12 gauge	2	Support Bracing Angle

3.4 INSERTS

A. Provide inserts for placement in concrete formwork.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concreter reinforcement section for inserts carrying pipe over 4 inches.

D. Where concrete slabs form finished ceiling, provide inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.5 FLASHING

A. Provide flexible flashing and metal counter-flashing where sleeves, piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Flexible sheet flash and counter-flash all curbs for mechanical equipment on roof with sheet metal; seal watertight.

3.6 EQUIPMENT BASES AND SUPPORTS

A. Coordinate installation of equipment bases of concrete type specified for all outdoor equipment on grade and floor mounted equipment in main central plant area, areas with floors below grade, penthouse equipment rooms floor mounted air handling units and where shown on drawings.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment

C. Construct support of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

E. Provide base of a minimum height of 4 inches above finished grade and a width that projects a minimum of 3 inches beyond equipment on all sides. Bevel edges of base.

F. Prepare surface under bases by cleaning, clearing, chipping and roughing.

G. Provide curbs of 14 inches minimum height above roofing surface for installation of mechanical equipment on roof.

3.7 CONCRETE FOUNDATIONS ("HOUSEKEEPING PADS")

A. Concrete foundations for the support of equipment such as floor mounted panels, pumps, fans, air handling units, etc., shall extend 4" on all sides beyond the limits of the mounted equipment unless otherwise noted and shall be poured in forms built of new dressed 6" nominal lumber. All corners of the foundations shall be neatly chamfered by means of sheet metal or triangular wood strips nailed to the form. Foundation bolts shall be placed in the forms when the concrete is poured, the bolts being correctly located by means of templates. Each bolt shall be set in a sleeve of size to provide 1/2" clearance around bolt. Allow 1" below the equipment bases for alignment and grouting. After grouting, the forms shall be removed and the surface of the foundations shall be hand rubbed with Carborundum. Foundations for equipment located on the exterior of the building shall be provided as indicated. Foundations shall be constructed in accordance with Shop Drawings submitted by the Contractor for review by the Architect/Engineer.

3.8 WALL, FLOOR AND CEILING PLATES

A. Except as otherwise noted, provide C.P. (Chrome plated) brass floor and ceiling plates around all pipes, conduits, etc., passing exposed through walls, floors, or ceilings, in any spaces except under floor and attic spaces. Plates shall be sized to fit snugly against the outside of the pipe or against the insulation on lines which are insulated and positively secured to such pipe or insulation. Plates will not be required for piping where pipe sleeves extend 3/4" above finished floor. All equipment rooms are classified as finished areas. Round and rectangular ducts shall have closure plates (NOT chrome plated) made to fit accurately at all floor, wall and ceiling penetrations. Floor penetrations in exposed (except in stair wells) areas shall be finished using 'bell' fitting to fit pipe or insulation and sleeve and shall be painted to match the pipe. Penetrations in stairwells shall have flat floor plate painted to match pipe.

3.9 SLEEVES

A. Provide sleeves for all pipe penetrations through walls, roof or slab above grade.

B. Set sleeves in position in formwork. Provide reinforcing around sleeves.

C. Extend sleeves through floors 2 inches above finished floor level. Caulk sleeves full depth and provide floor plate.

D. Where piping or ductwork penetrates floor, ceiling wall, close off space between pipe or duct and adjacent work with fire stopping insulation and seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration. When penetration is through a fire rated floor or wall, provide fire safe insulation so that the assembly, when complete, is UL listed and equals the fire rating of construction penetrated by the sleeve.

E. Install chrome plated steel escutcheons at finished surfaces.

F. Provide three 6 inch long reinforcing rods welded at 120-degree spacing to the sleeve on all sleeves supporting riser piping 4 inches and larger. Embed reinforcing rods in concrete or grout to existing concrete.

G. Install sleeve assembly for walls below grade with 1/4-inch thick plate located in the middle of the wall.

H. Neatly cut hose in existing walls, floors and roofs for placement of sleeves. Place sleeve and grout, and caulk annular space to provide finished appearance.

I. Install pipe in sleeve so that neither the pipe nor its insulation touches the sleeve at any point.

J. Seal space between pipe and sleeve watertight for all sleeves penetrating the roof.

3.10 SLEEVES

A. General: All openings through all floors, walls, and roofs, etc., regardless of material for the passage of piping, ductwork, conduit, cable trays, etc., shall be sleeved. All penetrations must

pass through sleeves. Sleeves shall be set in new construction before concrete is poured, as cutting holes through any part of the concrete will not be permitted unless acceptable to the Architect/Engineer. If a penetration is cored into an existing vertical solid concrete, masonry or stone structure, then the installation of a sleeve will not be necessary.

1. Sleeve material for floors and exterior walls shall be Schedule 40 galvanized steel with welded water stop rings.

2. Sleeves through interior walls to be galvanized sheet metal with gauge as required by wall fire rating, 20 gauge minimum.

B. The minimum clearance between horizontal penetrations including insulation where applicable, and sleeve shall be 1/4", except that the minimum clearance shall accommodate a Thunderline Link-seal closure where piping exits the building, or penetrates a wall below ground level. Contractor shall be responsible for the accurate location of penetrations in the slab for his pipe, duct, etc. All penetrations shall be of ample size to accommodate the pipe, duct, etc., plus any specified insulation. Void between sleeve and pipe in interior penetrations shall be filled with Nelson Flameseal Firestop or approved equal caulk or putty.

C. Floor sleeves shall extend above the finished floor as detailed on the drawings, except that floor sleeves in stairwells shall be flush with the finished floor. Sleeves in walls shall be trimmed flush with wall surface. Refer to the details on the project drawings. Where the details differ from these specifications, the drawings take precedence.

D. Sleeves for penetrations passing through walls or floors on or below grade shall be removed, if practical, and after the pipes have been installed, the void space around the pipe shall be caulked with a suitable material to effect a waterproof penetration. Note that the practicality of the removal of the sleeve shall be the decision of the Construction Inspector. The decision of the Inspector shall be final.

E. Vermin proofing: The open space around all ductwork, piping, etc., passing through the ground floor and/or exterior walls shall be vermin proofed in a manner acceptable to the Architect/Engineer.

F. Waterproofing: The annular space between a pipe and its sleeve in interior floors shall be filled with polyurethane foam rods 50 percent greater in diameter than the space as backing and fill material and made watertight with a permanent elastic polysulfide compound. Seal both surfaces of floor.

G. Air Plenums: The space around piping, ductwork, etc., passing through air plenums shall be made airtight in a manner acceptable to the Architect/Engineer.

H. Fireproofing: Seal all cable trays, pipe, conduit, duct, etc., penetrations through roof, fire rated walls and floors with a foam or sealant as described below, that will form a watertight, vermin tight barrier that is capable of containing smoke and fire up to 2000° F for two hours. Sealing of cable trays and conduits that extend through rated walls from ends of cable tray shall be done after conductors have been installed. For wet locations, the foam material shall be silicone RTV foam or an approved equal. For dry locations, premixed putty equal to Nelson Flameseal Firestop putty may be used.

3.11 ANCHOR BOLTS

A. Locate position of anchor bolts by means of suitable templates.

B. When equipment is placed on vibration isolators, secure equipment to the isolator and the isolator to the floor, pad or support as recommended by the vibration isolator manufacturer.

3.12 INSULATION SHIELDS

A. Provide insulation shields at every hanger support.

A. Provide shields of the proper length to distribute weight evenly and to prevent sagging or indentation of insulation at hanger.

B. Install shield so that hanger is placed at the center of the shield.

B. Attach shield to insulation with adhesive to prevent slippage or movement.

C. Supports, hangers, anchors and guides shall be provided for all horizontal and vertical piping. Shop Drawings shall be provided, indicating locations and details of anchors, guides, expansion loops and joints, hangers, etc. The hanger design shall conform to the ASME Code for Pressure Piping.

D. All auxiliary steel required for supports, anchors, guides, etc. shall be provided by the Mechanical Trades unless specifically indicated to be provided by others.

E. The supports, hangers, anchors, and guides for the chilled water supply and return piping, steam piping, condensate return piping, etc. of the Campus Loop System routed through utility tunnels and below buildings shall be provided as indicated on the Drawings.

F. Contractor shall review all Drawings, including Structural Drawings, for details regarding pipe supports, anchors, hangers, and guides.

G. All Supports shall be of type and arrangement to prevent excessive deflection, to avoid excessive bending stresses between supports, and to eliminate transmission of vibration.

H. All rod sizes indicated in this Specification are minimum sizes only. This trade shall be responsible for structural integrity of all supports, anchors, guides, etc. All structural hanging materials shall have a minimum safety factor of 5 built in.

I. Anchor points as indicated on Drawings or as required shall be located and constructed to permit the piping system to take up its expansion and contraction freely in opposite directions away from the anchored points.

J. Guide points shall be located and constructed wherever required or indicated on Drawings and at each side of an expansion joint or loop, to permit free axial movement only.

K. Supports, hangers, anchors, and guides shall be fastened to the structure only at such points where the structure is capable of restraining the forces in the piping system.

L. K. Hangers supporting and contacting brass or copper lines 3" in size and smaller shall be Grinnell Fig. CT-99c, adjustable, copper plated, tubing ring. Hangers supporting and contacting brass or copper lines 4" and larger shall be Grinnell Fig. 260, adjustable clevis, with a nut above and below the hanger, and approved neoprene isolating material between pipe (or tubing) and hanger on the support rod. For insulated copper or brass domestic water lines, hangers for all sizes of pipe shall be Grinnell Fig. 300, adjustable clevis, with a nut above and below the hanger, and approved neoprene isolating material between pipe (or tubing) and hanger on the support rod. Isolate all copper or brass lines from all ferrous materials with approved dielectric materials. Hangers supporting and contacting plastic or glass piping shall be of equal design, but shall be padded with neoprene material or equal. The padding material and the configuration of its installation shall be submitted for approval.

M. Hangers supporting insulated lines where the outside diameter of the insulation is the equivalent of 8" diameter pipe or smaller in size and supporting all ferrous lines 6" and smaller in size shall be Grinnell Fig. 260, adjustable clevis, with a nut above and below the hanger on the support rod.

N. Hangers supporting and contacting ferrous lines larger than 6" in size and outside of insulation on lines with the outside diameter equivalent to 10" diameter pipe shall be Grinnell Fig. 260, adjustable clevis, with a nut shields as specified in Section 23 07 19 - PIPING INSULATION. Protect insulation from crushing by means of a section of rigid insulation to be installed at hanger points. Hangers for high temperature insulated pipes and all insulated hot and cold domestic water pipes shall be encased in the insulation unless supported by trapezes in which case shield and rigid insulation shall be provided as specified above for low temperature insulated pipes.

O. Supports for vertical piping in concealed areas shall be double bolt riser clamps, Grinnell Fig. 261, or other approved equal, with each end having equal bearing on the building structure, and located at each floor. Two-hole rigid pipe clamps at 4 ft. o.c. or Kindorf channels and Grinnell Fig. 261 riser clamps may be used to support pipe directly from vertical surfaces or members where lines are not subject to expansion and contraction. When piping is subject to expansion and contraction, provide spring isolators (see Section 23 05 48 - Vibration Isolation). Where brass or copper lines are supported on trapeze hangers or Kindorf channels the pipes shall be isolated from these supports with plastic tape with insulating qualities, or strut clamps as manufactured by Specialty Products Company, Stanton, California.

P. Supports for vertical piping in exposed areas (such as fire protection standpipe in stairwells) shall be attached to the underside of the building structure above the top of the riser, and the underside of the penetrated structure. The contractor shall use a drilled anchor as specified above, and use a Grinnell No. 595 Socket Clamp with Grinnell No. 594 Socket Clamp Washers, as a riser clamp. The top riser hanger shall consist of two (2) hanger rods (sized as specified) anchored to the underside of the building structure, supporting the pipe by means of the material specified. Risers penetrating floors shall be supported from the underside of the penetrated floor as specified for the top of the riser.

Q. Pipe Supports in Chases and Partitions: Horizontal and vertical piping in chases and partitions shall be supported by hangers or other suitable support. Pipes serving plumbing fixtures and equipment shall be securely supported near the point where pipes penetrate the finish wall. Supports shall be steel plate, angles, or special channels such as Unistrut mounted in vertical or

horizontal position. Pipe clamps such as Unistrut P2426, P2008, P1109 or other approved clamps shall be attached to supports. Supports shall be attached to wall or floor construction with clip angles, brackets, or other approved method. Supports may be attached to cast iron pipe with pipe clamp, or other approved method. All copper or brass lines shall be isolated from ferrous metals with dielectric materials to prevent electrolytic action.

R. All electrical conduits shall be run parallel or perpendicular to adjacent building lines. Single conduits running horizontally shall be supported by "Caddy" or "Minerallac" type hangers from adequately sized rods (minimum 1/4") from the building structure. Where multiple conduits are run horizontally, they shall be supported on trapeze of "Unistrut" type channel suspended on rods or bolted to vertical building members. Conduit shall be secured to channel with galvanized "Unistrut" type conduit clamps or stainless steel "Unistrut" type "Uni-Clips". All hangers shall be fastened to the building structure in the same manner as specified above for pipe hangers above and below the hanger on the support rod.

S. Other special type of hangers may be employed where so specified or indicated on the Drawings, or where required by the particular conditions. In any case, all hangers must be acceptable to the owner.

T. Each hanger shall be properly sized to fit the supported pipe or fit the outside of the insulation on lines where specified. Hangers for dual or low temperature insulation pipes shall bear on the outside of the insulation, which shall be protected by support

U. Spacing of hangers shall be adequate for the weight and rigidity of the conduits involved; in any case, no greater than 8' centers. Where feasible, conduits may be fastened to the concrete by one hole straps thoroughly anchored to the concrete in an approved manner. Flexible conduit shall also be supported in an acceptable manner so as not to interfere with the maintenance of above ceiling equipment, and to support it from touching the ceiling system. Conduit shall be located so as not to inhibit removal of ceiling tiles.

END OF SECTION 230529

230548 - VIBRATION ISOLATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish and install vibration isolators for rotary, dynamic, or reciprocating equipment or components; include:

1. Inertia bases

2. Vibration isolation

1.2 RELATED SECTIONS:

A. Section 013300 Submittals.

A. Section 01524 Construction Waste Management

B. Section 01352 LEED Requirements

C. Section 01611 Environmental Management

D. Section 01570 Pollution Prevention and Control

1.3 REFERENCES

B. ASHRAE – Guide to average Noise Criteria Curves

A. Local codes and ordinances

B. Special conditions

1.4 SUBMITTALS

C. Indicate isolation base dimensions.

A. Indicate vibration isolator locations, with static and dynamic load.

B. Include calculation required to certify compliance with specified requirements.

C. Submit manufacturer’s certificate that isolators are properly installed and properly adjusted to meet or exceed specified requirements.

D. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
   b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.5 QUALITY ASSURANCE

D. Maintain ASHRAE criteria for average noise criteria curves for all equipment at full load condition.

A. Provide vibration isolation devices, including auxiliary steel bases and pouring forms, from a single manufacturer or supplier who will be responsible for complete coordination of all phase of this work.

1.6 INTENT OF RESPONSIBILITY

A. It is the intent of this specification to provide for vibration isolation supports for all equipment, piping, and ductwork as set out below. The transmission of perceptible vibration, structural borne noise, or objectionable air borne noise to occupied areas by equipment installed under this contract will not be permitted. The Contractor shall be held responsible for installing the vibration isolators as specified herein or shown on the drawings or otherwise required to prevent the transmission of vibration which would create objectionable noise levels in occupied

areas. The isolation supplier must be a firm capable of dealing effectively with vibration and noise characteristics effects and criteria, and one which can provide facilities and capabilities for measuring and evaluating the aforementioned disturbances.

A. All vibration isolation devices, including auxiliary steel bases and pouring forms, shall be designed and furnished by a single manufacturer or supplier who will be responsible for adequate coordination of all phases of this work. Concrete housekeeping pads and inertia bases shall be included as part of mechanical work. Pads under electrical gear shall be included as part of electrical work. The concrete work shall meet the requirements specified in the General Contract Specifications.

B. The Contractor shall furnish complete submittal data, including Shop Drawings, which shall indicate the size, type, and deflection of each isolator; and the supported weight, disturbing frequency, and efficiency of each isolator proposed; and any other information as may be required for the Architects and Engineers to check the isolator selection for compliance with the specification. All steel bases and concrete inertia bases shall be completely detailed, and shall show completely any reinforcing steel that may be required to provide a rigid base for the isolated equipment. Further, the submittal data shall indicate, clearly, outlined procedures for installing and adjusting the isolators and bases mentioned above.

C. The vibration isolation manufacturer, or his qualified representative, shall be responsible for providing such supervision as may be required to assure correct and complete installation and adjustment of the isolators. Upon completion of the installation and after the system is put into operation and before acceptance by the Owner, the isolation manufacturer or his qualified representative, in company with the Architect or his designated representative, shall make a final inspection and submit his report to the Architects and Engineers, in writing, certifying the correctness of the installation and compliance with approved submittal data. Any discrepancies or maladjustments found shall be so noted in the report. Should any noise or vibration be objectionable to the Owner, Architect or Engineer, a field instrumentation test and measurement must be made to determine the source, cause, and path of any such disturbance. Any variation or noncompliance with these specification requirements is to be corrected by the installing contractor in an approved manner.

D. Vibration isolation devices shall be as manufactured by Amber/Booth Company, Consolidated Kinetics, Korfund Dynamics Corporation, or approved equal.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 MANUFACTURERS

A. Amber-Booth Company

A. Mason Industries, Inc.

B. Noise Control, Inc.

2.5 GENERAL DESIGN FEATURES

A. Provide vibration isolation for all mechanical equipment. Provide inertia bases for all equipment mounted on upper floors.

A. All vibration isolators and bases furnished by the Contractor shall be designed for and treated for resistance to corrosion.

B. Steel components shall be PVC coated or phosphated and painted with industrial grade enamel. All nuts, bolts and washers shall be zinc-electroplated or cad-plated. Structural bases shall be thoroughly cleaned of welding slag and primed with zinc-chromate or metal etching primer. A finish coat of industrial grade enamel shall be applied over the primer.

C. All isolators exposed to the weather shall have steel parts PVC coated, hot-dip galvanized or zinc-electroplated plus coating of Neoprene or Bitumastic paint. Aluminum components for outdoor installation shall be etched and painted with industrial grade enamel.

D. Required spring deflections for isolators supporting various items of equipment are shown on the Drawings or tabulated elsewhere in these specifications, but in no case shall be less than one inch. The springs shall be capable of 30% over-travel before becoming solid.

E. Where height-saving brackets for side mounting of isolators are required, the height-saving brackets shall be designed to provide for an operating clearance of 2" under the isolated structure, and designed so that the isolators can be installed and removed when the operating clearance is 2" or less. When used with spring isolators having a deflection of 2-1/2" or more, the height-saving brackets shall be of the pre-compression type to limit exposed bolt length between the top of the isolator and the underneath side of the bracket.

F. All isolators supporting a given piece of equipment shall limit the length of the exposed adjustment bolt between the top and base to a maximum range of 1" to 2".

G. All isolators supporting a given piece of equipment shall be selected for approximately equal spring deflection.

H. Isolators for equipment installed out-of-doors shall be designed to provide adequate restraint due to normal wind conditions and to withstand wind load of 55 PSF (pounds per square foot) applied to any exposed surface of the equipment without failure.

2.6 ISOLATION BASES

A. Type A: Integral structural steel fan and motor base with motor slide rails.

A. Type B: Slung structural steel base with gusseted brackets.

B. Type C: Reinforced 3,000 psi concrete set in full depth perimeter structural steel channel frame, with gusseted brackets and anchor bolts.

C. Type D: Reinforced 3,000 psi concrete base with chamfered edges without channel frame.

2.7 BASE TYPES: BASE TYPES AND REQUIRED DEFLECTIONS ARE SPECIFIED UNDER "SCHEDULE OF ISOLATED EQUIPMENT," PARAGRAPH 7.8, OR ARE INDICATED ON THE DRAWINGS. THE BASES SHALL COMPLY WITH THE FOLLOWING DESCRIPTIONS FOR EACH TYPE REQUIRED ON THE PROJECT.

A. Type B-1 - A structural steel fan and motor base with motor side rails and holes drilled to receive the fan and motor. The steel members shall be adequately sized to prevent distortion and misalignment of the drive, and specifically shall be sized to limit deflection of the beam on the drive side to 0.05" due to starting torque. Snubbers to prevent excessive motion on starting or stopping shall be furnished, if required; however, the snubbers shall not be engaged under steady running conditions.

A. Type B-2 - A concrete inertia base, consisting of a perimeter steel pouring forming, reinforcing bars welded in place, bolting templates, anchor bolts, and height saving brackets for side mounting of the isolators. The perimeter steel members shall be structural channels having a minimum depth of 1/12 of the longest span, but not less than 6" deep. The inertia base for pumps shall be at least equal in weight to the pump with its driving motor and be sized for a minimum overlap of 4" around the base of the equipment. Concrete inertia bases for pumps shall be sized to support the suction elbow of end suction pumps and both the suction and discharge elbows of horizontal split case pumps. The bases shall be T-shaped where necessary to conserve space.

2.8 VIBRATION ISOLATORS

A. Type 1 - An adjustable, free-standing, open-spring mounting with combination leveling bolt and equipment fastening bolt. The spring(s) shall be rigidly attached to the mounting base plate and to the spring compression plate. The isolator shall be designed for a minimum Kx/Ky (horizontal to vertical spring rate) of 1.0. A Neoprene pad having a minimum thickness of 1/4" shall be bonded to the base plate. Base plates shall be sized to limit pad loading to 100 psi.

A. Type 2 - An aluminum-housed, or cast iron housed, adjustable, spring mounting having telescoping top and bottom sections separated by resilient inserts of Neoprene or other suitable material to limit horizontal motion. The inserts shall be permanently lubricated to minimize vertical friction. Sheet or cast iron housings may be used if they are hot-dip galvanized after fabrication. A Neoprene pad having a minimum thickness of 1/4" shall be bonded to the base plate.

B. Type 3 - An elastomeric mounting having steel base plate with mounting holes and a threaded insert at top of the mounting for attaching equipment. All metal parts shall be completely embedded in the elastomeric materials. The elastomer may be Neoprene or high synthetic rubber with anti-ozone and anti-oxidant additives. Mountings shall be designed for approximately 1/4" deflection and loaded so that deflection does not exceed 15% of the free height of the mounting.

C. Type 4 - A pad-type mounting consisting of two layers of 3/8" thick, ribbed or waffled, Neoprene pads bonded to a 16 gauge galvanized steel separator plate. Bolting not required. Pads shall be sized for approximately 20 to 40 psi load, or a deflection of 0.10" to 0.16".

D. Type 5 - A spring hanger consisting of a rectangular steel box, coil springs, spring cups, Neoprene impregnated fabric washer, steel washer, and Neoprene insert designed to prevent metal to metal contact between the hanger rod and bottom of the hanger box. The hanger box shall be capable of supporting a load of 200% of rated load without noticeable deformation or failure.

E. Type 6 - A spring hanger, as described in Type 5, with the addition of an elastomeric element at the top of the box for acoustic isolation. The design shall be such to prevent metal - to metal contact between the hanger rod and the top of the hanger box. The elastomeric element shall meet the design requirements for Type 3 mountings.

F. Type 7 - An elastomeric hanger, consisting of a rectangular steel box and an elastomeric isolation element, which shall be of Neoprene or high quality synthetic rubber with anti-ozone and

anti-oxidant additive. The elements shall be so designed for approximately 1/4" deflection and loaded so that deflection does not exceed 15% of the free height of the element. The design shall be such as to prevent metal-to-metal contact between the hanger rod and the steel box.

2.9 FABRICATION

A. Provide pairs of neoprene side snubbers or restraining springs where side torque or thrust may develop.

A. Color code spring mounts.

B. Select spring to operate at two-thirds maximum compression strain, with 1/4 inch ribbed neoprene pads.

C. Type 1 Isolators: Fabricate with cast aluminum or hot-dipped galvanized steel housing with PVC coated steel spring and neoprene pad bonded to base plate.

2.10 VIBRATION ISOLATION ROOF CURBS FOR ROOF MOUNTED UNITS

A. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb designed to resiliently support roof-mounted equipment and to withstand 125-mph wind impinging laterally against the side of the equipment.

1. Components: Upper support frame; lower support assembly; freestanding, un-housed, laterally stable steel springs; vertical and horizontal restraints.

2. Lower Support Assembly: Provide a means of attachment to the building structure and include a wood nailer stripe for attachment of roof material and 2 inches of rigid insulation on the inside of the assembly.

3. Spring Isolators: As indicated or scheduled. Include adjustment bolt to permit leveling of equipment after installation. Attach to lower assembly with a rubber isolation pad. Locate spring isolators so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

4. Water Seal: Elastomeric seal conforming to UL Class A roofing materials, attached to the upper support frame, extending down past the wood nailer of the lower support assembly, and counter flashed over the roof materials.

PART 3 - EXECUTION

3. 1 INSTALLATION

A. Install vibration isolators for motor driven equipment.

A. Set steel bases for 1 inch clearance between housekeeping pad and base. Set concrete inertia bases for 2 inch clearance. Adjust equipment level.

B. Provide spring isolators on piping connected to isolated equipment as follows:

- Up to 4 inch diameter, first three points of support; five to 8 inch diameter, first four points of support;
- 10 inch diameter and over, first six points of support. Static deflection of first point to be twice deflection of isolated equipment.

C. Provide minimum of four hangers for each fan coil unit and fan powered terminal units. Provide isolators for each hanger.

3. 2 SCHEDULE

Isolated Equipment	Base Type	Isolator Type
Air Handling Units Floor Mounted	B-1	1
Centrifugal Fans Class I & II to 54 inches Class I & II over 60 inches Class III	B-1 B-2 B-2	1 1 1
Chillers (Grade mounted) Roof mounted AHU	Concrete Pad	4
Other than Slab on Grade	B-2	1
Pumps 3 hp & Smaller 5 hp & Over	 B-1 B-2	 7 2
Piping		5
Isolated Equipment	Base Type	Isolator Type
Ductwork		N/A

Fan Powered Terminal Units		6
Fan Coil Units		6

END OF SECTION 230548

230553 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish and install materials for identification of mechanical products installed under Division 22 and 23.

1.2 RELATED SECTIONS

A. Section 090190 – Maintenance of Painting and Coatings.

B. Section 013300 Submittals.

C. Section 01524 Construction Waste Management

D. Section 01352 LEED Requirements

E. Section 01611 Environmental Management

F. Section 01570 Pollution Prevention and Control

1.3 REFERENCES

A. ANSA A 13.1 – Scheme for the Identification of Piping Systems.

B. NFPA 90A – Installation of air conditioning and Ventilating Systems.

1.4 SUBMITTALS

A. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 - PRODUCTS

A. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.

b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
   b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

2.1 MANUFACTURERS

B. W.H. Brady Company

C. Marken Corporation

D. Seton Name Plate Company

2.2 MATERIALS

A. Color: Meet requirements of ANSI A13.1, unless specified otherwise.

E. Plastic Nameplates: Laminated three-layer plastic with engraved white letters on a black background; minimum size 3 inches long and 1 inch high. Minimum lettering height for numbers and names is 1/4-inch and other data is 1/8-inch.

F. Metal Tags: Brass with stamped letters: tag size if minimum of 1-1/2 inch diameter with smooth edges.

G. Stencils: With clean cut symbols and letters 2-1/2 inch high for ductwork and equipment

H. Stencil Paint: Semi-gloss, high built epoxy esther or alkyd paint.

I. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering, minimum information indicating flow direction arrow and fluid being conveyed.

J. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

K. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inches wide by 4 mil thick, manufactured for direct burial service.

L. Paint:

1. Material Capability: Provide primers, undercoat, finish coat, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.

2. Material Quality:
   a. Provide the manufacturer's highest-quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
   b. Use of manufacturer=s proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish the manufacturer's material data and certificates of performance for proposed situations.
   c. Provide primer and undercoat materials with a minimum six month guaranteed life against fade and/or color bleed-through.

3. Colors: Provide color samples to the Architect/Engineer for selection form the manufacturer's full range of standard colors.

4. Primers: Provide the manufacturer's recommended factory-formulated primers that are compatible with the substrate and finish coats indicated. Subject to compliance with requirements, prime coat materials that may be incorporated in the Work include, but are not limited to the following:
   a. Galvanized Metal Primers:
      1) Devoe: 13201 Mirrorlac Galvanized Metal Primer.
      2) Gidden: 5229 Glid-Guard All-Purpose Metal Pirmer.
      3) Moore: IornClad Galvanized Metal Latex Pirmer #155.
   b. Ferrous Metal Primers
      1) Devoe: 14920 Bar-Ox Quick Dry Metal Primer, Red.
      2) Gidden: 5210 Glid-Guard Universal Fast-Dry Metal Primer.
      3) Moore: IornClad Retardo Rust-Inhibitive Paint #163.

5. Undercoat Materials: Provide the manufacturer's recommended factory-formulated primers that are compatible with the substrate and finish coats indicated. Subject to

compliance with requirements, prime coat materials that may be incorporated in the Work include, but are not limited to the following:

a. Galvanized Metal Primers:
   1) Devoe: 8801 Velour Alkyd Enamel Undercoat.
   2) Gidden: 4200 Spred Ultra Semi-Gloss Enamel.
   3) Moore: Moore's Alkyd Enamel Underbody #217.
b. Ferrous Metal Primers
   1) Devoe: 8801 Velour Alkyd Enamel Undercoat.
   2) Gidden: 4200 Spred Ultra Semi-Gloss Enamel.
   3) Moore: Moore's Alkyd Enamel Underbody #217.

6. Finish Paint: Provide the manufacturer's recommended factory-formulated primers that are compatible with the substrate and finish coats indicated. Subject to compliance with requirements, prime coat materials that may be incorporated in the Work include, but are not limited to the following:
   a. Galvanized Metal Primers:
      1) Devoe: 26XX Velour Alkyd Semi-Gloss Enamel.
      2) Gidden: 4200 Spred Ultra Semi-Gloss Enamel.
      3) Moore: Moore's Sating Impervo Enamel #235.
   b. Ferrous Metal Primers
      1) Devoe: 26XX Velour Alkyd Semi-Gloss Enamel.
      2) Gidden: 4200 Spred Ultra Semi-Gloss Enamel.
      3) Moore: Moore's Sating Impervo Enamel #235.
   c. Cotton or Canvas Covering Over Insulation Interior Flat Latex Emulsion Size:
      1) Devoe: 36XX Wonder-Tones Latex Flat Wall Paint.
      2) Gidden: 3400 Spred Satin Latex Wall Paint.
      3) Moore: Regal Wall Sating #215.

PART 3 - EXECUTION

3. 1 PREPARATION

A. Thoroughly clean all surfaces to be painted as required to remove all oil, grease, loose scale, rust, and foreign matter. Piping must be completely dry at the time of application. The painting of piping associated with an operating system is strictly prohibited. Site touch-up of the factory applied coating or paint, to include preparation and painting of field welds, must be completed and approved by the Engineer prior to installation of insulation (No Exceptions).

3. 2 INSTALLATION

A. General: The Contractor shall make it possible for the personnel operating and maintaining the equipment and systems in this project to readily identify the various pieces of equipment, valves, piping, etc., by marking them. All items of equipment such as fans, pumps, etc., shall be clearly marked using engraved nameplates as hereinafter specified. The item of equipment shall indicate the same number as shown on the Drawings. For example, pumps will be identified as 3A, 3B, 3C, etc.; exhaust fans will be E-1, E-2, etc.; supply fans will be S-1, S-2, etc.

B. Mechanical: All items of mechanical equipment shall be identified by the attachment of engraved nameplates constructed from laminated phenolic plastic, at least 1/16" thick, 3-ply, with black surfaces and white core. Engraving shall be condensed Gothic, at least 1/2" high, appropriately spaced. Nomenclature on the label shall include the name of the item, its mark number, area, space, or equipment served, and other pertinent information. Equipment to be labeled shall include but not be limited to the following:

C. Electrical: Nameplates shall be 2 or 3 ply laminated plastic, a minimum of 3/32" thick, such that letters will be white on black background. Letters shall be similar to Roman Gothic of a size that is legible and appropriate to the application. Attachment of nameplates shall be by screws. Rivets or adhesives are not acceptable.

D. Electrical equipment to be identified includes: All switchgear, distribution panels, transformers, motor control centers, panel boards, disconnect switches, starters, contactors and time switches.

E. Nameplates on distribution panels, motor control centers and panel boards shall give voltage characteristics.

Example:
PANEL LA
120/208V, 3 PH, 4 W
served from.

F. Individual circuit breakers in distribution panels, individual units in motor control centers, disconnecting means, and motor starters, shall have nameplates showing the load served.

G. Branch circuit panel boards shall have neatly typed circuit directories behind clean plastic. Identify circuits by room numbers. Room numbers shall be those finally selected by the Owner, not necessarily those given on contract Drawings. If a circuit serves more than one room, list each room. Spares and spaces shall be indicated with erasable pencil, not typed.

H. The Contractor shall prepare and install, in a suitable glazed frame, typewritten valve charts giving the number, location and function of each line valve installed under this Contract. Each valve shall be numbered on these charts in accordance with the system of which it is a part of its location. For example, valves in different systems would be designated as follows:

HWS-1-3 Hot water Supply	1st Level - Valve No. 3
CHS-2-4 Chilled Water Supply	2nd Level - Valve No. 4

3. 3 VALVE TAGS

A. The Contractor shall provide and install identification tags lettered and numbered to correspond to the information shown on the charts described above. These tags are to be affixed to all valves except simple service and drain valves located within 10' and within sight of the device or equipment served. For example, it would not be expected that valves at a pressure reducing station in a machine room would be tagged. These tags shall be 1/8" thick brass discs, 1 1/2" in diameter. Each tag shall be attached to its valve with copper clad annealed iron wire or other approved material.

B. Valves at water headers and steam PRV stations, valves associated with condensate, gas, water meters, and other valves as specified shall also be tagged with standardized color coded plastic tags. These tags shall be 2 1/2" wide by 1 1/2" high with these color codlings: Red = normally closed; Green = normally open; Blue = open in winter, closed in summer; and Yellow = closed in winter, open in summer. Tags should be engraved on both sides.

C. In addition, pipe runs throughout the building including those above lift out ceilings, under floor, and those exposed to view when access doors or access panels are opened shall be identified by means of Seton Setmark or Brady Mechanical Pipe Markers. Concealed areas, for purposes of this identification section, are those areas which cannot be seen except by demolition of the building elements. In addition to the pipe markers, arrow markers shall be used to indicate direction of flow. The following specific instructions shall apply to the application of these markers:

D. Provide a pipe marker at each valve to indicate proper identification of pipe contents. Where several valves exist on one header, it is necessary to mark only the header.

E. Provide an arrow marker with each pipe marker pointing away from the pipe marker to indicate direction of flow.

F. Provide a double ended arrow marker when flow can be in either or both directions.

G. Provide a pipe marker and an arrow marker at every point of pipe entry or exit where line goes through a wall or service column.

H. Provide pipe markers and arrow markers at intervals not exceeding 50 feet.

I. Markers shall be located on the two lower quarters of the pipe where view is unobstructed.

J. Use Seton Setmark Type SNA or Brady Snap-on type identification for all piping systems, 3/4" thru 6". For piping systems larger than 6", use Seton or Brady strap on markers.

K. Pipe Markers shall conform to ANSI A 13.1-1981 "Scheme for the Identification of Piping Systems." Arrow markers must have same ANSI background colors as their companion pipe markers, or be incorporated into the pipe identification marker.

L. Locate markers to be visible from floor.

M. Plastic Nameplates: Secure nameplates to equipment fronts using corrosive resistant screws and rivets. Install nameplates parallel to equipment lines.

N. Metal Tags: Install with corrosive-resistant chain and "j-hook."

O. Stencil Painting: Apply single coat sufficient to cover background completely with minimum 4 mils dry film thickness.

P. Plastic Pipe Markers: Install in accordance with manufacturer's instructions.

Q. Plastic Tape Pipe Markers: Install completely around pipe in accordance with manufacturer's instructions.

R. Underground Plastic Pipe Markers: Install 6 to 8 inches below finished grade, directly above buried pipe.

S. Equipment

1. Identify mechanical equipment scheduled on Drawings with nameplates, except of air devices, sprinkler heads, plumbing fixtures, and plumbing shock absorbers.

2. Identify name, number, function, capacity, and other pertinent information of air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates.

T. Controls: Identify control panels and major control components outside panels with plastic nameplates.

U. Valves: Identify with metal tags, ALL valves in main and branch piping connections to equipment, and all run out piping to coils with metal tags.

V. Fire Dampers: Label with plastic nameplates in accordance with NFPA 90A.

W. Piping

1. Paint all exposed piping, including insulated piping, in mechanical and equipment rooms with colors to meet ANSI standards. In addition, identify all piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. Identify service, flow direction and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 10 feet on straight runs, including risers and drops, adjacent to each valve and tee at each obstruction. Provide a flow arrow at each identification marker.

2. Paint all exposed piping, including insulated piping, with primer and undercoat only. Provide color samples to the Architect for selection from the manufacturer’s full range of standard colors. Refer to Section 090190 for finish coat compatibility.

X. Ductwork:

1. Paint all exposed ductwork with primer and undercoat only. Provide color samples to the Architect for selection from the manufacturer’s full range of standard colors. Refer to Section 090190 for finish coat compatibility

2. Paint all ductwork, except as indicated above, with stenciled painting. Identify as to air handling unit number, zone number, and area served. Locate identification at air handling unit, at each side of all wall and floor penetrations or enclosures and at each obstruction.

3. Preparation:
   a. Examine substrates and conditions under which painting is to be performed for compliance with paint application requirements. Surfaces receiving paint must be thoroughly dry before paint is applied.
   b. Before applying paint or other surface treatments, thoroughly clean substrates of substances that could impair the bond of the various coatings. Remove all oil and grease prior to cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
   c. Clean and prepare surface to be painted according to the manufacturer's instruction for each particular substrate condition and as specified.
   d. Clean galvanized surfaces with nonpetroleum-based solvents so that the surface is completely free of oil and surface contaminates. Remove pretreatment from galvanized sheet metal by mechanical methods.
   e. Do not begin to apply paint until unsatisfactory conditions have been corrected.
   f. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

4. Application
   a. Apply paint to all ductwork surfaces as previously indicated, according to manufacturer's directions. Use applicators and techniques best suited or the substrate and type of material being applied.
   b. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable pain film.
      1) Paint colors, surface treatments, and finishes are indicated in the schedules.
      2) Provide primers and undercoats that are compatible with finish coats used (No Exceptions).
      3) The number of coats and film thickness required are the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce a smooth even surface according to the manufacturer's directions.
   c. Apply additional coats if undercoats, stains, or other conditions show through finish coat of point until paint film is of uniform finish, color, and appearance. Provide special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.
   d. The term "exposed piping and ductwork surfaces" is denied to include all visible or open-to-view areas, related hangers, supports, diffusers, grilles, and other similar components. Extend coating sin these areas, as required, to maintain the system integrity and provide the desired protection.
   e. Paint interior surfaces of all ducts, where visible through grilles, registers, or diffusers, with flat, non-specular black paint.
   f. Minimum Coating Thickness: Apply materials no thinner than the manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer or as herein specified, whichever is the greater.
      1) Primer: Apply a minimum of two coats with a total dry film thickness of not less than 2.5 mils.

2) Undercoat: Apply a minimum of two coats over primer with a total dry film thickness of not less than 2.5 mils.
3) Lusterless (Flat) Finish: Apply a minimum of two coats over primer and undercoat with a total dry film thickness not less than 2.5 mils.
4) Semi-gloss Finish: Apply a minimum of two coats over primer and undercoat with a total dry film thickness not less than 3.0 mils.

Y. Use identification of equipment on the “Record Drawings” for nameplate designations.

Z. Attach identification for items such as special switches, etc., located in finished areas, on or in the immediate vicinity of the item.

3. 4 VALVE CHART AND SCHEDULE

A. Provide valve chard and schedule in aluminum frame with clear plastic shield. Install on in each individual equipment room at locations as directed engineer or Owner.

3. 5 COLOR CODE FOR MARKING PIPE

MATERIAL	BAND	LETTERS AND ARROWS	LEGEND
Cold water (portable) WATER	Green	White	PORTABLE
Fire protection water (WATER)	Red	White	FIRE PR.
Hot water (domestic)	Green	White	H.W.
Hot water re-circulating (domestic)	Green	White	H.W.R.
Heating water supply	Yellow	Black	L.TW.S.
Heating water return	Yellow	Black	L.T.W.R.
Chilled water supply	Green	White	C.H.W.S.
Chilled water return	Green	White	C.H.W.R.
Treated water	Yellow	Black	TR. WATER
Chemical feed	Yellow	Black	CH. FEED

3. 6 COLOR CODE FOR MARKING SIZES

OUTSIDE DIAMETER OF PIPE COVERING (INCHES)	LENGTH OF COLOR BAND (INCHES)	ARROW LENGTH BY WIDTH (INCHES)	SIZE OF LEGEND LETTERS AND NUMBERS (INCHES)
Less than 1-1/2	8	8 x 2-1/4	1/2
1-1/ to 1-3/8	8	8 x 2-1/4	3/4
2-1/2 to 1-7/8	12	8 x 2-1/4	1-1/4
8 to 10	24	12 x 4-1/2	2-1/2
Over 10	32	12 x 4-1/2	3-1/2

END OF SECTION 230553

230593 - SYSTEM TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

A. Related Sections:

1. Section 013300 Submittals.
2. Section 01524 Construction Waste Management
3. Section 01352 LEED Requirements
4. Section 01611 Environmental Management
5. Section 01570 Pollution Prevention and Control

1.2 RELATED DOCUMENTS

A. Contract Documents, General Requirements for Building Construction and Related Work, apply to work specified in this section.

B. Coordinate with Commissioning Requirements indicated in Section 019113. This contractor is responsible to comply with all requirements for the above section.

1.3 SCOPE

A. An independent Testing, Adjusting and Balancing (TAB) Contractor for the HVAC systems shall be selected by Owner and paid by Contractor and conform as part of this contract. TAB contractor shall not be hired by general contractor or any sub-contractor. Mechanical Contractor shall provide all assistance and information requested by the TAB contractor.

B. This section provides for the testing and balancing, of all systems and equipment. Refer to section 019113 for commissioning requirements.

C. These tests are required to determine that all systems and equipment involved may be safely energized and equipment.

D. Perform tests by and under the supervision of fully experienced and qualified personnel. Advise each respective manufacturer’s representative of tests on their equipment.

E. Record all test data.

F. Each section of Divisions 22 and 23 that has the products or systems listed herein, incorporate this section by reference and is incomplete without the required tests stated herein.

G. This Section includes testing, adjusting, balancing HVAC systems and alarm point reporting verification to produce design objectives, including the following:

1. Balancing airflow and water flow within distribution systems, including sub-mains, branches, and terminals, to indicated quantities according to specified tolerances.

2. Adjusting total HVAC systems to provide indicated quantities.

3. Measuring electrical performance of HVAC equipment.

4. Testing, adjusting, and balancing of Hydraulic piping systems.

5. Testing, adjusting, and balancing of refrigerating systems.

6. Measurement of final operating condition of HVAC systems.

7. Sound measurement of equipment operating conditions.

8. Setting quantitative performance of HVAC equipment.

9. Verifying that automatic control devices are functioning properly and perform their intended functions.

10. Calibrating automatic temperature control sensors.

11. Verification of building alarm and alarm remote monitoring.

1.4 QUALIFICATIONS

A. The independent testing, adjusting, and balancing agency certified by National Environmental Balancing Bureau (NEBB) or by the Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified by NEBB or AABC as a Test and Balance Engineer.

B. The Firm shall have operated a minimum of five (5) years under its current Firm name, and shall be in good standing with the State of Texas, Franchise Tax Board. The firm shall submit their full incorporated name, Charter Number and Taxpayer's I.D. Number for proper verification of the firm's status.

C. The Firm shall be capable of providing a performance bond, by a bonding company licensed to do business in the State of Texas, if determined by the Owner that such a bond is required. The amount of the bond which may be required shall be equal to the cost of the proposal submitted, or in the case of more than one proposal, the sum of all such proposals and any awarded work in progress.

D. All personnel used on the job site shall be either professional engineers or engineering technicians, who shall have been permanent, full time employees of the firm for a minimum of six (6) months prior to the start of work for this specific project.

E. The TAB firm shall submit biographical data on the individual proposed who will directly supervise the TAB work, as well as other personnel scheduled to perform the technical work under the contract. It shall also submit a background record of at least five years of specialized experience in the field of air hydronic system balancing, and shall possess properly calibrated instrumentation. The supervisory personnel for the TAB firm shall be registered engineers in the mechanical field and all of the employees used in the TAB firm shall be permanent, full-time employees of the firm.

F. Pre-Balancing Conference: Prior to beginning of testing, adjusting, and balancing procedures, schedule and conduct a conference with the Engineer and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of the system operation and readiness for testing, adjusting, and balancing.

G. Test, adjust, and balance the air systems before hydraulic, steam, and refrigerant systems.

H. Test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within five degrees Fahrenheit wet bulb temperature of maximum summer design condition, and within ten degrees Fahrenheit dry bulb temperature of minimum winter design condition. Take final temperature reading during seasonal operation.

I. Approved TAB Contractors:

1. Engineered Air Balance

2. Precision Air

1.5 SERVICES OF THE MECHANICAL CONTRACTOR

A. Contractor shall provide all volume dampers, balancing dampers, balancing valves, test ports and Pete’s plugs as required by the Testing and Balancing Firm.

B. Contractor shall furnish a set of sheet metal shop drawings and HVAC piping drawings to the Testing and Balancing Firm during the submittal phase and incorporate the Testing and Balancing Firm’s mark-ups and requests into the project.

C. Contractor shall provide all required equipment to facilitate Testing and Balancing Firm’s work. This coordination shall be included in the Contractor’s base bid price.

D. Provide, correct, repair or replace deficient items or conditions found during the testing and balancing.

E. Provide replacement sheaves as directed by TAB Contractor to achieve scheduled air volumes.

F. For motors with a variable frequency drive, contractor shall provide belt and sheave adjustment such that units deliver their design CFM when speed drive is at 60 hertz.

G. Verify systems are complete and operable before commencing work. Verify the following:

1. Systems are started and operating in safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place or in normal position.
15. Service and balancing valves are open.
16. 1Re-sheave

1.6 REPORTS

A. The TAB firm shall, as a requirement of the TAB contract, arrange with the Architect to compile one set of mechanical specifications, all pertinent change orders, and the following:

1. One complete set of Drawings less the structural sheets.
2. One set of mechanical floor plans of the conditioned spaces. These Drawings shall be hard copy and PDF type to facilitate marking.

B. Approved submittal data on equipment installed, and related changes as required to accomplish the test procedures outlined in Paragraphs 1.06 through 1.10 of this Specification will be available through the Construction Inspector.

C. Submit test report forms for review a minimum of 30 days prior to requesting a final review by the Architect/ Engineer.

D. Furnish six (6) individually bound copies of test data. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of test instrument and list all measurements take, both prior to and after any corrections are made to the system. Record all failures and corrective action taken to remedy incorrect situation.

E. The Architect will retain on (1) copy and the Engineer will retain one (1) copy. The remaining four (4) copies will be returned to the Contractor for inclusion in the operation and maintenance manuals. Refer to Division 01 – Closeout Submittals.

1.7 REFERENCES

A. AABC. 1989. National Standards for Total System Balance, 5th edition.

B. AABC. 1997. Testing and Balancing Procedures.

C. ASHRAE – 1999 Applications Handbook: Chapter 36 – Testing, Adjusting and Balancing.

D. ASHRAE – 1999 Applications Handbook: Chapter 41 – Building Commissioning.

E. ASHRAE – 1999 HVAC Application Handbook: Chapter 46, Sound and Vibration Control.

1.8 RESPONSIBILITIES OF THE TAB FIRM

A. The TAB personnel shall check, adjust, and balance the components of the air conditioning system which will result in optimal noise, temperature, and airflow conditions in the conditioned spaces of the building while the equipment of the system is operating economically. This is intended to be accomplished after the system components are installed and operating as provided for in the contract documents. It is the responsibility of the Mechanical Contractor to place the equipment into service. Variable air volume systems shall be balanced in accordance with AABC 1989 Standard, Fifth Edition.

B. Liaison and Early Inspection:

1. The TAB firm personnel shall support on the job the commissioning authority responsible to act as liaison between the Owner, Architect and Contractor. The following reviews (observations) and tests shall be performed by the TAB Agency:
    a. During the design stage, before the documents are finalized, review the mechanical drawings and specifications for balance ability and provide commentary.
    b. During construction, review all HVAC submittals such as control diagrams, air handling devices, etc., that pertain to commissioning work and balance ability.

c. Allow for a fixed number of trips to the project site, over and above those required for testing and balancing for inspection of installation of the mechanical piping systems, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems during the construction stage. These inspections shall be made prior to and/or at the above ceiling inspection. Commentary will be provided to the RCM of each observation.

d. Test one (1) 8" single duct terminal box for performance capability and leakage as described in Section 23 36 00. The shipment of the box to the TAB Agency's lab will be at the manufacturer's cost and the test period will be for three (3) weeks from receipt of the box. Submittal data will not be approved until box testing passes. If the sample box is rejected for any reason the second test will be at the Contractor's cost and the time allowed will restart when the box is received at the TAB Agency.

e. Test one (1) 8" dual duct box for performance capability and leakage as described in Section 23 36 00. The shipment of the box to the TAB Agency's lab will be at the manufacturer's cost and the test period will be for three (3) weeks from receipt of the box. Submittal data will not be approved until box testing passes. If the sample box is rejected for any reason the second test will be at the Contractor's cost and the time allowed will restart when the box is received by the TAB agency.

f. Test 10% of the single and dual duct boxes for casing and damper leakage when the shipment arrives at the project site. All testing (except for the initial boxes) shall be performed on site. Boxes requiring re-testing will be charged to the Contractor at the unit price provided to the Owner.

g. Test one (1) lab configuration including fume hood with air valve, general exhaust air with air valve and supply air with air valve for performance capability through a full range of inlet pressures. The tracking capability of the exhaust air versus the supply air will be with the submitted hood sash fully open and as the sash is closed in 2" increments until fully closed. Track the three (3) valves' response time in relation to sash movement and the lab differential.

1) During the balancing process, as abnormalities and malfunctions of equipment or components are discovered by the TAB personnel, the Construction Inspector shall be advised in writing so that the condition can be corrected by the Mechanical Contractor. The written document need not be formal, but must be understandable and legible. Data from malfunctioning equipment shall not be recorded in the final TAB report. The TAB firm shall not instruct or direct the Contractor in any of the work, but will make such reports as are necessary to the Owner.

1.9 VABRIATION TESTS

A. Location of Points for Air Handling Unit Fans and all other Fans:

1. Fan bearing, drive end.

2. Fan bearing, opposite end.

3. Motor bearing, center (if applicable)

4. Motor bearing, drive end.

5. Motor bearing, opposite end.

B. Test Readings.

1. Horizontal, velocity and displacement.

2. Vertical, velocity and displacement.

3. Azial, velocity and displacement.

C. Normally acceptable readings, velocity and acceleration.

D. Unusual conditions at time of test.

E. Vibration sources (if non-complying)

1.10 FINAL AIR BALANCE

A. General: When systems are complete and ready for operation, the TAB Consultant will perform a final air balance for all air systems and record the results. The outside, supply, exhaust and return air volume for each air handling unit, supply fan and exhaust fan and the supply, exhaust or return air volume for each distribution device shall be adjusted to within ±5% of the value shown on the drawings. Air handling unit and fan volumes shall be adjusted by changing fan speed and adjusting volume dampers associated with the unit. Air distribution device volume shall be adjusted using the spin-in tap damper for flexible duct connected devices and the device OBD for duct connected devices. Air distribution devices shall be balanced with air patterns as specified. Duct volume dampers shall be adjusted to provide air volume to branch ducts where such dampers are shown. The general scope of balancing by the TAB Consultant will include, but is not limited to, the following:

1. Filters: Check air filters and filter media and balance only system with essentially clean filters and filter media. The Division 23 Contractor shall install new filters and filter media prior to the final air balance.

2. Blower Speed: Measure RPM at each fan or blower to design requirements. Where a speed adjustment is required, the Division 23 Contractor shall make any required changes.

3. Ampere Readings: Measure and record full load amperes for motors.

4. Static Pressure: Static pressure gains or losses shall be measured across each supply fan, cooling coil, heating coil, return air fan, air handling unit filter and exhaust fan. These readings shall be measured and recorded for this report at the furthest air device or terminal unit from the air handler supplying that device. Static pressure readings shall also be provided for systems which do not perform as designed.

5. Equipment Air Flow: Adjust and record exhaust, return, outside and supply air CFM (s) and temperatures, as applicable, at each fan, blower and coil.

6. Coil Temperatures: Set controls for full cooling and for full heating loads. Read and record entering and leaving dry bulb and wet bulb temperatures (cooling only) at each cooling coil, heating coil and HVAC terminal unit. At the time of reading record water flow and entering and leaving water temperatures (In variable flow systems adjust the water flow to design for all the above readings).

7. Zone Air Flow: Adjust each zone of multizone units, each HVAC terminal unit and air handling unit for design CFM.

8. Outlet Air Flow: Adjust each exhaust inlet and supply diffuser, register and grille to within +5% of design air CFM. Include all terminal points of air supply and all points of exhaust. Note: For Labs and Rooms that are negative exhaust air flow shall be set to design +10% and supply to design -5%. Positive areas will have opposite tolerances.

9. Pitot Tube Traverses: For use in future troubleshooting by maintenance personnel, all exhaust ducts, main supply ducts and return ducts shall have air velocity and volume measured and recorded by the traverse method. Locations of these traverse test stations shall be described on the sheet containing the data.

10. Maximum and minimum air flow on terminal boxes.

1.11 SOUND VIBRATION AND ALIGNMENT

A. Sound: Read and record sound levels at up to 15 locations in the building designated by the Engineer. All measurements shall be made using an Octave Band Analyzer. All tests shall be conducted when the building is quiet in the presence of the Engineer, if he so desires.

B. Vibration: Read and record vibration for all water circulating pumps, air handling units, and fans which have motors larger than 10 HP. Include equipment vibration, bearing housing vibration, foundation vibration, building structure vibration, and other tests as directed by the Engineer. Readings will be made using portable IRD (or approved equal) equipment capable of filtering out various unwanted frequencies and standard reporting forms. Maximum vibration at any point listed above, or specified, shall not exceed 1 mil on fans and 1 mil on pumps unless otherwise specified. Equipment manufacturers shall rectify all systems exceeding vibration tolerances.

1.12 TESTING OF TEMPERATURE CONTROL SYSTEMS

A. In the process of performing the TAB work, the TAB Agency shall:

1. Work with the temperature control contractor to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding of intended control performance.

2. Verify that all control devices are properly connected.

3. Verify that all dampers, valves and other controlled devices are operated by the intended controller.

4. Verify that all dampers and valves are in the position indicated by the controller (open, closed or modulating).

5. Verify the integrity of valves and dampers in terms of tightness of close-off and full-open positions. This includes dampers in multizone units, terminal boxes and fire/smoke dampers.

6. Observe that all valves are properly installed in the piping system in relation to direction of flow and location.

7. Observe the calibration of all controllers.

8. Verify the proper application of all normally opened and normally closed valves.

9. Observe the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts or cold walls.

10. Observe the locations of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media. Control Contractor will relocate as deemed necessary by the TAB Agency.

11. Verify that the sequence of operation for any control mode is in accordance with approved shop drawings and specifications. Verify that no simultaneous heating and cooling occurs.

12. Verify that all controller setpoints meet the design intent.

13. Check all dampers for free travel.

14. Verify the operation of all interlock systems.

15. Perform variable volume system verification to assure the system and its components track with changes from full flow to minimum flow.

B. A systematic listing of the above testing and verification shall be included in the final TAB report.

1.13 SUBMITTALS

A. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:

a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
   b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Follow industry standard practices and procedures for testing, balancing, as listed in paragraph 1.3 above.

B. The A/E must be notified a minimum of 72 hours prior to any tests being conducted.

C. The TAB Contractor must be notified a minimum of five working days prior to conduction any duct leakage tests and same must be present to witness all duct leakage tests.

3.2 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.

E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for **50 percent** loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches positive static pressure near building entries in clean rooms.

3.3 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.
    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
    b. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    c. Measure static pressure directly at the fan outlet or through the flexible connection.
    d. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    e. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    a. Report the cleanliness status of filters and the time static pressures are measured.
    b. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.

c. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
d. Obtain approval from construction manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
e. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, sub-main ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of sub-main and branch ducts.

2. Where sufficient space in sub-main and branch ducts is unavailable for Pitottube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

3. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.

4. Re-measure each sub-main and branch duct after all have been adjusted. Continue to adjust sub-main and branch ducts to indicated airflows within specified tolerances.

5. Measure air outlets and inlets without making adjustments.

C. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.4 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.

2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.

3. Measure total system airflow. Adjust to within indicated airflow.

4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.

5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

6. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

7. Re-measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

8. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

9. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.

10. Record final fan-performance data.

3.5 MECHANICAL EQUIPMENT

A. Verify the following:

1. Equipment is operable and in safe and normal condition.

2. Temperature control systems are installed complete and operable.

3. Proper thermal overload protection is in place for electrical equipment.

4. Final filters are clean and in place. If required, install temporary media in addition to final filters.

5. Duct systems are clean of debris.

6. Correct fan rotation.

7. Fire and volume dampers are in place and open.

8. Coil fins have been cleaned and combed.

9. Access doors are closed and duct end caps are in place.

10. Air outlets are installed and operable.

11. Duct system leakage has been minimized.

12. Pretest components in the VFD. Provide factory certification of testing the entire VFD with varying induction motor loads for 24 hours prior to shipment.

13. Proper sequencing and operation of all DDC Control System components and equipment as required by ASHRAE Standard on Total Building Mechanical System operation.

14. Perform sound power level tests and provide required data on each occupied space adjacent to, above, or below mechanical/ air handling unit equipment rooms.

15. Perform vibration test and provide required data on each piece of air handling/ ventilation equipment or fan. Vibration testing must be complete in compliance with the requirements of ASHRAE – 1999 HVAC applications Handbook Chapter 46, Sound and Vibration Control and the maximum listed RMS values listed herein.

B. Duct Leakage

1. Test all supply air ductwork, to include, but not limited to, downstream of all single zone and multi-zone air handling units, downstream of all VAV air handling units and upstream of fan powered terminal units at 2-1/2 inches of static pressure (except where this requirement would exceed the ductwork design pressure classification) to have a total leakage value not to exceed 2% of the total system airflow.

2. Test all supply, return, and exhaust air ductwork, to include, but not limited to, downstream of fan coil units and fan powered terminal units, upstream of air handling units, and upstream and downstream (where applicable) of fans at 1-1/2 inches of static pressure to have a total leakage value not to exceed 2% of the total system design airflow.

3. Ductwork that initially fails these tests shall be replaced, modified, resealed, etc. as required to meet the leakage requirement and then re-tested to ensure compliances.

3.6 REPORTS

A. The activities described in this section shall culminate in a report to be provided in quadruplicate (4) individually bound to the RCM. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of test instrument and list all measurements taken after all corrections are made to the system. Record all failures and corrective action taken to remedy incorrect situation. The intent of the final report is to provide a reference of actual operating conditions for the Owner's operations personnel.

B. All measurements and recorded readings (of air, electricity, etc.) that appear in the reports must have been made onsite by the permanently employed technicians or engineers of the firm.

C. At the option of the Construction Inspector, all data sheets tabulated each day by TAB personnel shall be submitted for initial by the Construction Inspector. Those work sheets so initialed, or copies thereof, shall be presented as a supplement to the final TAB report.

D. Submit reports on forms approved by the Owner & Engineer which will include the following information as a minimum:

1. Title Page
    a. Company Name
    a. Company Address
    b. Company telephone number
    c. Project name
    d. Project location
    e. Project Manager
    f. Project Engineer
    g. Project Contractor
    h. Project Identification Number

2. Instrument List
    a. Instrument
    a. Manufacturer
    b. Model
    c. Serial Number
    d. Range
    e. Calibration date
    f. What test instrument was used for

3. Fan Data (Supply and Exhaust)
    a. Location
    a. Manufacturer
    b. Model
    c. Air flow, specified and actual
    d. Total static pressure (total external), specified and actual
    e. Inlet pressure
    f. Discharge pressure
    g. Fan RPM

4. Return Air/Outside Air Data (If fans are used, same data as for 3 above)
    a. Identification/location
    a. Design return air flow
    b. Actual return air flow
    c. Design outside air flow
    d. Return air temperature
    e. Outside air temperature
    f. Required mixed air temperature
    g. Actual mixed air temperature

5. Electric Motors
    a. Manufacturer
    a. HP/BHP
    b. Phase, voltage, amperage, nameplate, actual
    c. RPM
    d. Service factor
    e. Starter size, heater elements, rating

6. V-Belt Drive
    a. Identification/location
    a. Required driven RPM
    b. Driven sheave, diameter and RPM
    c. Belt, size and quantity
    d. Motor sheave, diameter and RPM
    e. Center-to-center distance, maximum, minimum and actual

7. Duct Traverse
    a. System zone/branch
    a. Duct size
    b. Area
    c. Design velocity
    d. Design air flow
    e. Test velocity
    f. Test air flow
    g. Duct static pressure
    h. Air temperature
    i. Air correction factor

8. Air Monitoring Station Data
    a. Identification/location
    a. System
    b. Size
    c. Area
    d. Design velocity
    e. Design air flow
    f. Test velocity
    g. Test air flow

9. Air Distribution Test Sheet
    a. Air terminal number
    a. Room number/location
    b. Terminal type
    c. Terminal size
    d. Area factor
    e. Design velocity
    f. Design air flow
    g. Test (final) velocity
    h. Test (final) air flow

10. Cooling Coil Data
    a. Identification/number
    b. Location
    c. Service
    d. Manufacturer
    e. Entering air DB temperature, design and actual
    f. Entering air WB temperature, design and actual
    g. Leaving air DB temperature, design and actual
    h. Leaving air WB temperature, design and actual
    i. Air pressure drop, design and actual

11. Heating Coil Data
    a. Identification/number
    a. Location
    b. Service
    c. Manufacturer
    d. Air flow, design and actual
    e. Entering air temperature, design and actual
    f. Leaving air temperature, design and actual
    g. Air pressure drop, design and actual

12. Sound Level Report
    a. Location (Location established by the design engineer)
    a. NC curve for eight (8) bands - equipment off
    b. NC curve for eight (8) bands - equipment on

13. Vibration Test on equipment having 10 HP motors or above
    a. Location of points:
        1) Fan bearing, drive end
        2) Fan bearing, opposite end
        3) Motor bearing, center (if applicable)
        4) Motor bearing, drive end
        5) Motor bearing, opposite end
        6) Casing (bottom or top)
        7) Casing (side)
        8) Duct after flexible connection (discharge)
        9) Duct after flexible connection (suction)

b. Test readings:
    1) Horizontal, velocity and displacement
    2) Vertical, velocity and displacement
    3) Axial, velocity and displacement
c. Normally acceptable readings, velocity and acceleration
d. Unusual conditions at time of test
e. Vibration source (if non-complying)

14. Control verification indicating date performed and any abnormalities identified.
    a. Point Location/Description
    b. EMS Readout (Setpoint and Actual)
    c. Actual Readout
    d. Interlocks
    e. Safeties
        1) VSD Normal Operation
        2) VSD Bypass Operation
    f. Alarms
    g. Sequences of Operation

END OF SECTION 230593

230713 - HVAC INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Retain or delete this article in all Sections of Project Manual.

B. Furnish and install thermal insulation for mechanical and plumbing piping systems including jackets and accessories.

C. Insulation systems for sheet metal duct conveying cold, hot and grease laden air. Provide duct insulation systems which have been manufactured, fabricated and installed to meet all thermal requirements of mechanical systems. Insulating systems shall be installed in strict accordance with manufacturer's field requirements and the current International Energy Conservation Code.

D. HVAC system includes horizontal roof drain, lines, and waste lines which receive condensate from air handling units or evaporators.

1.2 RELATED SECTIONS

A. Section 090190 – Maintenance of Painting and Coatings.

B. Section 230529 – Hangers and Supports for HVAC Piping and Equipment.

C. Section 230553 – Mechanical Identification

D. Section 013300 Submittals.

E. Section 01524 Construction Waste Management

F. Section 01352 LEED Requirements

G. Section 01611 Environmental Management

H. Section 01570 Pollution Prevention and Control

1.3 REFERENCES

A. ASTM C 178 – Steady State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-HOT-Plate Apparatus.

B. ASTM C 195 – Mineral Fiber Thermal Insulation Cement.

C. ASTM C 533 – Calcium Silicate Block and Pipe Thermal Insulation.

D. ASTM C 534 - Preformed Flexible Elastomeric Cellular Thermal Insulation.

E. ASTM C 547 – Mineral Fiber Preformed Pipe Insulation.

F. ASTM C 591 – Preformed Cellular Polyurethane Thermal Insulation.

G. ASTM C 1126 – Rigid Cellular Phenolic Thermal Insulation.

H. ASTM B 209 – Aluminum and Aluminum-alloy Sheet and Plate.

I. ASTM E 84 – Surface Burning Characteristics of Building Materials.

J. ASTM E 96 –Water Vapor Transmission of Materials.

1.4 SUBMITTALS

A. Include product description, list of materials, and thickness for each service and locations.

B. Include detail drawings of insulation dams.

C. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal’s Standard GS-11.
   b. Submit manufacturer’s certification that products comply with Green Seal’s Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.5 QUALITY ASSURANCE

A. Application Company Qualifications: The installing company must be solely and exclusively in the business of insulation installation for the previous consecutive fiver year period. The installing company must also be regularly engaged in installing the specific specified insulation material types on projects of equal or greater magnitude and scope as this project for the previous consecutive five year period. Documentation of the above listed requirements must be submitted prior to insulation material submitted.

B. Application Personnel Qualifications: The installing company must provide qualified installation personnel on this project jobsite directly employed by them who are skilled and proficient at installing the specific specified insulation Material types.

C. Any material found, by the A/E, to be improperly installed or not installed in total compliance with the specific installation instructions and methods (written or implied) of the material manufacturer must be removed by the installing company. The preparation instructions must be followed prior to the re-installation of the insulation material using the correct installation instructions and methods of the material manufacturer.

D. All material (to include, but not limited to, insulation, jackets, facings, coatings, mastics, adhesive, sealants, etc.) Installed inside the building must have a certified and tested composite flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesive and insulation.

B. All insulation shall comply with IECC 2012.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 MANUFACTURERS

A. Insulation

1. Ownes-Corning Fiberglass Corporation.

2. UpJohn CRP/DOW Chemical Company.

3. Knuff Corporation.

4. FGH Fabricators, Inc.

5. Armstrong.

6. Quiet Liner by Acoustical Surfaces Inc.

B. Jackets

1. Childers Products Company.

2. PABCO.

3. RFR Products, Inc.

4. Kinetics Duct Wrap

2.5 PIPE INSULATION

A. Type B-1: Elastomer, closed cell, flexible, insulation; ASTM E 96, maximum vapor transmission rating of 0.20 pers; ASTM C 177; 'k' value of 0.27 at 75 degrees F.

B. Type B-2: Fiberglass Piping Insulation: ASTM C 547, Class 1 unless otherwise indicated. (Indoor locations only).

2.6 DUCT INSULATION MATERIALS

A. Type C: Flexible Fiberglass Duct Insulation (Indoor application): ASTM C 553, Type I, Class B-4, 2 " thick, 1.0 PCF density, minimum R-6 (installed) with foil faced continuous vapor barrier. This application is limited to concealed indoor locations only.

B. Type D: Rigid Fiberglass Duct Insulation (Indoor application): ASTM C 612, Class 1, 2" thick, 3.0 PCF densities, for both supply and exhaust round ducts exposed to view locations, or spaces without ceilings. Round duct insulation shall be E. O. Wood Rigid wrap® for all round ducts in areas without ceiling.

C. Type E: Rigid Foam Glass Duct Insulation (Outdoor application): Foamglas ONE™ block with 7.3 lbs/ft3 and 0.29 BTU-inch /hr F thermal conductivity per ASTM C 240, Type I.

D. Type F: Quiet Liner by Acoustical Surfaces Inc. or approved equal. Quiet Natural Fiber Liner shall be thermally bonded HVAC insulation with superior acoustic and thermal performance. Liner shall be made from natural fibers; Quiet Liner™ shall not contain fiberglass. The fibers used to manufacture Quiet Liner shall offer sound absorption properties. The air stream surface shall be overlaid with a durable, fire-resistant black facing, to provide additional strength to the product. Both the insulation and the facing shall be treated with an EPA registered anti-microbial agent. Surface Burning Characteristics shall be less than 25/50 shall be Class A / Class 1 per ASTM E84, UL 723, and NFPA 255. Fungi Resistance shall indicate no growth per ASTM C1338 and ASTM C739. Water Vapor Absorption shall be less than 1% by weight per ASTM C1104.

E. Jackets for Duct Insulation: ASTM C 921, Type I for duct with temperatures below ambient; Type II for duct with temperatures above ambient.

F. Jackets for outdoor Duct Insulation: Encase exterior duct insulation with 16 MIL Stainless steel jacket with "Z" closures for weather-proof construction.

G. Duct Insulation Accessories: Provide bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

H. Mechanical Fasteners:

1. Gemco Type IH-A from Goodloe E. Moore, Inc., Danville, IL 800-331-1164.

2. Eckoustic-Klip from Eckel Industries Inc., Cambridge, MA 617-491-3221.

3. INC Stick-Pin from Industrial Noise Control Inc. Addison, IL 312-620-1998.

I. Duct Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

1. 15-141 from King Co., St. Louis, MO 314-772-9953.

2. Tuffbond from Goodloe E. Moore, Inc., Danville, IL 800-331-1164.

3. INC C-700 from Industrial Noise Control Inc., Addison, IL 312-620-1998.

J. All external duct wrap shall be 2 " thick, 1.0 P.C.F. density minimum, and is required on all and supply air duct that also meets with the minimum R-value per International Energy Code 2013. External duct wrap shall be with foil faced continuous vapor barrier. This application is limited to concealed indoor locations only.

2.7 DUCTWORK JACKETS

A. Interior, Concealed Applications

1. Type D Insulation: one and a half (1½”) pounds per cubic feet minimum density semi-rigid glass fiber. Provide factory applied ASJ white kraft foil vapor barrier. Type B Insulation: Finish coat is not required.

2. Insulate fittings, joints and valves with molded insulation of like material and thickness as adjoining pipe. Use insulating cement to fill voids and cracks. Finish with #10 glass membrane and Childers #CP-30 L.O. vapor barrier mastic.

B. Interior, Exposed Applications

1. Double wall duct and fittings will consist of a solid inner liner, 1" thick x 1.0 lb/ft3 layer of glass fiber insulation, and a solid outer pressure shell.

2. Double wall jacket with spiral lockseam with standing rib.

3. Fitting ends shall be sized to slip-fit into spiral duct of the same nominal size.

C. Exterior Applications

1. Prime sheet metal with Pittcote 300 before the installation of insulation.

2. Insulate exterior ductwork with 2 layers of 1 ½” thick FOAMGLAS sheet.

3. Wrap insulation with 8 oz canvas. Finish with 2 coats on 8 oz canvas shall be Childers CP-50 prior to final jacket installation.

4. Cover with 0.02 inch thick stainless steel jacket having integral moisture barrier with seams located at 2 or 10 o'clock position of horizontal piping. All laps must be minimum 2".

D. Jacket Materials

1. Factory Applied Jackets: White kraft bonded to reinforced foil vapor barrier with self-sealing adhesive joints.

2. PVC Jackets: One piece, pre-molded type, to meet flame spread and smoke developed rating of 25/50 in accordance with ASTM E 84.

3. Canvas Jackets: UL listed treated cotton fabric, 8 ounces per square

4. Fiberglass Cloth Reinforcing Mesh: #10 glass cloth with minimum weight of 3.9 ounces per square yard.

5. Aluminum Jackets: (Indoor applications exposed to view) ASTM B 209, 0.020 inch thick; smooth finish with factory applied moisture barrier.

6. Stainless Steel Jackets: (Outdoor applications) Type 304 stainless steel; 0.010 inch thick; smooth finish.

2.8 ACCOUSTICAL DUCT WRAP (TYPE L)

A. The sound control lagging material is applied continuously as part of the duct system to reduce sound transmission from the duct i.e., control breakout noise.

B. Material shall consist of a rugged, reinforced aluminized-faced, mass loaded limp vinyl barrier, 9.8-kg/m^2 (2-psf). Material shall be non-lead composition for safe handling and easy installation.

C. Pipe and duct shall be wrapped with fiber glass batt or other appropriate resilient material in order to decouple sound control lagging from surface of pipe and duct. For the required optimal performance, sound control lagging shall be installed / wrapped over the duct thermal insulation and shall not be applied directly to surface of duct.

D. The sound control lagging material shall be provided by a manufacturer having a minimum of five years' experience in furnishing similar noise control lagging material for pipe and duct.

E. The barrier shall be constructed of a 6-mm (0.24") thick mass loaded, limp vinyl sheet bonded to a thin layer of reinforced aluminum foil on one side. The barrier shall have a nominal density of 9.8-kg/m^2 (2.0-psf).

F. Sound control lagging material shall be Kinetics Noise Control, Inc. Model KNM-200AL or equal.

G. Products not meeting minimum test standards will not be accepted. Submittals shall include test reports from independent laboratories meeting the following minimum criteria:

H. Insertion Loss when tested as a duct wrap over 51-mm (2”) thick, 80.1 kg/m (5-pcf) fiber glass over a 20-gauge duct system (per ASTM E1222-90)

1.

Frequency, Hz	63	125	250	500	1000	2000	4000
	5	9	18	28	34	37	37

2.9 ACCESORIES

A. A. Insulation Bands: 3/4 inch wide; 0.015 inch thick galvanized steel, stainless steel or 0.007 inch thick aluminum.

B. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum or 0.010 inch thick stainless steel to match jacket.

C. Insulating Cement: ASTM C 195; hydraulic setting mineral wool; Ryder One-Coat.

D. Sealants: Used at valve, fittings and where insulation is terminated. Brushes apply sealant to end of insulation and continued along pipe surface. Provide Childers CP-30 L.O. sealant.

E. Adhesives: Used to adhere the longitudinal lap seam of vapor barrier jackets and at butt joints between insulation or fitting covers. Provide Childers CP-82 or approved equal as general purpose adhesive. Use Childers CP-97 fibrous adhesive for calcium silicate or when adhering pipe saddles and shields to the insulation.

F. Primers: Provide Childers CP-50 diluted 50% with water primer to cover insulating cements prior to finish coating.

PART 3 - EXECUTION

3.1 PIPE PREPARATION

A. Thoroughly clean all surfaces to be insulated as required to remove all oil, grease, loose scale, rust, and foreign matter. Piping must be completely dry at the time of application.

B. The installation of piping insulation associated with an operating chilled water system is strictly prohibited.

C. Provide primer coat on all piping, to include field welds and over factory applied paint/ coating, in total compliance and compatible with and approved by the Engineer prior to installation of insulation (No Exceptions).

D. Install insulation material only after all performance tests on piping have been completed and approved by the Engineer (No Exceptions).

3.2 PIPE INSULATION INSTALLATION

A. Install materials in complete and total compliance with the specific manufacturer's installation instructions.

B. Continue vapor barrier through wall and floor penetrations.

C. In exposed piping, locate insulation and cover seams in least visible locations.

D. Insulate fittings, valves, flanges and strainers. On flexible connections, expansion joints and unions, bevel and seal ends of insulation and continue sealant a minimum of 4 inches along the piping.

E. Provide dams in insulation at intervals not to exceed 20 feet to prevent migration of condensation or leakage.

F. Provide an insert of same thickness and contour as adjoining insulation, between support shield and piping, and under the finish jacket, on piping 2 1/2 inch diameter or larger, to prevent insulation form sagging at support points. Provide inserts for 180-degree arc and not less than the length of the pipe support shield or minimum 12 inches long (whichever is greater) manufactured of 5.0# density cellular phenolic insulation material suitable for the planned temperature range. Factory fabricated inserts with integral galvanized pipe saddles are recommended. Adhere pipe support shield to insulation with adhesive.

G. Neatly finish and seal insulation at supports, protrusions and interruptions. Maintain vapor barrier with finish coat.

H. Paint exposed pipe insulation in total compliance with Section 210553 and Section 090190.

3.3 DUCT SYSTEM INSULATION

A. Insulate all supply, return fresh-air, outside-air, make-up air and exhaust ducts.

B. Cold Ducts: Temperatures below the space dew point shall have the insulation vapor barrier be continuous and unbroken through inside walls, sleeves and floor openings. Where connection is made to fire or fire/smoke damper in wall or floor the vapor barrier must extend to the wall or floor to prevent ambient air water vapor from condensing on the cold surfaces of the fire damper.

C. Duct Wrap: Fasten all longitudinal and circumferential laps with outward clinching staples 3" on center. On rectangular ducts over 24" wide, apply as above and hold insulation in place on bottom side with mechanical pins and clips on 12" centers.

D. Duct Wrap: Seal all joints, fastener penetrations and other breaks in vapor barrier with 3-inch-wide strips of white glass fabric embedded between two coats of vapor barrier mastic, Childers CP-30 or approved equal.

E. Cold Duct (Below Ambient Temperature):

1. Application Requirements: Insulate the following cold duct:
   a. Outdoor air intake duct between air entrance and fan inlet or HVAC unit inlet.
   b. HVAC supply duct between fan discharge, or HVAC unit discharge, and room terminal outlet.
      1) Insulate neck, backside, and bells of supply diffusers.
   c. HVAC return duct between room terminal inlet and return fan inlet, or HVAC unit inlet.
   d. HVAC plenums and unit housings not pre-insulated at factory or lined.
   e. Exhaust duct work within the building non air-conditioned spaces.

2. Insulate each duct system specified above with one of the following types and thicknesses of insulation:
   a. Rigid Fiberglass: 2" thick, 3.0 PCF density, for both supply and exhaust round ducts exposed outdoor locations, or spaces without ceilings. Round duct insulation shall be E. O. Wood Rigid wrap® for all round ducts in areas without ceiling.
   b. Flexible Fiberglass: 2" thick, 1.0 PCF density, minimum R-6 with foil faced continuous vapor barrier. This application is limited to concealed indoor locations only.
   c. Foamglass: two (2) layers of 1" thick insulation blocks or 2" thick Armstrong Type II Armaflex flexible elastomeric closed cell sheet insulation or approved equal. (For outdoors locations).
   d. Exhaust ductwork within the air-conditioned spaces do not require to be insulated. Exhaust duct on roof exposed to the outside weather do not require to be insulated.

3.4 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Insulated ductwork conveying air below ambient temperature:

1. Provide insulation with vapor barrier jackets.

2. Finish with tape and vapor barrier jacket.

3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

C. Insulated ductwork conveying air above ambient temperature:

1. Provide with or without standard vapor barrier jacket.

2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

D. For ductwork exposed in finished spaces.

1. Double wall duct and fittings will consist of a solid inner liner, 1" thick x 1.0 lb/ft3 layer of glass fiber insulation, and a solid outer pressure shell.

2. Double wall jacket with spiral lockseam with standing rib.

3. Fitting ends shall be sized to slip-fit into spiral duct of the same nominal size.

E. External / Outdoor Duct Insulation Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive to match jacket.

2. Secure insulation without vapor barrier with staples, tape, or wires.

3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.

4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.

5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

6. Install 0.02” thick smooth Stainless steel jacket on ductwork installed outdoors / on roof.

F. The sound control lagging material is critical in order to achieve the desired noise reduction. Sound control lagging material shall be cut to length, wrapped around the outside of the duct, and fastened with mechanical fasteners or bands. Tape and adhesive can be used in conjunction with mechanical fasteners or bands. All sound control lagging materials must be installed per the manufacturer’s installation guidelines.

G. Duct and Plenum Liner Application:

1. Adhere insulation with adhesive for 100 percent coverage.

2. Secure insulation with mechanical liner fasteners. Refer to SMACNA Standards for spacing.

3. Seal and smooth joints.

4. Seal liner surface penetrations with adhesive.

5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

H. All piping, equipment, ductwork, all plenums including metal and masonry construction, fans, etc., shall be insulated as indicated on the Drawings, as specified herein, and as required for a complete system. In each case, the insulation shall be equal to that specified and materials applied and finished as described in these Specifications.

I. All insulation shall be applied by mechanics skilled in this particular work and regularly engaged in such occupation. All insulation shall be applied in strict accordance with these Specifications and with factory printed recommendations on items not herein mentioned. Unsightly, inadequate, or sloppy work will not be acceptable, and all such work shall be removed and replaced as many times as necessary to achieve an acceptable installation.

J. All insulation, jacket, adhesives, mastics, sealers, etc., utilized in the fabrication of these systems shall meet NFPA for fire resistant ratings (maximum of 25 flame spread and 50 smoke developed ratings) and shall be approved by the insulation manufacturer for guaranteed performances when incorporated into their insulation system, unless a specific product is specified for a specific application, and is stated as an exception to this requirement. Certificates to this effect shall be submitted along with Contractor's submittal data for this section of the Specifications. No material may be used that, when tested by the ASTM E84-89 test method, is found to melt, drip or delaminate to such a degree that the continuity of the flame front is destroyed, thereby resulting in an artificially low flame spread rating.

K. All surfaces to be insulated shall be clean and dry before applying the insulation. All sections of molded pipe covering shall be firmly butted together. Where an insulation covering is applied, it shall lap the adjoining section of insulation by at least three inches (3"). Where insulation terminates, it shall be neatly beveled and finished. No insulation shall be applied until the pipe, duct, etc., have been pressure tested and found tight. Piping, flexible connections, flanges, valves, strainers, and unions shall be covered unless specifically noted otherwise. Flexible connections on duct shall not be covered. All materials used shall be fire retardant or nonflammable.

L. Where vapor barriers are required, the vapor barrier shall be on the outside. Extreme care shall be taken that the vapor barrier is unbroken. Joints, etc., shall all be sealed. Where insulation with a vapor barrier terminates, it shall be sealed off with the vapor barrier being continuous to the surface being insulated. Ends shall not be left raw.

M. Extreme care shall be taken in covering high and medium pressure (high and medium pressure ductwork shall be all ductwork between the fan discharge and all mixing boxes) ductwork to insure the duct is not pierced with sheet metal screws or other fasteners. All high and medium pressure ducts in these specifications are classified as high velocity ductwork.

N. Where specified, aluminum bands shall be used on piping insulation. The bands shall be applied three (3) to a section of pipe. Fittings, valves, etc., shall have bands on each side.

O. For purpose of definition in this Specification: "concealed" areas are those areas which cannot be seen by the building occupants, and "exposed" areas are all areas which are exposed to view by the building occupants, including under counter and inside cabinet areas, plus all mechanical rooms.

P. Provide 2 hour enclosure on grease exhaust duct. Enclosure shall extend from kitchen hood to underside of roof deck.

Q. The handling and installation of all insulation materials shall be performed in strict accordance with the manufacturer’s recommendations.

3.5 SCHEDULE

A.

Duct or Piping	Type	Duct / Pipe Size	Insulation Thickness
Condensate Drain Lines (Interior Exposed)	B-1	All Sizes	1”
Refrigerant Suction Piping	B-1	2" & Smaller	1 ½ ”
Indoor ductwork Insulation Concealed Spaces	C	All sizes	2” & 1.0 lbs. density
All ductwork downstream from the VAV terminal units	L	All ducts All sizes	1” thick & 2 lbs. density.
Acoustical ductwork Liner In Transfer Ducts and Return Boots	F	All sizes	2” & 1.5 lbs density
Indoor ductwork Insulation Non-concealed Spaces Provide Aluminum Jacket	D	All sizes	2” & 3.0 lbs density
Outdoor Ductwork Insulation Provide 0.020”x 36” smooth Stainless steel Jacket	E	All sizes	two (2) layers of rigid 1 " thick, and 7.3 lbs/ft3 density

END OF SECTION 230713

230716 - EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Retain or delete this article in all Sections of Project Manual.

B. Equipment insulation.

C. Covering.

1.2 RELATED SECTIONS

A. Section 090190 – Maintenance of Painting and Coatings.

A. Section 232123 – Centrifugal Hydronic Pumps.

B. Section 230553 – Identification for HVAC Piping and Equipment.

C. Section 013300 Submittals.

D. Section 01524 Construction Waste Management

E. Section 01352 LEED Requirements

F. Section 01611 Environmental Management

G. Section 01570 Pollution Prevention and Control

1.3 REFERENCES

A. First four paragraphs below are defined in Division 01 Section "Submittal Procedures" as "Action Submittals."

A. ASTM C 195 – Mineral Fiber Thermal Insulation Cement.

B. ASTM C 533 – Calcium Silicate Block and Pipe Thermal Insulation.

C. ASTM C 534 - Preformed Flexible Elastomeric Cellular Thermal Insulation.

D. ASTM C 553 – Mineral Fiber Blanket and Felt Insulation.

E. ASTM C 591 – Preformed Cellular Polyurethane Thermal Insulation.

F. ASTM C 612 – Mineral Fiber Block and Thermal Insulation.

G. ASTM C 1126 – Rigid Cellular Phenolic Thermal Insulation.

H. ASTM E 84 – Surface Burning Characteristics of Building Materials.

I. ASTM 255 – Surface Burning Characteristics of Building Materials.

J. UL 723 – Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Include product description, list of materials, and thickness for equipment scheduled.

B. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
   b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.5 QUALITY ASSURANCE

A. Application Company Qualifications: The installing company must be solely and exclusively in the business of insulation installation for the previous consecutive fiver year period. The installing company must also be regularly engaged in installing the specific specified insulation material types on projects of equal or greater magnitude and scope as this project for the previous consecutive five year period. Documentation of the above listed requirements must be submitted prior to insulation material submitted.

A. Application Personnel Qualifications: The installing company must provide qualified installation personnel on this project jobsite directly employed by them who are skilled and proficient at installing the specific specified insulation Material types.

B. Any material found, by the A/E, to be improperly installed or not installed in total compliance with the specific installation instructions and methods (written or implied) of the material manufacturer must be removed by the installing company. The preparation instructions must be followed prior to the re-installation of the insulation material using the correct installation instructions and methods of the material manufacturer.

C. All material (to include, but not limited to, insulation, jackets, facings, coatings, mastics, adhesive, sealants, etc.) Installed inside the building must have a certified and tested composite flame spread/smoke developed rating of 25/50 in accordance with ASTM E84.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesive and insulation.

A. Insulation to provide minimum R-Value in accordance with International Energy Conservation Code as adopted by Fort Bend County.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 MANUFACTURERS

A. Owens-Corning Fiberglass Corporation.

B. UpJohn CPR/ Dow Chemical Company.

C. Manville Corporation.

D. Armstrong.

2.5 INSULATION

A. Type A: Mineral fiber or fiberglass preformed insulation: ASTM C 553; ‘k’ value of 0.24 at 75 degrees F; 2.0 lb/ cu ft. density.

B. Type B: Rigid fiberglass or mineral fiber board; ASTM C 612; ‘k’ value of 0.24 at 75 degrees F; 6.0 lb/ cu ft. density.

C. Type C: Molded closed cell poyisocyanurate insulation; ASTM E96, maximum water vapor transmission rating of 0.005 perm-in; ASTM C177, ‘k’ value of 0.18 at 75˚F; ASTM D2842m water absorption value of 0.05 lb/ft².

D. Type D: Calcium silicate; ASTM C 533; asbestos free; ‘k’ value of 0.40 at 250 degrees F.

E. Type E: Closed cell, chemically neutral, neoprene insulation, ‘k’ value of 0.27 at 75 degrees F; sheet form; Armstrong Armaflex.

F. Type F: Phenolic closed cell, ASTM C1126 rigid foam, 3.5 labs. Nominal density, CFC free; ASTM C177, 'k' value of 0.18 at 75□F.

2. 1 INSULATION METAL JACKET

G. Provide Metal Jacket outdoors.

H. Jacket - .016"x 36" aluminum smooth with moister barrier jacket.

I. Jacket - .020" x 36" aluminum smooth with moister barrier jacket (High traffic areas.).

J. Aluminum fasteners – ¾" bands, ¾" wing seals .024 elbow covers.

K. T-304 stainless steel fasteners – ½" x .020 bands, ½" wing seals.

L. Screws are not to be used to secure jacketing.

2.6 ACCESSORIES

A. Adhesives: Non-shrinking, permanently flexible, compatible with insulation. For general purpose use Childers CP-82 adhesive. For calcium silicate, use Childers CP-97 fibrous adhesive.

B. Sealants: For general purpose to seal the end of the insulation, use Childers CP-30 L.O. sealant.

C. Insulating Cement: ASTM C 195; hydraulic setting mineral wool; Ryder One-Coat.

D. Wire Mesh: Corrosive-resistant metal; 1 inch hexagonal pattern.

E. Primers: Use Childers CP-50 diluted 50% with water primer to seal over insulating cements and fibrous adhesives prior to finish coating.

F. Finish Coats: For general purpose, use Childers CP-30 L.O. reinforce with glass cloth. For calcium silicate, use Childers CP-50 finish coat reinforced with canvas jacket. For finish coat over closed cell electrometric, use Childers CP-17 or Armstrong "Finish" acrylic finish.

G.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Do not insulate factory insulated equipment.

C. Do not insulate boiler or expansion or volume tank manholes, hand holes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation. Provide removable insulation sections to cover parts of equipment which must be

opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

D. Apply insulation as close as possible to equipment by grooving, scoring, and beveling insulation, if necessary. Secure insulation to equipment with studs, pins, clips, adhesive, wires or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. Cover insulation with metal mesh and finish with heavy coat of insulating cement.

G. Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.

H. When equipment with insulation requires periodical opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.

3.2 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Do not insulate factory insulated equipment.

C. On exposed equipment, locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. Insulated dual temperature equipment or cold equipment containing fluids below ambient temperature:

1. Provide vapor barrier jackets, factory applied or field applied.
2. Finish with glass cloth and vapor barrier adhesive.
3. Insulate entire system.

G. For insulated equipment containing fluids above ambient temperature:

1. Provide standard jackets, with or without vapor barrier, factory applied or field applied.
2. Finish with glass cloth and adhesive.
3. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
4. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions, including those at equipment, but label the insulation to indicate a concealed flange or union.

H. Inserts and Shields:

1. Application: Equipment 2 inches diameter or larger.

2. Shields: Galvanized steel between hangers and inserts.
3. Insert location: Between support shield and equipment and under the finish jacket.
4. Insert configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert material: Heavy density insulating material suitable for the planned temperature range.

I. Finish insulation at supports, protrusions, and interruptions.

J. For equipment in mechanical equipment rooms or in finished spaces, finish with aluminum jacket.

K. For exterior applications, provide vapor barrier jacket or finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal equipment.

L. Cover cellular glass and cellular foam insulation with aluminum jacket.

M. Do not insulate over any nameplate or ASME stamps. Bevel and seal insulation around such.

N. Install insulation for equipment requiring access for maintenance, repair, or cleaning, in such a manner that it can be easily removed and replaced without damage.

O. All piping, equipment, ductwork, all plenums including metal and masonry construction, fans, etc., shall be insulated as indicated on the Drawings, as specified herein, and as required for a complete system. In each case, the insulation shall be equal to that specified and materials applied and finished as described in these Specifications.

P. All insulation shall be applied by mechanics skilled in this particular work and regularly engaged in such occupation. All insulation shall be applied in strict accordance with these Specifications and with factory printed recommendations on items not herein mentioned. Unsightly, inadequate, or sloppy work will not be acceptable, and all such work shall be removed and replaced as many times as necessary to achieve an acceptable installation.

Q. All insulation, jacket, adhesives, mastics, sealers, etc., utilized in the fabrication of these systems shall meet NFPA for fire resistant ratings (maximum of 25 flame spread and 50 smoke developed ratings) and shall be approved by the insulation manufacturer for guaranteed performances when incorporated into their insulation system, unless a specific product is specified for a specific application, and is stated as an exception to this requirement. Certificates to this effect shall be submitted along with Contractor's submittal data for this section of the Specifications. No material may be used that, when tested by the ASTM E84-89 test method, is found to melt, drip or delaminate to such a degree that the continuity of the flame front is destroyed, thereby resulting in an artificially low flame spread rating.

R. All surfaces to be insulated shall be clean and dry before applying the insulation. All sections of molded pipe covering shall be firmly butted together. Where an insulation covering is applied, it shall lap the adjoining section of insulation by at least three inches (3"). Where insulation terminates, it shall be neatly beveled and finished. No insulation shall be applied until the pipe, duct, etc., have been pressure tested and found tight. Piping, flexible connections, flanges, valves, strainers, and unions shall be covered unless specifically noted otherwise. Flexible

connections on duct shall not be covered. All materials used shall be fire retardant or nonflammable. Refer to Section 15A.

S. Where vapor barriers are required, the vapor barrier shall be on the outside. Extreme care shall be taken that the vapor barrier is unbroken. Joints, etc., shall all be sealed. Where insulation with a vapor barrier terminates, it shall be sealed off with the vapor barrier being continuous to the surface being insulated. Ends shall not be left raw.

T. Extreme care shall be taken in covering high and medium pressure (high and medium pressure ductwork shall be all ductwork between the fan discharge and all mixing boxes) ductwork to insure the duct is not pierced with sheet metal screws or other fasteners. All high and medium pressure ducts in these specifications are classified as high velocity ductwork.

U. Where specified, aluminum bands shall be used on piping insulation. The bands shall be applied three (3) to a section of pipe. Fittings, valves, etc., shall have bands on each side.

V. Where canvas finish is specified, use Arabol lagging adhesive to prevent mildew in securing canvas. Do not use wheat paste. In addition, cover all canvas insulation with a fire retardant coating.

W. For purpose of definition in this Specification: "concealed" areas are those areas which cannot be seen by the building occupants, and "exposed" areas are all areas which are exposed to view by the building occupants, including under counter and inside cabinet areas, plus all mechanical rooms.

X. The handling and installation of all insulation materials shall be performed in strict accordance with the manufacturer’s recommendations.

3.3 SCHEDULE

EQUIPMENT	TYPE	INSULATION THICKNESS
HOT EXPANSION TANKS PROVIDE ALUMINUM JACKET	E	2”
CHILLED WATER EXPANSION TANKS PROVIDE ALUMINUM JACKET	E	2”
AIR SEPARATORS	E	1”
HEAT EXCHANGER PROVIDE ALUMINUM JACKET	D	2 1/2”
COLD SURFACES (NOT FACTORY INSULATED)	E	1 ½ ”
CHILLED AND HOT WATER PUMP BODIES PROVIDE ALUMINUM JACKET	E	2”
CHEMICAL FEED (CHILLED/HOT WATER)	E	3/4”

END OF SECTION 230716

230923 - ENERGY MANAGEMENT AND CONTROL SYSTEM (EMCS)

PART 1 - GENERAL

1.1 GENERAL

A. The Energy Management and Control System (EMCS) shall be comprised of a Local Area Network (LAN) infrastructure, Operator Workstations (OWS), Engineering Workstations (EWS), a Primary Network Server (PNS), Network Area Controllers (NAC), Application Specific Controllers (ASC), Unitary System Controllers (USC), and Field Devices installed within the facility.

B. The Workstations, Primary Network Server, and Network Area Controllers shall be connected by an EMCS Contractor supplied and installed Local Area Network. The LAN shall comply with all IEEE Standards as outlined in: IEEE STD 802-2014: IEEE Standard for Local and Metropolitan Networks, Overview and Architecture.

C. If the EMCS Contractor wishes connect to the Owner's Wide Area/Local Area Network as part of the control system network, the EMCS Contractor shall acquire permission in writing and include the letter in the submittal. Any system that requires connection to the Owner's network for communication between NAC, ASC, USC and/or field devices that is submitted without the written permission from the Owner shall be rejected. The EMCS Contractor shall coordinate with the Owner and supply all required information.

D. Access to the system, either locally in the building, or remotely from a central site or sites, shall be accomplished through standard web browsers, via the Internet and/or a local area network. System shall be compatible across various devices including iPhone, Android and Windows phones and various tablets running these operating systems. Provide upgrades to the existing campus server as required to accomplish this requirement.

E. All EMCS controllers and workstations shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135-2016, latest revision. Management level TCP/IP Ethernet network speeds shall be 1 Gbps minimum and the Automation Level MS/TP network speeds shall be 76.8 Kbps minimum.

F. The Server shall gather data from the system and generate HTML5 pages accessible through a conventional web browser from all personal computers (PCs), tablets and mobile phones connected to the network. System shall include any and all software and hardware to support unlimited users. The EMCS shall be compatible with all common web browsers.

G. Facility Operators shall be able to view and configure systems through the standard web browser and all graphical/data representations shall appear identical, whether the user is on site or viewing via the Internet at a remote location. Standard operator functions such as control point manipulation, configuration and viewing of trends, schedules and alarms shall be performed through the standard browser. Each mechanical system and building floor plan shall be depicted on the operator workstation by point-and-click graphics.

H. The EMCS shall directly control HVAC equipment as specified in the Sequence of Operations. Furnish Energy Conservation features such as Optimal Start/Stop, Night Setback, Setpoint Reset logic, and Demand Control Ventilation.

I. The EMCS vendor shall provide the following additional services as part of this Specification: warranty and service during the warranty period; submittals, samples and record documentation; comprehensive startup and testing of the EMCS with documentation; training services for the Owner and facility operators; coordination with other contractors and suppliers; operator and technician training program, and shall cooperate fully with the Project Commissioning Agent (CxA).

J. Products furnished under this Specification but installed by others.

1. Mechanical devices installed under Division 23 by the Mechanical Contractor or other suppliers: temperature sensing thermowells; automatic control dampers not installed in air handling unit mixing boxes or louver schedules; damper actuators for variable air volume (VAV) terminal units; mounting cost of controller and actuator for VAV terminal units.

2. Electrical devices installed under Division 26 by the electrical Contractor:
   a. 120 VAC power to controllers and control panels at locations indicated on the Drawings. Review and verify that these locations are adequate for the proposed EMCS.
   b. Interlock wiring to duct mounted smoke detector or fire alarm shutdown relays to HVAC equipment motor starters, variable frequency drives (VFD) and etc.

K. Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.

L. DDC system to be tied in to emergency button/switch to initiate shut down of all HVAC equipment when activated.

M. System shall be fully compatible and interface with existing County system. Owner shall be able to use Maintenance Direct for Actions on individual Areas as needed and requested by Owner. Contractor responsible for all hardware, software and coordination involved.

N. It is Contractor responsibility to discover and integrate all devices and points into system as necessary. This includes, but not limited to, HVAC, electrical, plumbing and lighting devices.

O. It is the intent of this Specification to describe the basic architecture and performance requirements of the Energy Management and Control System (EMCS). The turn-key EMCS shall include all work station software including operator software, cables, programming tools, graphics editor, all other available software programs, modules, handhelds, or plug- ins offered by the DDC manufacturers, hardware, Control Units, Distributed Controllers, Unitary Controllers, Local Area Networks (LANs), sensors, modems, wiring, connectors, control devices, actuators, installation and calibration, supervision, adjustments and fine tuning necessary for a complete and fully operational system.

P. Systems shall be furnished and installed complete in all respects, including any and all equipment, controls, wiring, instrumentation, enclosures, labor, engineering, training, commissioning, programming, supervision, calibration, coordination with other trades, etc. No information given in (or omitted from) these Specifications shall relieve the Contractor of this absolute requirement. Include all associated electrical work except as noted. Work includes furnishing of all labor, superintendence, materials, tools, equipment and sources necessary for the complete installation or modification of the following systems as herein specified. It is the intent of these Specifications that the Contractor shall furnish and install the systems complete in every respect and ready to operate. All equipment, miscellaneous items and accessories required for such installation and for the correct and convenient operation of the entire installation whether or not each such item or accessory is shown on the plans or mentioned in these Specifications shall be furnished and installed.

Q. All systems shall be complete true stand-alone systems. Program database, data acquisition, and all control sequence logic shall reside in each DDC Device.

R. The Building Level Communication Network (BLCN) shall not be dependent upon connection to a Server or Master Controller for the performance of the Sequence of Control as outlined in this Specification. Each Device shall, to the greatest possible extent, perform its programmed sequence without reliance on the BLCN.

1. All devices installed shall be native BACnet. **LonWorks or proprietary protocols are NOT ALLOWED.** Devices that are not BACnet tested, compliant, certified, clearly stamped and listed by the BACnet Testing Laboratories (BTL) shall not be acceptable under this Specification and are strictly prohibited.

2. System shall be provided with a complete Web-enabled operator interface. The application shall operate on industry standard PC hardware. Proprietary server hardware or “Black Boxes” will not be acceptable. Third party Web-enabled applications are acceptable if they are configured to be indistinguishable from the OWS applications.

3. No Gateways, Communication Bridges, Protocol Translators or any other device that translates any proprietary or other communication protocol to the BACnet communication the protocol shall be permitted as a part of the EMCS installation under this Specification section. Gateways may only be used as required for communication to existing systems or systems installed under other Specification sections.

4. All EMCS DDC Devices shall be capable of updating firmware using software via the internet without replacing any hardware, microprocessors or chips.

5. Installed system must have full access to logic and functional blocks. User shall have full ability to modify programming.

6. Outside air temperature shall be supplied by the National Weather Service with a local backup at every site.

7. Point naming/labeling shall be consistent throughout buildings.

8. Where Drawings are provided as part of or supplement to these Specifications, such Drawings are inherently schematic only and not intended to convey all controls, wiring, installation, details, etc. It shall be the responsibility of the EMCS Contractor to verify that control approaches presented are appropriate for the HVAC systems involved, and that bids include all work described, specified, or otherwise necessary for a complete and functioning system.

9. System shall have the ability to program schedules locally if needed during network outages.

1.2 RELATED DOCUMENTS & REFERENCES

A. Drawings and general provisions of the contract documents, apply to this section including:

1. Division 01 for General Conditions and Supplementary Conditions.

2. Division 21 for fire protection equipment.

3. Division 22 for plumbing equipment and domestic water systems.

4. Division 23 for mechanical equipment, ductwork, and piping systems.

5. Division 26 for electrical equipment, lighting control, and fire alarm systems.

6. Section 013300 Submittals.

7. Section 01524 Construction Waste Management

8. Section 01352 LEED Requirements

9. Section 01611 Environmental Management

10. Section 01570 Pollution Prevention and Control

B. The latest edition of the following standards and codes in effect as approved by the authority having jurisdiction and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:

1. ANSI MC85.1 - Terminology for Automatic Control.

2. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).

3. ANSI/ASHRAE Standard 135-2016, BACnet.

4. BTL Mark by the BACnet Testing Laboratories.

5. International Building Code (IBC), 2015 edition including local amendments.

6. International Energy Conservation Code (IECC), 2015 edition including local amendments.

7. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.

8. National Electrical Code (NEC), 2017 edition.

9. FCC Part 15, Subpart J, Class A.

10. National Institute of Standards and Technology (NIST).

11. IEEE STD 802-2014: IEEE Standard for Local and Metropolitan Networks, Overview and Architecture.

1.3 RELATED WORK IN OTHER SECTIONS

A. Refer to Division 00 and Division 01 for allowances and related contractual requirements.

B. Refer to Division 21 for General Fire Protection Provisions and fire suppression pump.

1. The EMCS Contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP or Modbus acceptable if IP interface is not available from equipment manufacturer.

2. The EMCS Contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

C. Refer to Division 22 for General Plumbing Provisions, domestic water heating systems, domestic water pumping systems, and domestic water metering.

1. The EMCS Contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP or Modbus acceptable if IP interface is not available from equipment manufacturer.

2. The EMCS Contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

D. Refer to Division 23 for General Mechanical Provisions for equipment such as air-handling units, terminal units, ventilation fans, variable frequency drives, unitary AC units, etc.

1. The EMCS Contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP or Modbus acceptable if IP interface is not available from equipment manufacturer.

2. The EMCS Contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

E. Refer to Section 26 for General Electrical Provisions for equipment such as electrical switchgear control, electrical power monitoring, emergency generators, lighting control system, etc.

1. The EMCS Contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP or Modbus acceptable if IP interface is not available from equipment manufacturer.

2. The EMCS Contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

1.4 ELECTRICAL POWER PROVISIONS

A. Primary power will be provided under Division 26 by the electrical Contractor to the panel locations indicated on the mechanical & electrical Drawings. Provide step down transformers within panel enclosures. Provide all necessary fuses and circuit protection devices.

B. Power will be provided to the controllers serving fan powered terminal units with electric heat via the control transformer provided with the unit.

C. All components of the EMCS shall be powered from the sources above. Provide final terminations from the locations indicated on the Division 23 Drawings.

D. The EMCS Contractor shall provide any additional control power that is required as part of this contract and not indicated by other. This shall include all conduit, cabling, circuit breakers, etc.

1.5 CONTRACTOR QUALIFICATIONS

A. The EMCS Contractor shall:

1. Have a local office within 100 miles of jobsite before bid date and at a minimum until the completion of the warranty period.

2. Have a local staff of trained personnel capable of giving instructions and providing routine and emergency maintenance on the EMCS, all components and software/firmware and all other elements of the EMCS.

3. Have a proven record of experience in the supply and installation of equivalent EMCS/BACnet systems over a minimum period of five years. Provide documentation of at least three equal and complexity, if so requested by the Owner’s Representative.

4. Be a factory certified representative of the native BACnet EMCS manufacturer for design, installation, and service of the proposed system.

5. Have comprehensive local service, training and support facilities for the total EMCS as provided. Maintain local, supplies of essential expendable parts.

6. Have a local 24/7 phone support service.

1.6 SUBMITTALS

A. All documents submitted shall be in native pdf format. Scans are not acceptable.

B. Shop Drawings:

1. The following information shall be included on the cover page for each shop drawing and equipment documentation submittal:
   a. Project name with date. Refer to the applicable Specifications by name and number.
   b. Provide submittal number and re-submittal number and date as applicable.
   c. Provided name and address of Consulting Engineer, Mechanical Contractor, General Contractor

2. Shop drawings shall be CAD generated, plot size of 8-1/2" x 11" or 11" x 17". Drawings shall include diagrams, mounting instructions, installation procedures, equipment details and software descriptions for all aspects of the system to be installed.

3. Provide schematic of systems indicating instrumentation locations, all interconnecting cables between supplied cabinets on a mechanical floor plan.

4. Software specifications and descriptions including operating sequences.

5. Provide a bill of material that indicates specific manufacturer, part number, part description and quantity of each device for all system components.

6. Provide a list of the wire labels to be installed on each end of the control wiring, at the device and the control panel terminal. Labels shall be machine generated, typed and legible with a maximum of 17 characters. The label description “AHU-1 SAT” shall indicate the supply air temperature of AHU-1.

7. Equipment Schematic: Provide an electronic equipment schematic for each piece of mechanical equipment. The schematic shall display all mechanical equipment

8. characteristics including fans, dampers, valves, sensors and other applicable control devices. The schematic shall show wiring terminations to each control device as shown in the submittal and as-build documentation. Control devices shall be labeled by a symbol that can easily be identified in a bill of material that is shown on this graphic. The bill of material shall show the device symbol, description, manufacture and part number.

9. Sequence of Operations: The control sequences shall be viewable for each piece of mechanical equipment and be in a text format as shown in the as built documentation. The sequence of operations shall be selectable at the applicable location for the control program.

10. Provide detail points list on every piece of equipment.

11. Provide technical cut sheets showing all relevant devices and/or information highlighted to distinguish what was installed.

C. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
   b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

D. Control Component Submittals:

1. Component technical data sheets with mounting and installation details.

2. The documentation shall include comprehensive and complete details of the BACnet Interoperability Building Blocks (BIBB) and automation level documentation including address, associated controller type, etc. as required and for the interface to the EMCS.

3. Details of networks/communications equipment, cabling and protocols proposed. Provide schedule of cabling including details of proposed cable types.

4. Module Drawing: Provide an electronic wiring diagram of each control module (as shown in submittal documentation). Diagram shall display wiring schematic and terminations to end devices. Diagram shall display each input and output terminals and label those that are used for the control application. Diagram shall display module type/name and network address.

5. Field sensor and instrumentation Specification sheets. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.

6. Schedule and Specification sheets for dampers, valves and actuators.

7. Design and provide layout of all components of panel mounted control devices, terminal strips and power supplies.

E. Color Graphics: Provide sample layout of color graphic representations of the systems for review. The submittal shall indicate the quality of the graphic to be provided with the system with a sample of the specific control points to be included. Control points shall as a minimum include points indicated in the input/output summary, control schematic and primary controlling points defined in the sequences of operation. Provide a sample of a floor plan layout, typical AHU, terminal unit, outside air pretreatment unit, variable frequency drive, exhaust/supply fan, chiller plant and hot water plant. For control points to be provided by equipment BACnet integration provide sample of the control points.

F. Verification Reports. The submittal shall include a sample of the verification reports to be utilized during the verification section of this Specification. Sample reports shall be approved as submitted or be modified by the engineer or Owner's representative. The verification reports shall be included in the final Operation & Maintenance Manuals. Reports shall be provided in electronic PDF format.

1. Project Systems Verification Form for each controller.
   a. General information for each form shall include: project name; associated equipment with mark number; control panel number and location; controller number and model number; controller device instance number (address); MS/TP LAN segment number; verifying technician and date.
   b. Each connected control point and device shall contain the following columns with a separate line for each connected physical point: point description (same as device label); input/output number for each connected control device (AI-XX, AO-XX, DI-XX, or DO-XX).
   c. Check boxes confirming that the verification tasks have been completed: device location, proper termination at device; proper termination at control panel; sequence is verified; point trend is enabled.
   d. Data entry boxes indicating measured/confirmed values: preliminary control point value on the graphic; observed control point value; calibration or adjustment value to correct offset; final displayed point value on the color-graphic; date of verification; engineer or Owner's representative verification.

2. Control Panel Verification Form for each control panel.
   a. General information: panel location and identification number; panel dimensions and NEMA rating; panel properly installed; Class 1 and Class 2 wiring are properly separated; correct voltage to the panel; no shorts or grounds in panel; no induce voltages in panel wiring; point to point termination match submittal; devices are mounted in the correct location; controller software revision number; address of controllers; panel device checkout is complete; panel startup is complete.

3. Sequence of Operation Verification Form per piece of equipment (AHU, VAV, chiller, boiler, etc.).
   a. General information: project name; system identifier; building area served; control panel and controller numbers; controller model number and instance number (address); MS/TP LAN segment number; name of verifying technician and date.
   b. Each step of the sequence of operation for each piece of equipment shall be documented shall include a “description of test”, “input to trigger test” and “expected outcome”. A pass/fail checkbox shall indicate each of these actions. Provide space for technician approval with associated date.

G. Operating and Maintenance (O&M) manuals: Provide O&M manual with full information to allow the Owner to operate, maintain and repair installed products. Include trade names with model numbers, color, dimensions and other physical characteristics.

1. Format: Produce on 8-1/2 x 11-inch pages, and bind in 3-ring/binders with durable plastic covers. Label binder covers with printed title “OPERATION AND MAINTENANCE MANUAL”, title of project, and subject matter and “Number _ of _” of binder. Provide substantial dividers tabbed and titled by section/component number.

2. Table of Contents for each volume:
   a. Part 1: Directory with name, address and telephone number of Designer, Contractor and Subcontractors and Suppliers for each Project Manual section.
   b. Part 2: Operation and maintenance instructions, arranged by Project Manual Section number where practical and where not, by system. Include:
      1) Product design criteria, functions, normal operating characteristic and limiting conditions. Installation, alignment, adjustment, checking instructions and troubleshooting guide. Operating instructions for start-up, normal operation,
      2) regulation and control, normal shutdown and emergency shutdown. Test data and performance curves.
      3) Spare parts list for operating products, prepared by manufacturers including detailed drawings giving location of each maintainable part, lists of spares recommended for user- service inventory and nearest source of in-stock spares.

H. Record Documentation:

1. Details of all alarm, diagnostic, error and other messages. Detail the Operator action to be taken for each instance.

2. Detail special programs provided and provide a complete programming instruction manual. Detail operation of all software applications.

3. Detailed list of the database for all installed devices.

4. Record drawings shall be CAD generated and shall include final locations and point ID for each monitored and controlled device.

5. In additional to the required hard-copies, provide electronic copies on a USB Drive with all of the record documentation in PDF format and a USB Drive containing backup copies of all installed software and graphics.

6. Provide an excel spreadsheet for tracking and maintenance by equipment type. Coordinate with Owner for database and template requirement.

7. Online as-built documentation: provide digital replications of as-builts that shall be accessible from each equipment graphic controlled or monitored by the EMCS.

1.7 WARRANTY

A. Warranty work and the equipment provided under this contract shall be for a period of one (1) year from the date of Substantial Completion. Warranty shall cover all components, system software, parts and assemblies supplied by this Contractor and shall be guaranteed against defects in materials and workmanship for one (1) year from the date of Substantial Completion. If manufacturer warranty on a product is longer than (1) year, Contractor is responsible for honoring and coordinating the warranty of that product up to the end of manufacturer warranty. Labor to troubleshoot, repair, reprogram or replace system components that have failed due to defects in materials and workmanship shall be provided by this Contractor at no charge to the Owner during the warranty period. All corrective software modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software. All warranty work shall be performed by the EMCS Contractor's local service group.

B. Warranty shall not include routine maintenance, e.g., equipment cleaning, mechanical parts lubrication, pilot lamp replacement, operational testing, etc. Warranty shall not cover repair or replacement of equipment damaged by under- or over-voltage, misuse, lack of proper maintenance, lightning, water damage from weather or piping failure.

C. Hardware and software personnel supporting this warranty agreement shall provide on- site or off-site service in a timely manner after failure notification to the EMCS Contractor. The maximum acceptable response time to provide this service at the site shall be 24 hours, during normal working hours.

1.8 OPERATOR WORKSTATION (OWS)

A. The Operator Workstation shall be any personal computer, connected to the WAN/LAN, with appropriate web browser software installed.

1.9 ENGINEERING WORKSTATION (EWS)

A. The Engineering Workstation shall be any personal computer or virtual pc and/or server, connected to the WAN/LAN, with a registered copy of the EMCS Contractor supplied engineering and/or programming software installed. The EMCS Contractor shall provide at least one copy of all required software(s) and files, to enable the Owner complete editing/programming functions of all controllers, graphics, and control logic.

B. The EMCS shall provide one (1) virtual pc and/or server which is compatible with the performance required by the EMCS Engineering Software. It shall be able to be reached locally and remotely as needed.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 CONTROL SYSTEM

A. Acceptable Manufacturer

1. Temperature control system: The BMCS system shall be fully integrated through the new operator workstation in compliance with the performance requirements set forth in this Specification. All equipment provided herein shall be required to communicate through a facility wide EMCS workstation by means of full binary interface to maintain operations for school district personnel. Any additional software or hardware required to maintain the integrity of the campus wide system shall be included in the bid price. DDC hardware and software introduced as part of this project shall in no way alter the integrity of the campus wide system.

2. Temperature control system:
   a. Manufacturers:
      1) Tracer by Trane
      2) Automated Logic

3. Installer is responsible for quality and satisfactory operation of devices, and for overall performance of system. New system shall integrate with existing campus BAS system.

4. Other manufacturers desiring approval shall comply with Section 01 60 00.

B. Temperature Control System:

1. Include:
   a. Temperature sensors.
   b. Humidity sensors.
   c. Controllers.
   d. Switches.
   e. Relays.
   f. Dampers.
   g. Damper operators.
   h. Thermostats.
   i. Humidistats.
   j. Hygrometers.
   k. Other associated controls required to maintain conditions described in detail on Drawings, together with thermometers, gauges and other accessory equipment.

2. Provide complete system of wiring and air piping as necessary to fill intent of these Specifications.

3. Control sequences indicated illustrate basic control functions only.

4. Provide additional controls required to meet intent of these Specifications and make a complete functional system.

5. Space temperature and humidity control.

6. Control of air handling units.

7. Control of exhaust systems.

8. Control of cooling systems.

9. Control of heating systems.

10. Control panels.

C. Where electronic sensing is used, furnish amplifier relays and transformer complete with overload protection.

D. Electrical drawings indicate type of motor control required by equipment.

2.5 PRIMARY NETWORK SERVER (PNS)

2.6 The EMCS shall be fully integrated and a continuation of Stafford MSD's existing Johnson Controls Server and system without exception. The EMCS Contractor shall either upgrade or provide a new ADX Server as part of this system if the existing server is not fully compatible with new Metasys EMCS being provided. The ADX Server shall utilize the Internet and provide efficient integration of standard open protocols. The ADX Server shall maintain comprehensive database management, alarm management and messaging services, and graphical user interface as follows:

1. Support an unlimited number of users and up to 5 concurrent users over the Internet/intranet with a standard web browser to access alarms, trend logs, graphics, schedules and configuration data. Access to the PNS shall be password protected utilizing authentication and encryption techniques. An audit trail of database changes indicating user, time stamp, and audit action shall be provided.

2. Enterprise level information exchange using an SQL database and HTML5 formats.

3. Synchronize controller databases, database storage scheduling, control and energy management routines

4. Alarm processing and routing shall include email, SMS text messages and paging as needed by the Owner.

5. HTML5 based help system that includes comprehensive online system documentation.

6. Support of multiple Network Area Controllers (NAC) connected to a Local Area Network.

7. Aggregate data and provide visualization interface and dashboard that includes, but not limited to, graphs, gauges, charts of relevant trends and energy usage.

B. Server Functions

1. It shall be possible to access all Network Area Controllers (NAC) via a single connection to the server through the Ethernet LAN. In this configuration, each Network Area Controller can be accessed from a single user login.

2. The PNS shall provide the following functions, at a minimum:

a. The server shall provide complete access to distributed global data. The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.
b. The server shall include a master clock service for its subsystems and provide time synchronization for all NACs.
c. The server shall provide scheduling for all NACs and their underlying field control devices.
d. The server shall provide demand limiting control that operates across all NACs. The network server shall be capable of multiple demand limiting programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.
e. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to NACs. Each Network Area Controller supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.
f. The server shall provide central alarm management for all NACs supported by the server. Alarm management shall include: routing of alarms to a video display, a printer, an email and pager; view and acknowledge alarms; query alarm logs based on user-defined parameters
g. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.
h. The server shall provide central management of logged data for all NACs supported by the server. Logged data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include: viewing and printing log data; exporting log data to other software applications; query log data based on user-defined parameters. A report log of manually overridden points shall be part of the management system.
i. Storage of the graphical screens shall be in the network web server, without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
j. Modify common application objects, such as schedules, calendars, and set-points in a graphical manner. Schedule times will be adjusted using a graphical slider. Holidays shall be set by using a graphical calendar.
k. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop- up menu. No entry of text shall be required.
l. The Primary Network Server shall be capable of supporting at the very minimum the following open system drivers.
    1) BACnet/IP
    2) Modbus TCP

C. Network Server Platform Requirements

1. Rack-Mounted Server Computer Hardware: DELL PowerEdge R230 or equal, Intel Xeon Quad E3-1225 V53.3 GHz or higher, 16GB RAM, 1TB hard drive, video card, 22" color monitor, and Ethernet adapter 1Gbps or higher.

2. Operating system software shall be Microsoft Windows 10 Professional or higher. Exceptions shall be pre-approved by Owner.

2.7 NETWORK AREA AUTOMATION ENGINE (NAE)

A. General

1. The Network Automation Engine (NAE) shall be a fully user-programmable, supervisory controller. The NAE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Engines.

2. Automation network – The NAE shall reside on the automation network and shall support a subnet of system controllers.

3. User Interface – Each NAE shall have the ability to deliver a web based User Interface using the Site Management Portal functionality previously described. All computers connected physically or virtually to the automation network shall have access to the web based user interface.
   a. The web based user interface software shall be embedded in the NAE. Systems that require a local copy of the system database on the user's personal computer are not acceptable.
   b. The NAE shall support a minimum of two (2) concurrent users.
   c. The web-based user shall have the capability to access all system data through a single NAE.
   d. Remote users connected to the network through an Internet Service Provider (ISP) or telephone dial up shall also have total system access through one NAE.
   e. Systems that require the user to address more than one NAE to access all system information are not acceptable.
   f. The NAE shall have the capability of generating web based user interface graphics. The graphics capability shall be embedded in the NAE.
   g. Systems that only support user interface graphics from a central database or require the graphics to reside on the user's personal computer are not acceptable.
   h. The web based user interface shall support the following functions using a standard version of Microsoft Internet Explorer:
      1) Configuration
      2) Commissioning
      3) Data Archiving
      4) Monitoring
      5) Commanding
      6) System Diagnostics
   i. Systems that require workstation software or modified web browsers for system queries are not acceptable.
   j. The NAE shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems.

4. Processor – The NAE shall be microprocessor-based with a minimum word size of 32 bits. The NAE shall be a multi-tasking, multi-user, and real-time digital control processor.

Standard operating systems shall be employed. NAE size and capability shall be sufficient to fully meet the requirements of this Specification.

5. Memory – Each NAE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.

6. User Authentication – The NAE shall support local users, Active Directory users, Microsoft Office 365 users and Remote Authentication Dial-in User Service (RADIUS).

7. Password Security – Access to the embedded user interface shall require a password of 8 to 50 characters including a minimum of one lower case letter, one upper case letter, one number, and one special character. An alarm shall be generated after three unsuccessful attempts within 15 minutes and the user shall be denied access until permission is renewed by a system administrator.

8. Network Security – Communication between the NAE and other system networked devices including additional Network Engines, Application and Data Servers, Open Data Servers (BACnet listed OWS), and user interface clients shall be encrypted and support HTTPS with Transport Level Security (TLS) Version 1.2. Self-signed certificates are to be provided with the option of configuring trusted certificates.

9. Hardware Real Time Clock – The NAE shall include an integrated, hardware-Based, real-time clock.

10. Diagnostics – The NAE shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Automation Engine shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.

11. Power Failure – In the event of the loss of normal power, The NAE shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.
    a. During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.
    b. Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.

12. Certification – The NAE shall be listed by UL.

13. Controller network – The NAE shall selectively support the following communication protocols on the controller network:
    a. The NAE shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135 on the controller network.
        1) The NAE shall support Remote field bus integration via a BACnet IP to MS/TP router.

2) The NAE shall be BTL certified and carry the BTL Label.
3) The NAE shall be tested and certified as a BACnet Building Controller (B-BC).
4) A BACnet Protocol Implementation Conformance Statement shall be provided for the NAE.
5) The Conformance Statements shall be submitted 10 days prior to bidding.

b. The NAE shall support LonWorks enabled devices using the Free Topology Transceiver FTT10.
1) All LonWorks controls devices shall be LonMark® certified.

B. Network Automation Engine – Large, Dual Trunk

1. The NAE shall support a minimum of:
a. One Hundred (100) BACnet Standard MS/TP controllers per trunk (200 total).
b. Two Hundred Fifty Five (255) LonWorks FTT10 Free Topology control devices.
c. One Hundred (100) N2 control devices per trunk (200 total).

2. The NAE shall include troubleshooting LED indicators to identify the following conditions:

3. Power – On/Off.
a. Ethernet Traffic – Ethernet Traffic/No Ethernet Traffic.
b. Ethernet Connection Speed – 10 Mbps/100 Mbps/1000 Mbps.
c. FC Bus A – Normal Communications/No Field Communications.
d. FC Bus B – Normal Communications/No Field Communications.
e. Peer Communication – Data Traffic between NAE Devices.
f. Run – NAE Running/NAE in Startup/NAE Shutting Down/Software Not Running.
g. Bat Fault – Battery Defective, Data Protection Battery Not Installed.
h. 24 VAC – 24 VAC Present/Loss of 24 VAC.
i. Fault – General Fault.
j. Modem RX – NAE Modem Receiving Data (as required).
k. Modem TX – NAE Modem Transmitting Data (as required).

4. Communications Ports – The NAE shall provide the following ports for operation of operator I/O devices, such as industry-standard computers, modems, and portable operator's terminals.
a. Two (2) USB port.
b. Two (2) RS-232 serial data communication port.
c. Two (2) RS-485 port.
d. One (1) Ethernet port.

5. Provide Johnson Controls NAE-55XX or approved equal as indicated on plans.

2.8 FIELD EQUIPMENT CONTROLLERS (FEC)

A. The Field Equipment Controller (FEC) shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol or optionally via N2Open.

1. The FEC shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135 on the controller network.

2. The FEC shall be BTL certified and carry the BTL Label.

3. The FEC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).

4. A BACnet Protocol Implementation Conformance Statement shall be provided for the FEC.

5. The Conformance Statement shall be submitted 10 days prior to bidding.

B. The FEC shall employ finite state programming to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.

C. Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable. The FEC shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.

D. The FEC shall include troubleshooting LED indicators to identify the following conditions:

1. Power On.

2. Power Off.

3. Download or Startup in progress, not ready for normal operation.

4. No Faults.

5. Device Fault.

6. Field Controller Bus – Normal Data Transmission.

7. Field Controller Bus – No Data Transmission.

8. Field Controller Bus – No Communication.

9. SA Bus – Normal Data Transmission.

10. SA Bus – No Data Transmission.

11. SA Bus – No Communication.

E. The FEC shall accommodate the direct wiring of analog and binary I/O field points with the following minimum A/D and D/A conversion resolution.

1. Provide a minimum 15 bit A/D resolution for analog inputs.

2. Provide a minimum 15 bit D/A resolution for analog outputs.

F. The FEC shall support the following types of inputs and outputs:

1. Universal Inputs – shall be configured to monitor any of the following:
2. Analog Input, Voltage Mode.
3. Analog Input, Current Mode.
4. Analog Input, Resistive Mode.
5. Binary Input, Dry Contact Maintained Mode.
6. Binary Input, Pulse Counter Mode.
7. Binary Inputs – shall be configured to monitor either of the following:
8. Dry Contact Maintained Mode.
9. Pulse Counter Mode.
10. Analog Outputs – shall be configured to output either of the following:
11. Analog Output, Voltage Mode.
12. Analog Output, current Mode.
13. Binary Outputs – shall output the following:
14. 24 VAC Triac.
15. Configurable Outputs – shall be capable of the following:
16. Analog Output, Voltage Mode.
17. Binary Output Mode.
18. The FEC shall have the ability to reside on a Field Controller Bus (FC Bus).

G. The FC Bus shall be a MS/TP Bus supporting BACnet Standard protocol SSPC-135.

1. The FC Bus shall support communications between the FECs and the NAE.
2. The FC Bus shall also support Input/Output Module (IOM) communications with the FEC and with the NAE.
3. The FC Bus shall support a minimum of 100 IOMs and FECs in any combination.
4. The FC Bus shall operate at a maximum distance of 15,000 Ft. between the FEC and the furthest connected device.

H. The FEC shall have the ability to monitor and control a network of sensors and actuators over a SA Bus.

1. The SA Bus shall be a MS/TP Bus supporting BACnet Standard Protocol SSPC-135.

2. The SA Bus shall support a minimum of 10 devices per trunk.

3. The SA Bus shall operate at a maximum distance of 1,200 Ft. between the FEC and the furthest connected device.

I. The FEC shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the FC Bus or the SA Bus.

J. The FEC shall support, but not be limited to, the following applications.

1. Chilled water/central plant applications including but not limited to:

2. Selection and sequencing of up to eight chillers of different sizes.

3. Selection and sequencing of up to eight (each) primary and secondary chilled water pumps of varying pumping capacities.

4. Selection and sequencing of up to eight condenser water pumps.

5. Selection and sequencing of cooling towers and bypass valve, including single speed, multi-speed, and Vernier control.

6. Selection and sequencing of up to four heat exchangers, of different capacities.

7. A proven and documented central cooling plant optimization program that incorporates custom equipment efficiency profiles, without rewriting software code, in order to meet the building load using the least amount of energy as calculated.

8. The use of advanced control algorithms that apply equipment specific parameters, including operational limits and efficiency profiles, in order to determine equipment start and runtime preferences.

9. Identification of the most efficient equipment combination and automatic control of state and speed of all necessary equipment to balance runtime, optimize timing and sequencing and ensure the efficiency and stability of the central cooling plant.

10. Control definition for the chiller plant in a single FAC, FEC, or NCE, as supported by available memory and point I/O, or capable of being split across multiple FACs, FECs, or NCEs.

11. Heating central plant applications.

12. Built-up air handling units for special applications.

13. Terminal & package units.

14. Special programs as required for systems control.

K. The FEC shall support a Local Controller Display either as an integral part of the FEC or as a remote device communicating over the SA Bus.

1. The Display shall use a BACnet Standard SSPC-135 MS/TP protocol.

2. The Display shall allow the user to view monitored points without logging into the system.

3. The Display shall allow the user to view and change setpoints, modes of operation, and parameters.

4. The Display shall provide password protection with user adjustable password timeout.

5. The Display shall be menu driven with separate paths for:

6. Input/Output.

7. Parameter/Setpoint.

8. Overrides.

9. The Display shall use easy-to-read English text messages.

10. The Display shall allow the user to select the points to be shown and in what order.

11. The Display shall support a back lit LCD with adjustable contrast and brightens and automatic backlight brightening during user interaction.

12. The display shall be a minimum of 4 lines and a minimum of 20 characters per line.

13. The Display shall have a keypad with no more than 6 keys.

14. The Display shall be panel mountable.

L. Provide Johnson Controls FEC or approved equal as shown on plans.

2.9 VAV MODULAR ASSEMBLY (VMA)

A. The VAV Modular Assembly (VMA) shall provide both standalone and networked DDC of pressure-independent, VAV terminal units. It shall address both single and dual duct applications.

B. The VMA shall be BTL certified and carry the BTL Label.

1. The VMA shall be tested and certified as a BACnet Application Specific Controller (B-ASC).

2. A BACnet Protocol Implementation Conformance Statement shall be provided for the VMA.

3. The Conformance Statement shall be submitted 10 days prior to bidding.

C. The VAV Modular Assembly shall communicate over the Field Controller Bus using BACnet Standard protocol SSPC-135.

D. The VAV Modular Assembly shall have internal electrical isolation for AC power, DC inputs, and MS/TP communications as provided. An externally mounted isolation transformer shall not be acceptable.

E. The VAV Modular Assembly shall be a configurable digital controller with integral differential pressure transducer and damper actuator. All components shall be connected and mounted as a single assembly that can be removed as one piece. Alternate configurations shall be available as follows:

1. A configurable digital controller with integral differential pressure transducer but without a damper actuator – for controlling large VAV boxes that require high torque.

2. A configurable digital controller with an integral damper actuator but without a differential pressure transducer –for commercial zoning applications or for pressure-dependent VAV box applications.

3. A configurable digital controller with an integral damper actuator and ball valve linkage but without a differential pressure transducer –for chilled beam applications.

F. The VAV Modular Assembly shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB or the controller is designed and suitable for use in other environmental air space (plenums) in accordance with Section 300.252(C) of the National Electrical Code.

G. The integral damper actuator shall be a fast response stepper motor capable of stroking 90 degrees in 60 seconds for quick damper positioning to speed commissioning and troubleshooting tasks.

H. The controller shall determine airflow by a state-of-the-art digital non-flow pressure sensor to provide 14-bit resolution with bidirectional flow operation that supports automatic correction for polarity on high- and low-pressure DP tube connections; this pressure sensor eliminates high- and low-pressure connection mistakes.

I. Each controller shall have the ability to automatically calibrate the flow sensor to eliminate pressure transducer offset error due to ambient temperature / humidity effects.

J. The controller shall utilize a proportional plus integration (PI) algorithm for the space temperature control loops.

K. Each controller shall continuously, adaptively tune the control algorithms to improve control and controller reliability through reduced actuator duty cycle. In addition, this tuning reduces commissioning costs, and eliminates the maintenance costs of manually re-tuning loops to compensate for seasonal or other load changes.

L. The controller shall provide the ability to download and upload VMA configuration files, both locally and via the communications network. Controllers shall be able to be loaded individually or as a group.

M. Control setpoint changes initiated over the network shall be written to VMA non-volatile memory to prevent loss of setpoint changes and to provide consistent operation in the event of communication failure.

N. The controller firmware shall be flash-upgradeable remotely via the communications bus to minimize costs of feature enhancements.

O. The controller shall provide fail-soft operation if the airflow signal becomes unreliable, by automatically reverting to a pressure-dependent control mode.

P. The controller shall interface with balancer tools that allow automatic recalculation of box flow pickup gain (“K” factor), and the ability to directly command the airflow control loop to the box minimum and maximum airflow setpoints.

Q. Controller shall have on-board diagnostics. These diagnostics shall consist of control loop performance measurements executing at each control loop’s sample interval, which may be used to continuously monitor and document system performance. The VMA shall calculate Exponentially Weighted Moving Averages (EWMA) for each of the following. These metrics shall be available to the end user for efficient management of the VAV terminals.

1. Absolute temperature loop error.

2. Signed temperature loop error.

3. Absolute airflow loop error.

4. Signed airflow loop error.

5. Average damper actuator duty cycle.

R. The controller shall detect system error conditions to assist in managing the VAV zones. The error conditions shall consist of:

1. Unreliable space temperature sensor.

2. Unreliable differential pressure sensor.

3. Starved box.

4. Actuator stall.

5. Insufficient cooling.

6. Insufficient heating.

S. The controller shall provide a flow test function to view damper position vs. flow in a graphical format. The information would alert the user to check damper position. The VMA would also provide a method to calculate actuator duty cycle as an indicator of damper actuator runtime.

T. The controller shall provide a compliant interface for ASHRAE Standard 62-1989 (indoor air quality), and shall be capable of resetting the box minimum airflow based on the percent of outdoor air in the primary air stream.

U. The controller shall comply with ASHRAE Standard 90.1 (energy efficiency) by preventing simultaneous heating and cooling, and where the control strategy requires reset of airflow while in reheat, by modulating the box reheat device fully open prior to increasing the airflow in the heating sequence.

V. Inputs:

1. Analog inputs with user-defined ranges shall monitor the following analog signals, without the addition of equipment outside the terminal controller cabinet:

2. 0-10 VDC Sensors.

3. 1000ohm RTDs.

4. NTC Thermistors.

5. The AVMA shall provide minimum 15 bit A/D resolution for analog inputs.

6. Binary inputs shall monitor dry contact closures. Input shall provide filtering to eliminate false signals resulting from input “bouncing.”

7. For noise immunity, the inputs shall be internally isolated from power, communications, and output circuits.

8. Provide side loop application for humidity control.

W. Outputs

1. Analog outputs shall provide the following control outputs:

2. 0-10 VDC

3. The AVMA shall provide minimum 15 bit D/A resolution of analog outputs

4. Binary outputs shall provide a SPST Triac output rated for 500mA at 24 VAC.

5. For noise immunity, the outputs shall be internally isolated from power, communications, and other output circuits.

X. Application Configuration

1. The VAV Modular Assembly shall be configured with a software tool that provides a simple Question/Answer format for developing applications and downloading.

Y. Sensor Support

1. The VMA shall communicate over the SA Bus with a Network Sensor.

2. The VMA shall support an LCD display room sensor.

3. The VMA shall also support standard room sensors as defined by analog input requirements.

4. The VMA shall support humidity sensors defined by the AI side loop.

Z. Provide Johnson Controls VMAxx or approved equal as shown on plans.

2.10 AIR HANDLING UNIT CONTROLLER

A. All devices required for single loop control shall be terminated on a single controller, (for example, AHU static pressure control. The differential pressure sensor and the VFD ramp signal.)

B. The EMCS Contractor shall provide controllers required for chilled/hot water and DX/electric heat air handling units and fan coil units. Provide an enclosure to house the controller and associated components including suitable mounting brackets shall be NEMA 1 rated and located outside the FCUs.

C. The controller shall be capable of monitoring and controlling the following parameters per the sequences of operation and input/output summary; space temperature; space relative humidity sensor; cooling/heating stage control or modulating valve control; fan on/off control and status; supply air sensor; occupancy sensor; carbon dioxide sensor; VFD control and monitoring.

2.11 SOFTWARE OVERVIEW

A. Dedicated Web Based User Interface

1. Where indicated on plans the BMS Contractor shall provide and install a personal computer for command entry, information management, network alarm management, and database management functions. Real-time control functions, including scheduling, history collection and alarming, shall be resident in the BMS Network Automation Engines and Data Server(s) to facilitate greater fault tolerance and reliability.

2. Dedicated User Interface Architecture – The architecture of the computer shall be implemented to conform to industry standards, so that it can accommodate applications provided by the BMS Contractor and by other third party applications suppliers, including but not limited to Microsoft Office Applications. Specifically it must be implemented to conform to the following interface standards.
   a. Microsoft Internet Explorer 11.0 or Edge for user interface functions.
   b. Microsoft Office Professional for creation, modification and maintenance of reports, sequences other necessary building management functions.
   c. Microsoft Outlook or other e-mail program for supplemental alarm functionality and communication of system events, and reports.
   d. Required network operating system for exchange of data and network functions such as printing of reports, trends and specific system summaries.
   e. PC Hardware/Software – The personal computer(s) shall be configured as specified in the Computing Hardware and Software section.

f. Provide one operational device as herein specified and located on plans.

3. Mobile, Web Based, User Interface (MUI)
   a. General
      1) The mobile, web based, user interface shall be HTML5-compliant and provide device-agnostic access to the system from smartphones, tablets, portable and desktop computers. User Interfaces that require software installation on the client device (e.g. Java, MicrosoftSilverlight®, Adobe® Flash®), or software downloads from an online app store shall not be acceptable for these purposes.
      2) The mobile user interface shall provide system operators with a simple location-based navigation approach to finding information, including the ability to search for any location by name and to bookmark a location in a standard browser.
      3) The mobile user interface shall organize and display information using customer specific locations and spaces. At a minimum, the user interface shall provide:
         a) Organization of all space, equipment and point information in a familiar way (using standard equipment names and location descriptions), reducing the need for extensive training prior to use.
         b) A navigation mechanism or tree for users to select the specific location or space for accessing information – only spaces and locations in the navigation tree or equipment serving that space, nothing more.
         c) The ability to search for and/or bookmark any location, space, or equipment by name for quick access to critical or troublesome areas.
         d) Application of the same navigation mechanisms across any client device (e.g. Smart phone, tablet, personal computer) for consistency and ease of use.
      4) The same user interface elements shall be accessible from any type of personal computer or mobile device running any type of operating system supported (e.g. iOS, Android, Windows®). It shall automatically adapt and optimize the display for the screen size and touch screen navigation.
      5) The user interface shall provide support for up to 50 concurrent users from individuals with defined access to the system.
   b. Navigation Trees
      1) A dedicated location based navigation tree shall be provided as part of the user interface in order to navigate to specific places within the facility on a hierarchical basis (typ. Facility, Building, Wing, Floor, Room.)
      2) The location-based tree shall use place names familiar to the operator without training or familiarization regarding special codes and conventions utilized in the generation of the BMS.
      3) Clicking or tapping on a location name in the tree shall display the home page associated with the space and simultaneously expand the tree to display the next level of spaces below the one selected.
      4) It shall be possible for qualified users to view a navigation tree of devices connected to the BMS network in order to enable troubleshooting of equipment and communications. Clicking or tapping on the Network Icon at the top of the Navigation Tree will access this alternate view. Users without the necessary access rights shall not see the Network Icon.

5) A click or tap on a device in the network tree shall display a dashboard for that device including information regarding related equipment and access to a separate focus view of commandable points associated with the piece of hardware. A click or tap on such a point shall display a control dialogue box allowing the user to modify or command that point as indicated. The dialog box shall contain an annotation box for describing why the action was taken or special circumstances that apply.
6) Specific hardware and software types in the Network tree shall also include access to one or more the following views in their dashboard depending on hardware type or network element (e.g. MS/TP trunk):
   a) Summary View
   b) Diagnostic View
   c) Network View
   d) Trend View
7) It shall be possible to hide the Network Tree and return to the Spaces Tree at any time by clicking on the Spaces Icon above the tree.

c. Dashboard Displays
1) The user interface shall provide the ability to view equipment visualizations, floor plans, and/or other graphics on mobile or desktop client devices in a browser environment, without the need for additional plugins or software. Graphics shall be accessible via a space (for floorplans, campus maps, etc.) or equipment dashboard.
2) Standard dashboards shall be configured for each defined space including one of the following predefined or custom elements:
   a) Equipment Serving Space
   b) Potential Problem Areas
   c) Equipment Summary
   d) Graphic Display (if specified)
   e) Schedule
3) Standard dashboards shall be configured for each system or device (typ. mechanical or electrical equipment) including the following predefined or custom elements:
   a) Trend
   b) Equipment Activity Summary
   c) Equipment Relationships Summary
   d) Equipment Data
   e) Graphic Display (if specified)
   f) Schedule
4) Users with appropriate permissions shall have access to a Dashboards Manager that can change the display order of Summaries and Data elements, add or remove elements and apply custom dashboards layouts to equipment and space by type.
5) Dashboard Manager shall apply dashboards to spaces or equipment based on the viewing platform (Desktop/Tablet or Phone) in order to tailor the user experience to the needs of the specific user base.
6) Default dashboard displays by space and equipment type shall be created per the guidelines in this specification or by mutual agreement with the owner's representative.

d. Alarm Management

1) The user interface shall provide a single display of all potential issues in a facility including items currently in alarm, warning, override, out-of-service and offline.
2) The user interface shall provide notification of new alarms, visually and audibly.
3) The user interface shall provide the ability to view a summary of alarms, including a chart of the number of alarms in each of the defined alarm priority ranges. The priority ranges should be filterable.
4) The user interface shall provide the capability to view multiple occurrences of the same alarm, ultimately providing the ability to acknowledge or discard all occurrences of the alarm in a single action.
5) The user interface shall provide the capability to view, and filter on, all alarms present in a well-defined mechanical system using the equipment serving equipment relationships.
6) The user interface shall provide the capability to acknowledge and discard all occurrences of at least 1000 alarms in one operation.
7) The user interface shall provide the user with the understanding of what physical space is being affected when an alarm occurs. The user interface shall provide the ability to filter alarms by physical space affected when the alarm occurred.
8) The user interface shall provide the capability to monitor alarms 24/7 without requiring an active login to the system, accessible via segregated web page. The user interface shall provide the capability to enabled or disable the 24/7 alarm monitor mode if desired.

e. Equipment Activity Summary
1) The user interface shall provide a filterable, single display, of all activity related to a specific piece of equipment including user changes, discarded user changes, pending alarms, discarded alarms, and acknowledged alarms for at least one year of historical data.
2) Items shall be listed in timed order with the latest activity at the top of the list.
3) Filters shall allow only specific activities for specific data points occurring within a specific time and date window to be displayed.
4) It shall be possible to export a .csv copy of the currently displayed summary by clicking or tapping on the export icon.
5) It shall be possible to create a custom trend graph containing the data shown in the currently displayed summary by tapping or clicking on the trend icon in the header bar and selecting the specific points to trend in the resulting selection panel.
6) Clicking on the information icon in front of any displayed activity listed in the summary shall expand the display to include the name of the user, server time, value prior to the activity, the ability to annotate the activity and a user selectable icon for displaying a trend graph of the point.

f. Equipment Relationships Summary
1) The user interface shall provide a summary of all equipment and spaces related to the operation of the system or device currently selected for viewing.

2) Include the capability to navigate to the home page of any related piece of equipment or space with a single click or tap on the desired element.

g. Equipment Data Summary
   1) The user interface shall provide a summary of all data pertaining to a particular piece of mechanical or electrical equipment in a tabular format.
   2) Clicking or tapping on any value in the summary shall display a related command panel allowing the user to command, override, or change service condition of the point selected and to annotate such actions for future reference.
   3) It shall be possible to export a .pdf copy of the report with a single click on the associated export icon.

h. Equipment Serving Space Summary
   1) The user interface shall provide a summary of all mechanical and electrical equipment as defined in the points list that serves a selected space from the navigation tree.
   2) The summary shall be capable of including a subset of the viewable points for each system representing the key elements of interest to operators without subjecting them to long lists of points irrelevant to basic operation.
   3) Clicking or tapping on any item in the summary shall navigate to the item's assigned home page in the user interface.
   4) It shall be possible to view a custom trend of information contained in the summary with a single click of the trend icon residing in the title header.
   5) It shall be possible to display specific systems and points by filtering equipment types desired.
   6) Because the data is intended to be a snapshot of the current conditions in the space it shall not dynamically update but a click or tap on the update icon at any time performs that function.

i. Potential Problem Areas
   1) The user interface shall provide a summary of all points in the system related to the space that are not operating correctly (e.g. alarm, off normal or not communicating correctly) in order to provide the operator with a quick update on current conditions.
   2) The information shall include:
      a) Point status (via color.)
      b) Point name.
      c) Value of the point when the summary was taken.
      d) Equipment that contains the offending point.
      e) Space that is served by that equipment.
   3) Data points in the summary may be filtered by one or more types of off-normal condition (e.g. above setpoint, offline and overridden).
   4) The summary may be exported in .csv format for inclusion in spreadsheets or other documents.

j. Equipment Summary
   1) The user interface shall provide a summary that allows the user to compare all similar equipment that serves the space as well as downstream (child) spaces in order to evaluate conditions quickly and determine patterns for troubleshooting purposes.

2) Each unique equipment type shall be selectable and display a representative set of values along with the space(s) being served by the device. Equipment types can be selected from a dropdown menu in the summary.
3) Clicking or tapping on a selected device in the summary shall navigate to the home page for that piece of equipment while clicking or tapping a data point shall display the command panel for that point.
4) It shall be possible to export a .pdf copy of the currently displayed summary by clicking or tapping on the export icon.
5) It shall be possible to create a custom trend graph containing the data shown in the currently displayed summary by clicking on the trend icon in the header bar and selecting the specific points to trend in the resulting selection panel.

k. User Defined Summaries
1) Provide the capability to view, command, and modify large quantities of similar data in summaries without the use of a secondary application (e.g. a spreadsheet). These summaries shall be generated automatically or user defined. User defined summaries shall allow up to seven user defined columns describing attributes to be displayed including custom column labels with up to 100 rows per summary.

l. Trend
1) The user interface shall provide the capability to view historical trend data from multiple pieces of equipment in both bar and line formats.
2) The user shall have the ability to navigate to a selection list of frequently viewed trends.
3) Trend graphs shall have to ability to be smartly auto-generated based on equipment and space relationships.
4) Each graph shall include a dedicated selection icon to export a copy of the graphic and data in .pdf format or the data only as a .csv file.

m. Operator Access
1) The user interface shall provide the ability to segment access to building data based on the space(s) or location(s) the user is physically located in and/or manages. The user interface shall provide the capability to assign “inherited” space permissions and the ability to assign user’s space based access in bulk.
2) The user interface shall provide the ability to segment access to building data based on the space(s) or location(s) the user is physically located in and/or manages. The user interface shall provide the capability to assign “inherited” space permissions and the ability to assign user’s space based access in bulk.

n. Graphics
1) The user interface shall display an equipment visualization or graphic within the context of its associated space (building, floor, room, etc.) or equipment dashboard.
2) Graphics shall include the ability to define individual information layers for operator selection in order to clarify systems status and simplify operation on mobile devices. Where desired a master layer may be defined to include important information about the facility on all graphic screens.
3) Graphics shall support the use of photo-realistic symbols as well as color change and animation to match the status of the related system control point.

4) It shall be possible to export a time stamped .pdf file of the graphic being viewed in order to communicate the current conditions in the space or the equipment being viewed and to provide a historic record.
5) An integral graphic manager shall be provided including the following features and capabilities:
   a) Creation and modification of graphics from any HTML5 capable browser without the need for additional plug-ins or software packages.
   b) Access to a full suite of pre-defined templates for air and water sourced HVAC applications as well as the ability to add custom templates as created for other use. Pre-aliased graphic templates may be defined and saved for repetitive representations of common mechanical and electrical equipment.
   c) A full suite of pre-defined three dimensional symbols for mechanical and electrical systems as well as all line, text and shape tools required for integration into a graphic with zoom and pan capabilities on multiple platforms and in multiple browsers.
   d) The ability to search and replace items in multiple graphics with a single command.
   e) The ability to import and insert photos and images into the graphic.
   f) The ability of the graphics manager to create and edit graphics including the ability to bind graphic elements to the values and conditions of system points in both an on-line and off-line mode.
6) As required, the BMS Contractor shall provide software licenses in the name of the owner for programming, configuration and graphics building tools to allow designated representatives to make changes, modifications or additions to the system. While future updates or revisions may require an update fee, the owner shall incur no additional cost if they choose not to update. Systems that require any annual or time-limited licensing fees shall not be permitted.

o. Scheduling
1) The user interface shall provide the capability to display, in a singular view, all of the effective schedules in the context of the space (building/floor/room, etc.) or equipment that the schedule effects. The software should have the ability to display an effective schedule, for the present, or a future date.
2) The user interface shall provide a report of all schedules affecting a space or equipment. The report shall provide the user details of events that comprise the weekly schedule and exception schedule(s). The report shall provide a means of viewing individual breakout scheduling elements for Weekly Schedule, Exceptions and Default Commands.
3) The user interface shall provide the capability to efficiently change or modify schedules in mass quantities. This includes the capability to add, in bulk, exceptions to schedules, in addition to assigning, in bulk, weekly schedules.

p. Command and Control
1) It shall be possible to command system analog and binary points via a dropdown menu accessed by clicking or tapping on the value shown in any equipment summary or graphic display and completing the task in the resultant menu including an optional annotation.
2) Commanding multiple points shall be possible on displays where multiple like system elements can be chosen.

q. Search

1) Typing a text string in the Search box shall display a list of all occurrences of that string in the mobile user interface. When a string is represented in the description of a space or network element, selecting it shall display its default dashboard.
2) Clicking or tapping on the Advanced Search Icon shall display the Advanced Search dialog box permitting the following:
   a) Search by Space and Equipment, Equipment Definition or Network Reference.
   b) Filter the search by wildcard name or object type.
   c) Multi-selection of objects for commanding or the creation of reports including Trend, Alarm, Audit and Activity for a specific period of time.

r. Offline Operation
1) The mobile user interface shall have the ability to operate in an offline mode in order to create or edit graphics and dashboard elements.
2) Content created offline shall be available to all authorized users for inclusion of an operating user interface later.

2.12 ENERGY SAVING PROGRAMS

A. Demand Limiting: Monitor total power consumption for each power meter and shed associated loads automatically to reduce power consumption to an operator set maximum demand level.

B. Duty Cycling: Periodically stop and start loads, based on space temperature, and according to various on/off patterns.

C. Automatic Time Scheduling: Self-contained programs for automatic start/stop/scheduling of building loads. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary schedules.

D. Optimal Start/Stop: Perform optimized start/stop as function of outside conditions, inside conditions, or both. Optimization shall be adaptive and self-tuning, adjusting to changing conditions by modifying occupancy period based upon the desired temperature at beginning and end of the occupancy period. Base optimization on occupancy schedules, outside air temperature, seasonal requirements, and interior room temperature. Employ adaptive model prediction for how long building takes to warm up or cool down under different conditions.

E. Night-Setback Program: Reduce heating space temperature setpoint or raise cooling space temperature setpoint during unoccupied hours in conjunction with scheduled start/stop and optimum start/stop programs.

F. Setpoint Reset: Setpoints for control of variable load systems shall be reset based on load demand, as described in the Sequence of Operations.

G. Calculated Points: Define calculations and totals computed from monitored points (analog/digital points), constants, or other calculated points.

H. Event Initiated Programming: Any data point capable of initiating event, causing series of controls in a sequence.

I. Holiday Scheduling.

J. Direct Digital Control: Furnish software so operator is capable of customizing control strategies and sequences of operation by defining appropriate control loop algorithms and choosing optimum loop parameters.

K. Trend logging shall be provided for all points per the input/output summary where there is a change in the analog or binary signal. Each controller shall be capable of storing trend values and then automatically transfer data to the NAC or the NS hard disk. Trend data shall be updated continuously per the operator assigned interval at intervals as low as one minute. Collect samples at intervals specified in minutes, hours, days, or month. Output trend logs as line-graphs or bar graphs. Binary points (input and output) shall only be logged upon a change of value (COV). Display trend samples on workstation in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time versus data.

2.13 FIELD INSTRUMENTATION

A. Temperature Sensors: All temperature sensors shall be thermistor type, factory- calibrated to within 1 degree F, interchangeable with housing appropriate for application. Sensors shall have a temperature curve rated for the application. Sensor wiring terminations shall be in a galvanized box.

1. Outside air temperature sensors shall be installed in weather proof enclosure with ventilated sun-shied

2. Duct mounted temperature sensors shall be averaging type for supply air, mixed air and low temperature applications for air handling units. Duct probe temperature sensor shall be acceptable for terminal units.

3. Space temperature sensors shall contain a backlit LCD digital display and user function keys along with temperature sensor, setpoint adjustment and after-hours override use. Override time may be set in one-hour increments.

4. Provide flat plate stainless steel space temperature sensors with no local setpoint adjustment as indicated on the Drawings.

B. Carbon Dioxide Sensors: The sensor shall be capable of monitoring carbon dioxide concentration with an accuracy of +/- 50 parts per million (PPM). The sensor shall produce a linear 0-10 VDC or 4-20 mA signal over the range of 0 to 2000 PPM. The sensor shall measure using non-dispersed infrared (NDIR) technology to measure carbon dioxide gas and shall be;

1. The EMCS Contractor shall utilize the required calibration devices to properly commission and calibrate the sensors per the manufacturer’s requirements.

C. Relative Humidity Sensors: relative humidity sensors shall be a two-wire type, 4-20 mA output proportional to the relative humidity range of 0-100%. The accuracy of the sensors shall be +2% over a range of 10-90% RH.

1. Outdoor relative humidity sensors: provide non-corroding outdoor shield to minimize wind effects and solar heating. Install wall-mount weather proof enclosure with conduit fitting.

2. Wall-mounted relative humidity sensor: sensor shall be installed in a wall- mounted enclosure with white cover.

3. Duct-mounted relative humidity sensor: sensor shall be provided with a moisture resistant enclosure with conduit fitting. The probe length shall be 8" minimum.

D. Pressure Transducers:

1. Air pressure sensor: The pressure sensors shall have an input range compatible with the medium being measured. The proportional output signal shall be 0-10 VDC or 4-20 mA.

E. Freezestat: Provide freezestats for all chilled water air handling systems that receive more than 10% untreated outside air. Freezestats shall provide vapor tension elements, which shall serpentine the inlet face on all coils. Provide additional sensors, wired in series, to provide one linear foot per square foot of coil surface area. Freezestat shall be manually reset at the switch. Interlock to the associated fan so that fan will shut down when HOA switch is in hand or auto position. Provide time delay relays with a 0-10 minute time delay relay duration to minimize nuisance freezestat trips. Time delay relay shall be adjustable at the associated control panel.

F. Air differential pressure switch: For fan shutdown, provide air differential pressure switches for all fans controlled by a variable frequency drive (VFD) to shut down the associated fan in the event of sensing high differential pressure. Air differential pressure switches shall have an adjustable setpoint with a range of 0-10 inches W.G. with manual reset at the switch. Provide ¼ inch copper tubing with compression fittings to mount to the side of the duct.

G. Momentary control relays: Provide momentary control relays as indicated. . Relays shall have coil ratings of 120 VAC, 50 mA or 10-30 VAC/VDC, 40 mA as suitable for the application. Contact ratings shall be 10 amp. Provide complete isolation between the control circuit and the digital output. Relays shall be located in the UC or other local enclosures and have pin-type terminals. Relays shall have LED indication of status.

H. Current sensing relay: Current sensing relays shall be rated for the applicable load. The output relay shall have an accessible trip adjustment over its complete operating range. Enclosure shall have an LED to indicate relay status.

I. Photocell: Ambient light level shall by a photocell in a non-corroding in a weatherproof housing with sun shield suitable for exterior installation. The control signal output shall be 4-20 ma or binary contact closure as specified in the sequences of operation. Mount the photocell on the north side of the building on the roof. The sensor reading shall be 0- 750 foot-candles.

J. Occupancy Sensors

1. The dual-technology occupancy ceiling mounted sensor shall be capable of detecting presence in the control area by via Doppler shifts in transmitted ultrasound and passive infrared (PIR) heat changes. Sensor shall utilize Dual Sensing Verification Principle for

coordination between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off. The sensor shall operate at 24 VDC/VAC.

2. Sensors shall have a time delay that is adjustable with configuration software or shall have a fixed time delay of 5 to 30 minutes, set by a DIP switch. Sensors shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.

3. The sensor shall have an additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options. The sensor shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled.

2.14 WHOLE BUILDING METERING

A. Buildings are to monitor electrical, water and gas usage. Any additional sub metering is to be provided by the Contractor and determined by each specific project as called out on the Drawings or Specifications.

2.15 AIRFLOW MEASURING STATIONS (AFMS)

A. Duct mounted airflow measuring stations with combination airflow and air temperature measurement devices shall have the following features:

1. Multi-point sensors in one or more probe assemblies with a maximum of one to sixteen sensor nodes per location, and a single remotely mounted microprocessor-based transmitter for each measurement location. Each sensor node shall consist of two hermetically sealed bead-in-glass thermistors. Each sensing point shall independently determine the airflow rate and temperature at each node, which shall be equally weighted in calculations by the transmitter prior to output as the cross-sectional average. Each ducted sensor probe shall have an integral, U.L. Listed, plenum rated cable. Each independent temperature sensor shall have a calibrated accuracy of +/-0.14° F (0.08° C) over the entire operating temperature range of -20° F to 160° F (-28.9° C to 71° C).and be calibrated at 3 temperatures against standards that are traceable to NIST. Acceptable manufacturer shall be EBTRON, Inc. GTx116-PC.

2. Each transmitter shall have a display capable of simultaneously displaying both airflow and temperature. Airflow rate shall be field configurable to be displayed as velocity or volumetric rates, selectable as IP or SI units. Each transmitter shall operate on 24 VAC and be fused and protected from over voltage, over current and power surges.

3. Each independent airflow sensor shall have a laboratory accuracy of +/-2% of reading over the entire calibrated airflow range of 0 to 5,000 fpm (25.4 m/s), and be wind tunnel calibrated at 16 points against air velocity standards that are traceable to NIST.

2.16 DAMPER ACTUATORS

A. Outside and exhaust air damper actuators shall be mechanical spring return. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the damper as required.

B. Outside and return air modulating actuators shall utilize analog (proportional) control 0-10 VDC. Actuators shall be driven in both the open and closed directions.

C. Electric damper actuators shall be direct shaft mounted and use a V-bolt and toothed V- clamp causing a cold weld effect for positive gripping. Single bolt or setscrew type fasteners are not acceptable.

D. Single section dampers shall have one electronic actuator direct shaft mounted.

E. Multi-section dampers with electric actuators shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft mounted per damper section.

F. Damper actuators shall be BELIMO or equivalent.

2.17 PANELS AND ENCLOSURES

A. Provide panels and enclosures for all components of the EMCS, which are susceptible to physical or environmental damage.

B. Interior panels and enclosures shall meet be NEMA 1 rated painted steel panels with locking door.

C. Exterior mounted panels and enclosures shall be NEMA 4 painted steel panels with locking door.

D. Panels for USCs shall be mounted on the outside of all unit ventilators and fan coil units with three feet of wall clearance in front of them and no higher than 7 feet to the bottom of the panel.

2.18 LABELING AND WARNING NOTICES

A. Provide labeling for all control panels and enclosures.

B. Provide labeling of all control wires and input/output points at the controller and at the control device; the label at each end of the wire shall be the same Labels shall be machine generated, typed and clearly legible with a maximum of 17 characters. Handwritten labels or labels written on the control wire jacket will not be acceptable. Each label shall be unique to its function and shall reference the applicable system. For example:

1. “AHU-1 SAT” will indicate the supply air temperature sensor for AHU-1. Improper labeling shall be removed and shall require re-commissioning of the control device and controller to document correct functionality.

C. Provide high voltage warning notices at all equipment controlled by the EMCS and at all associated motor starters when used by equipment controller.

2.19 TUBING AND PIPING

A. Provide tubing and piping as required for the field instrumentation.

B. Tubing within equipment rooms, vertical risers, and penetrations to ductwork shall be either copper pipe or shall be plastic tubing within conduit. Tubing for all water-based instrumentation shall be copper pipe. Identify the type of tubing proposed in the shop drawing submittal.

C. Provide suitable bulk head fittings for duct and panel penetrations.

D. Tubing in plenum rated areas may be plastic tubing. Polyethylene tubing shall meet, at minimum, the following requirements: flame retardant; crack resistant; 300 psi burst pressure.

2.20 CONDUIT AND FITTINGS

A. Provide all conduits, raceways and fittings for the EMCS monitoring, communication and control cabling. All work shall meet all applicable codes.

B. Conduit, where required, shall meet, the requirements specified within Division 26.

C. EMCS monitoring and control cable shall not share conduit with cable carrying voltages in excess of 90 VAC.

D. Conduit and fittings must be rated for exterior/outdoor conditions.

2.21 CABLING

A. Provide all cables for the EMCS. Cable shall meet, at minimum, the following requirements:

1. Minimum 98% conductivity stranded copper.

2. Proper impedance for the application as recommended by the EMCS component manufacturer.

3. Monitoring and control cable shall be #18 AWG or larger, dependent on the application. Analog input and output cabling shall be shielded.

4. Management Level Network cable shall be CAT 6, 24 gauge unshielded.

5. Automation Level Network cable shall be #24 AWG shielded.

6. Shield shall be grounded at the CCP, UC, or control panel. Ground at one end only to avoid ground loops.

7. Identification of each end at the termination point. Identification should be indicated on and correspond to the record drawings.

B. 120 VAC power wiring shall be of #12 AWG solid conductor or larger as required.

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION

A. The EMCS supplier shall provide a pre-construction coordination meeting with the affected trades to ensure a cooperative efficient process of installation. The invited trades shall include the general Contractor, mechanical Contractor, electrical Contractor, test and balance Contractor, Owner's representative, consulting engineer and others with a direct interest in the coordination of the affected systems. The EMCS Contractor shall provide an outline of the meeting agenda highlighting the construction schedule, coordination with mechanical and electrical trades. Provide a sign-in sheet and submit it through the attendees along with a summary of the meeting notes for future reference.

3.2 INSPECTION DURING INSTALLATION

A. Provide a technician to assist the Engineer or Owner's Representative, Test and Balance and Commissioning Agent with inspections made during the installation period that are required to review the progress and quality of ongoing work. The Engineer/Owner's representative shall generate field observation reports on the findings of the inspection. The engineer or Owner's representative shall advise the EMCS Contractor during the inspection of any concerns noted with respect to the installation and shall repeat the concerns in writing as soon as possible after the inspection is completed. The EMCS Contractor shall take corrective action to meet the requirements of the Specifications. Upon correction, the EMCS Contractor shall submit written documentation through the contractors to the engineer.

3.3 INSTALLATION OF COMPONENTS

A. Provide all interlock and control wiring. All wiring shall be installed in a neat and professional manner in accordance with Specification Division 26 and all national, state and local electrical codes.

B. Provide wire and wiring techniques recommended by equipment manufacturers. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the Owner's Representative prior to rough-in. Provide auxiliary pilot duty relays on motor starters as required for control function.

C. Electrical Contractor shall provide 120 or 277 volt power at a junction box within 48" of the controller. The EMCS Contractor shall coordinate with the Electrical Contractor to identify locations of power requirements prior to the installation of the controls.

D. Conduit for control wiring shall be provided whenever one of the following conditions exists:

1. Conduit is indicated on the Drawings or specifically required by the Specifications.

2. Cabling runs through inaccessible areas such as within partitions/walls, above closed in ceilings, under floor; within trenches and underground; on the exterior of the building; exposed on the surface of the building; when encased in concrete or other material that makes the cable inaccessible or when located such that access to the cable is not readily obtained.

3. Cable within mechanical, telecommunications and electrical equipment rooms and control rooms.

4. Conduit shall be installed, inside wall from sensor box to above the wall, for all wall mounted temperature, humidity and CO_2 sensors.

E. Control wiring located above an accessible ceiling space may be plenum-rated cable. Plenum rated wire shall be bundled and routed at right angles to the building lines and secured to the building structure every 15 feet.

F. When communication bus enters or exits a building, a surge suppressor shall be installed. The surge suppressor shall be installed according to the controls manufacturer's instructions.

G. Provide sleeves for all cable and conduit passing through walls, partitions, structural components, floors and roof

H. All sensor wiring shall be labeled to indicate the origination (at the device) and destination of data (at the control panel). The description shall indicate the type and location of the control device such as "AHU-1 SA temp" or "VAV 1-1 space temp".

I. Wall temp sensors at 48" above the finished floor to comply with ADA requirements and to match the height of the light switches. Mount humidity sensor at equal height to wall temperature sensor.

3.4 VERIFICATION REQUIREMENTS

A. Verification shall be provided by the EMCS Contractor to demonstrate and confirm that the installed system complies with the Specifications and the control sequences of operation herein specified. Upon completion of the verification process the EMCS Contractor shall demonstrate to the Engineer or Owner's representative and Commissioning Agent the functionality of the control system devices are in compliance with the Contract Documents.

1. The installing contractor shall perform a complete Performance Validation (PV) of the Building management system three (3) times throughout the project:
   a. At project turnover to customer.
   b. At six (6) months of project operation.
   c. At twelve (12) months of project operation or end of warranty.

2. Performance Verification shall include a complete and current Building Automation System site inventory including the following information at a minimum: a listing of all field and supervisory controllers with the following key attribute data; corresponding

model numbers, firmware versions, available security updates, CPU and memory performance data, battery conditions, integrations, controlled equipment, and device and point counts.

3. Performance Verification shall include a complete written evaluation of system configuration and performance in the following categories:
   a. Security – The Security evaluation shall include information about controllers that require security updates and conformance of user accounts to latest security rules and best practices.
   b. Energy Performance – The Energy Performance and Savings evaluation shall identify opportunities through schedule and nightly setbacks, economizers, eliminating simultaneous heating and cooling and adding VSD to equipment.
   c. Comfort and Health – The Comfort and Health evaluation shall identify temperature, pressure, and carbon dioxide values that deviate from desired set points that could lead to occupant discomfort.
   d. Reliability – The Reliability evaluation shall identify overridden control points, control points creating excessive alarms, and opportunities to adding control points and trends to further enable system functionality.
   e. Standards – The Standards evaluation shall identify conformance to published standards for point count, network performance and protocol standards.

B. Technicians provided by the EMCS Contractor shall be factory trained and qualified in the operation of the provided control system. The EMCS Contractor shall provide, if requested, the factory training certificates of the individuals providing the verification services on this project.

C. Verification tools, applicable to the system provided, shall be utilized by the factory- trained technicians for proper verification of system operation and functionality. Temperature verification sensors shall be NIST certified within the last 12 months. Meters such as Fluke 52 series or better shall be utilized. Use of non-certified meters may require the system to be re-verified with certified meters at no cost to the Owner.

D. Documentation of the verification process shall be provided per the project general conditions in electronic PDF format as required. Documentation shall include the following forms:

1. Project System Verification Forms for each controller provided on the project to verify the proper function of each controller, control device and system component provided.

2. Panel Verification Forms for each control panel to document the proper installation and function of each control panel provided.

3. Sequence of Operation Verification Forms for each piece of controlled equipment to confirm compliance of the control system with the specified sequences of operation.

4. Not providing proper documentation for each control devices, panel, or system, upon request by the engineer or Owner’s representative, may require the EMCS Contractor to re-verify the applicable systems at no additional cost to the Owner.

E. After completion of the verification, the EMCS Contractor shall be able to demonstrate the sequence of operations for each system to the engineer and the Owner’s representative.

F. Equipment checkout sheets are to be produced by this Contractor showing checkboxes and compliance with the following procedures for each piece of equipment and turned over to the Owner and/or Mechanical Engineer.

3.5 COLOR GRAPHICS

A. The color graphics shall be provided for the EMCS system prior to system acceptance and Owner training. Owner has final approval and decision on all graphic templates.

B. The color graphics provided shall include the following as a template. Provide forward and backward links on the graphic.

1. Site plan with link to overall building plan including detached buildings. The site plan shall be referenced to an automatically updated aerial view or map view of the area such as Google Maps or Bing Maps. Provide link to proceed to the overall building floor plan.

2. The overall building plan shall indicate space temperature conditions referenced by the color of the zone. Specific details of the zone temperatures and equipment are not required. Provide a link to the floor plan wings, upper floors and remote buildings.

3. The floor plan color graphics shall indicate the space temperatures by color references. Additional information shall indicate the space temperature, the occupancy of the zone, air handling units, VAV terminals and ductwork with diffusers. A link at each terminal unit or AHU shall automatically connect the system operator to the equipment color graphic.

4. The color graphics for the equipment shall as a minimum be equal to the points from the input/output summary or control schematic. Primary control devices as required by the sequences of operation shall also be provided.

5. Control points from equipment that are integrated into the EMCS via BACnet shall be provided to convey the operating conditions of the attached equipment. Coordination of the integration points shall be accomplished during the submittal phase. The EMCS Contractor shall provide a list of all integrated points on their submittal.

3.6 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A. Startup testing documentation: Prepare the checklist documenting startup testing of each input and output device, with technician's initials and date certifying each device has been tested and calibrated prior to acceptance testing. This document shall indicate proof that the following functions have been commissioned and shall be included in the as-built documentation: short to ground check, configuration of trends, confirmation that color- graphics are accurately representing actual systems, point to point checkout, all damper and valve actuators respond to input change, control modules are addressed and have functional descriptors, specified interlocks are functional, calibration report of all sensors, discrete outputs respond to time schedule or manual enable command.

B. Demonstration. Prior to acceptance, demonstrate the following performance tests to demonstrate system operation and compliance with the Specifications.

1. Engineer, Owner's representative and mechanical Contractor shall be invited to observe and review system demonstration. Provide attendees at least 10 day's notice.

2. Demonstration shall follow process approved as part of the submittal and shall include complete checklists and forms for each system as part of system demonstration.

3. Demonstrate actual field operation of each sequence of operation as specified. Demonstrate calibration and response of any input and output points requested by engineer or Owner's representative.

4. Demonstrate complete operation of operator interface including review of color-graphics, time schedules, trend logs, alarm notification, functionality of tablet PC operation.
   a. PID loop response. Supply graphical trend data output showing each PID loop's response to a set point change representing an actuator position change of at least 25% of full range. Trend sampling rate shall be selectable from 10 seconds to 3 minutes, depending on loop speed. Each sample's trend data shall show set point, actuator position, and controlled variable values.
   b. Demand limiting. Supply trend data output showing demand-limiting algorithm action. Trend data shall document action sampled each minute over at least a 30-minute period and shall show building kW, demand limiting setpoint, and status of set points and other affected equipment parameters.
   c. Trend logs for each system. Trend data shall indicate set points, operating points, valve positions, and other data as specified. Logs shall be accessible through system's operator interface and shall be retrievable for use in other software programs.

5. Alarms and Interlocks. Check each alarm with an appropriate signal at a value that will trip the alarm. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction. Alarm verification shall include temperatures exceeding alarm threshold (high and low), fan failure safety, duct high static pressure switch, freezestat, and smoke detector shutdown.

6. Tests that fail to demonstrate proper system operation to the engineer shall be repeated after Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.

C. Owner Acceptance.

1. After tests described in this Specification are performed to the satisfaction of both Engineer and Owner's representative and Commissioning Agent, the Engineer shall accept the control system as meeting completion requirements. Engineer may exempt tests from completion requirements that cannot be performed due to circumstances beyond EMCS Contractor's control. Engineer shall provide written statement of each exempted test. Exempted tests shall be performed as part of warranty.

2. System shall not be accepted until completed demonstration forms and checklists are submitted and approved by the Engineer, Owner and Commissioning Agent (CxA).

3. No portion of the total Contract will be declared substantially complete until the automatic temperature control system has been demonstrated to be complete and functioning as intended. The temperature control system will be complete and functioning as intended when all of the space temperatures are maintained at plus or minus two (2) degrees F of setpoint.

3.7 DEMONSTRATION AND OWNER TRAINING

A. Provide a training session for the Owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.

2. Principle of how the equipment works.

3. Important parts and assemblies.

4. How the equipment achieves its purpose and necessary operating conditions

5. Most likely failure modes, causes and corrections.

6. On site demonstration that includes hands-on demonstration of the manipulation of setpoints, schedules and other adjustable elements of the system.

7. The demonstration shall be on the actual, completed graphic interface pages for the specific project.

B. Provide a second training session six (6) months after initial session for any follow-up or additional training requested by Owner's personnel. Allow three (3) hours for the second training session.

C. EMCS Contractor shall provide ongoing free classroom training at their local office for Stafford MSD.

PART 4 - I/O POINTS

4.1 GENERAL

A. The sequences of operations indicated on the Control Drawings shall be accomplished by the EMCS. Coordinate with Owner in operating equipment to maximize comfort and economy. All points required to accomplish the sequences shall be provided and connected to the EMCS.

B. Equipment interfaces are acceptable for providing information but each piece of equipment (including but not limited to chillers, VFD's, unitary equipment, etc.) shall have a hardwired point for start/stop and speed control.

C. All Points added by Engineer and/or Control Contractor needed for the sequences shall be identified in the Submittals and Project Record Documents.

D. All VFD's and actuators shall have feedback that reports to the EMCS.

E. All units to have economizer sequences and economizer fault detection and diagnosis capabilities.

F. Flow meters at air handlers shall be integrated into the EMCS.

G. Interlock of fire suppression in IT spaces is required and shall be fully coordinated by the EMCS and Fire Suppression Contractors. BACnet interface to be provided by Fire Suppression Contractor for items installed by that contractor.

4.2 BUILDING METERING

A. I/O Points Lis

1. Electrical Switchgear – Modbus Integration

2. Domestic Water Meter – AI (Domestic Flow Meter by Plumbing Contractor)

B. Natural Gas Meter – AI (Natural Gas Meter by Plumbing Contractor)

4.3 BUILDING SHUTDOWN (SHELTER IN PLACE)

A. I/O Points List

1. Shutdown switch status – dry contact - DI

B. A maintained mushroom type emergency local override button shall be installed in the principal's office or the administration area shall shut down the HVAC system in case of emergency. Once pushed the button must be reset to allow the HVAC system to resume normal operation. The final location of the building shutdown is to be determined by Stafford MSD personnel

4.4 IRRIGATION CONTROL

A. I/O Points List

1. Monitor and display current flow showing gallons per minute - AI

2. Monitor total gallons used (trend) - AI

B. EMCS system will interface with irrigation controller to allow owner to control scheduling and zoning of irrigation.

4.5 DOMESTIC WATER HEATING CIRCULATION PUMP

A. I/O Points List

1. Start/stop – DO
2. Return water temperature – AI
3. Status

4.6 VARIABLE AIR VOLUME BOX WITH SUPPLEMENTAL HEAT

A. I/O POINTS

1. Space temperature sensor – AI
2. Electric heating coil - AO
3. Cooling damper - AO
4. Fan status – DI
5. Fan speed (hi/lo) - DO
6. Discharge air temperature –AI
7. Space occupancy sensor – DI

4.7 EXHAUST FANS

A. I/O POINTS LIST

1. Fan start/stop – DO
2. Fan status – DI

4.8 OUTDOOR AIR CONDITIONS

A. I/O POINTS LIST

1. Outdoor air temperature – AI
2. Outdoor air humidity – AI

B. The sensors shall be mounted in an area on the North side of the building where the representative temperature and humidity can be monitored, both shall have sun shields. Based on the outside air temperature and humidity the B.A.S. shall calculate the outdoor enthalpy, wet

bulb, and dew point temperatures. The outdoor air temperature and humidity shall be broadcast as global information for use by the other control programs.

4.9 IDF AND MDF ROOMS

A. I/O POINTS LIST

1. Space temperature – AI

B. The EMCS shall monitor the space temperature in the IDF and MDF rooms.

C. The EMCS shall report a high temperature alarm to the computers, pagers, and/or text message compatible cell phones designated by the School district personnel if the space temperature rises above 68°F (adjustable) for five (5) minutes (adjustable).

4.10 UNIT HEATER

A. I/O POINTS LIST

1. Space temperature - AI

2. UH start/stop and hot water valve open/close - DO

B. A space temperature sensor shall monitor the air temperature in the space. If the space temperature falls below 60 degrees F (operator adjustable) the Unit Heater fan shall be energized and the hot water valve shall be opened. The fan shall continue to run with the hot water valve open until the space temperature rises by 4 degrees F (operator adjustable).

4.11 DX/ GAS RTU WITH HOT GAS REHEAT AND CO_2

A. I/O POINTS LIST

1. Space temperature – AI

2. Discharge air temperature – AI

3. Return air temperature - AI

4. RTU fan status – current switch - DI

5. DX Cooling – Multiple stages as necessary- DO

6. Heating – multiple stages as necessary - DO

7. RTU fan start/stop - DO

8. Exhaust fan start/stop - DO

9. Outdoor air damper – AO

10. Return Air CO_2 – AI

END OF SECTION 230923

233100 - DUCTWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Low pressure duct.

B. Duct pressure testing.

1.2 RELATED WORK

A. Section 09900 - Painting: Weld priming, weather resistant, paint or coating.

B. Section 15140 - Supports and Anchors: Sleeves.

C. Section 15250 - Mechanical Insulation.

D. Section 15910 - Duct Accessories.

E. Section 15990 - Testing, Adjusting and Balancing.

F. Section 013300 Submittals.

G. Section 01524 Construction Waste Management

H. Section 01352 LEED Requirements

I. Section 01611 Environmental Management

J. Section 01570 Pollution Prevention and Control

1.3 REFERENCES

A. ASHRAE - Handbook 1993 Fundamentals; Chapter 32 - Duct Design.

B. ASHRAE - Handbook 1992 HVAC Systems and Equipment; Chapter 16 - Duct Construction.

C. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.

D. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

E. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.

F. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

G. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.

H. SMACNA - Low Pressure Duct Construction Standards.

I. UL 181 - Factory-Made Air Ducts and Connectors.

J. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

K. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooling Equipment.

1.4 DEFINITIONS

A. Duct sizes shown are net inside clear dimensions. Duct shall be externally insulated. Where offsets or transitions are required, the duct shall maintain the equivalent diameter based on hydraulic diameter and rectangular duct size for equal flow, velocity and pressure drop as calculated by Huebscher formulae #30 and/or 31 in ASHRAE Duct Design Fundamentals Handbook and Figure 5 Friction Chart for round duct.

B. Low Pressure: Three pressure classifications: 1/2 inch WG positive or negative static pressure and velocities less than 2,000 fpm; 1 inch WG positive or negative static pressure and velocities less than 2,500 fpm, and 2 inch WG positive or negative static pressure and velocities less than 2,500 fpm. All ducts shall be sealed as specified, independent of SMACNA pressure class.

1.5 SUBMITTALS

A. Refer to other applicable sections for additional coordination drawings, duct shop drawings and product data and conform to provisions of Division 1.

B. Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work.

C. The Contract Documents are schematic in nature and are to be used only for design intent. The Contractor shall prepare coordination and sheet metal shop drawings, fully detailed and drawn to scale, indicating all architectural partitions, structural conditions, all plumbing pipe and light fixtures co-ordinations, and all offsets and transitions as required to permit the duct to fit in the space allocated and built and show all bottom of duct elevations. All duct revisions required as a result of the Contractor not preparing fully detailed shop drawings will be performed at no additional cost to the Owner.

D. Sheet metal ductwork "shop" drawings shall be made after actual job measurements are obtained. Sheet metal ductwork drawings shall indicate the coordination of the Contractor with sprinkler piping and other mechanical and electrical services installed under Division 15 and 16. These "Shop Drawings" shall be submitted for review as specified. Ductwork joint, connection, ductwork "shop" drawing submittal. Details shall be indexed and index number shall appear on ductwork "shop drawing" at its point of use.

E. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
   b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 1.

B. Store and protect products under provisions of Division 1.

C. Protect duct from contamination by dirt, dust or rain by covering openings; do not store duct in open on site.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 ACCEPTABLE MANUFACTURERS

A. Armco - "Zinc-Grip".

B. Flex-master.

C. Substitutions: Under provisions of Division 1.

2.5 DUCTWORK GENERAL

A. All ductwork indicated on the Drawings, specified or required for the air conditioning and ventilating systems shall be of materials as hereinafter specified unless indicated otherwise. All air distribution ductwork shall be fabricated, erected, supported, etc., in accordance with all applicable standards of SMACNA Duct Manuals where such standards do not conflict with NFPA

90A and where class of construction equals or exceeds that noted herein. All exhaust ductwork including toilet room exhausts shall be constructed and leak tested as specified for medium pressure supply ducts at negative pressure.

B. All ductwork shown on the Drawings, specified or required for the heating, ventilating and air conditioning systems shall be constructed and erected in a first class workmanlike manner. The work shall be guaranteed for a period of one (1) year from and after the date of acceptance of the job against noise, chatter, whistling, vibration, and free from pulsation under all conditions of operation. After the system is in operation, should these defects occur, they shall be corrected as directed by the Architect.

C. All duct sizes shown on the Drawings are air stream sizes. Allowance shall be made for internal lining where required, to provide the required cross sectional area.

D. All holes in ducts for damper rods and other necessary devices shall be either drilled or machine punched (not pin punched), and shall not be any larger than necessary. All duct openings shall be provided with sheet metal caps if the openings are to be left unconnected for any length of time.

E. Except for special ducts specified elsewhere herein, all sheet metal used on the project shall be constructed from prime galvanized steel sheets and/or coils up to 60" in width. Each sheet shall be stenciled with manufacturer's name and gauge. Coils of sheet steel shall be stenciled throughout on ten foot (10') centers with manufacturer's name and must be visible after duct is installed. Sheet metal must conform to SMACNA sheet metal tolerances as outlined in SMACNA's "HVAC Duct Construction Standards."

F. Where ducts, exposed to view (including equipment rooms), pass through walls, floors or ceilings, furnish and install sheet metal collars around the duct.

2.6 MATERIALS

A. General: Non-combustible and conforming to requirements for Class 1 air duct materials, or UL 181.

B. Steel Ducts: ASTM A525 galvanized steel sheet, lock-forming quality, having zinc coating of 1.25 oz per sq. ft. for each side in conformance with ASTM A90. Minimum gauge for all duct shall be 26 gauge (0.019").

C. Flexible Round Ducts:

1. Low pressure: Interlocking spiral wire of galvanized steel or aluminum construction with flexible trilaminate inner fabric rated to 6 inches WG positive and 1 inches WG negative for low pressure ducts, insulated with 1" thick fiberglass insulation and reinforced metalized outer vapor barrier; Flexmaster type 5-m insulated or equal, NFPA 90A and U.L. 181 class 1 listed;

D. Fasteners: Rivets, bolts, or sheet metal screws.

E. Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

F. Hanger Rod: Steel, galvanized; continuously threaded.

2.7 LOW PRESSURE DUCT

A. The scope of low pressure ductwork is defined as all ductwork downstream of terminal units, and all exhaust ductwork downstream of fans. Construction of all low pressure duct shall be in accordance with Low Velocity Duct Construction Standards as published by Sheet Metal and Air Conditioning Contractors National Association (SMACNA) and shall be sealed and tested at 3" static with the same test procedures as required by SMACNA.

B. Spiral wound round duct shall be as manufactured by United McGill Sheet Metal Company or approved equal.

C. The metal gauges listed in the latest SMACNA HVAC Duct Construction Standards for Metal and Flexible Duct are the minimum which shall be used for this project. It shall be noted that the Contractor is responsible that the metal gauge selected is heavy enough to withstand the physical abuse of the installation.

D. Elbows shall be radius type and have a centerline radius of 1-1/2 times the duct diameter or width. Elbows in round ducts may be smooth radius as described above or 5-piece 90 degree elbows and 3-piece 45 degree elbows. Joints in round ducts shall be slip type with a minimum of three sheet metal screws. Joints in sectional elbows shall be sealed as specified for duct sealing.

E. SEALANT: All ductwork (except welded exhaust duct) shall be sealed with either "MP" (Multi-Purpose), Hardcast "Iron-grip 601", Polymer Adhesive "Airseal #11", or "United Duct Seal" (United McGill Corp.) water base, latex or acrylic type sealant. Note that, except as noted, oil or solvent based sealants are specifically prohibited for use on this project. For exterior applications, "Uni-Weather" (United McGill Corp.) neoprene based sealant shall be used. No other sealants may be used. All seams and joints in shop and field fabricated ductwork shall be sealed by applying one layer of sealant, then immediately spanning the joint with a single layer of 3" wide open weave fiberglass tape. Sufficient additional sealant shall then be applied to completely imbed the cloth. All sealants shall be UL rated at no more than flame spread of 5 and smoke developed of 0. At contractor’s option Hardcast 1602 sealant tape may be used in lap joints and flat seams.

F. Fabricate and support in accordance with SMACNA Low Pressure Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated, except that all duct joints and longitudinal seams for all SMACNA classes of duct shall be sealed with U.L. Listed Hardcast DT-tape and sealant FTA-20.

G. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by approved shop drawings.

H. Construct tees, offsets, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide single thickness turning vanes for duct velocities up to 1500 fpm and for higher duct velocities, provide airfoil turning vanes.

I. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

J. Use crimp joints with bead for joining round duct sizes 6 inch smaller with crimp in direction of air flow.

K. Use double nuts and lock washers on threaded rod supports.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Obtain manufacturer's inspection and acceptance of fabrication and installation of duct at beginning of installation.

B. Provide openings in duct where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal well and closure device to ensure against air leakage. Where openings are provided in insulated duct, install insulation material inside a metal ring.

C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

D. Connect fan coil units to low pressure OA intake ducts with short length of flexible duct. Hold in place with corrosion resistant clamp or strap.

E. Connect air distribution devices to low pressure ducts with 6 feet maximum, 4 feet minimum, length of flexible duct. Hold in place with corrosion resistant strap or clamp.

F. During construction provide temporary closures of metal or taped polyethylene on open duct to prevent construction dust from entering duct system.

G. The interior surface of all duct shall be smooth. No sheet metal parts, tabs, angles, or anything else may project into the ducts for any reason, except as specified to be so. All seams and joints shall be external.

H. Where ducts pass through floors, provide structural angles for duct support. Where ducts pass through walls in exposed areas, install suitable sheet metal escutcheons.

I. All angles shall be carried around all four sides of the duct or group of ducts. Angles shall overlap corners and be welded or riveted.

J. All ducts shall be fabricated in a manner to prevent the seams or joints being cut for the installation of air distribution devices.

K. All rectangular duct located exposed on roof shall have top horizontal surface "crowned or sloped" to prevent water from ponding. Ref: Insulation for additional requirements.

L. Provide all new round flex duct maximum length 2'-0", for extension use round sheet metal duct externally insulated with 1-1/2" thick, 1.5 p.c.f. Density fiberglass insulation with "F-S-K-L" (foil-skrim-kraft-laminate) vapor barrier.

M. Provide round spin-in fittings with locking quadrant butterfly volume dampers for all round duct connections to rectangular ducts. Spin-in and flex duct shall be same size as air distribution device neck diameter. Secure flex duct to spin-in and air distribution device neck with stainless steel worm gear clamps and seal vapor barrier. Suspend flex duct from structure above; round and flexible duct shall be as detailed by SMACNA in section iii round, oval and flexible duct. Round duct seams shall be type RL-1 spiral seam or seam type RL-5 grooved seam flat pipe lock constructed in accordance with SMACNA figure 3-1; flexible duct supports shall be constructed and installed in accordance with SMACNA figures 3-9 and 3-10.

N. Duct dimensions shown are net clear Internal Dimensions; allowance must be made for 1-1/2" thick external insulation as specified; all rectangular and round supply air, return air, outside air and exhaust air duct shall be galvanized sheet metal.

O. Provide duct test wells at all locations required for testing, adjusting balancing, and temperature measuring.

P. All duct shall be mounted tight to underside of structure and shall be top level with bottom and side transitions only, except that allowance shall be made for duct to be externally insulated, which shall be mounted 3" below structural beams and joists or other obstruction to allow installation of the external duct insulation. Some ducts may require the use of "ESS"-drive joints or flat seams to allow crossing of duct or installation of other equipment or piping. Raise existing duct where required to allow installation of other duct or equipment; use 45 degree radius elbows (center line radius = 1.5 times duct height) to offset.

Q. Typical supply, return and exhaust duct shall be as detailed by SMACNA in Section II fittings and other construction. All 90 degree elbows shall be constructed in accordance with SMACNA figure 2-2, style RE-1 radius elbow (center line radius = 1.5 times duct height or width), space permitting or style RE-2 square throat with turning vanes (provide duct access panel up stream of turning vanes for cleaning purposes).

R. Turning vanes shall be installed in accordance with figure 2.3; single wall type with trailing edge for duct velocities up to 1500 fpm and double wall turning vanes above 1500 fpm duct velocity.

S. Parallel flow branches shall be constructed in accordance with figure 2-7. Rectangular duct branch connections shall be expanded 45 degree entry type and round branch duct connections shall be spin-in type in accordance with figure 2-8 and offsets and transitions shall be in accordance with figure 2-9.

T. Duct access doors shall be constructed in accordance with figure 2-12 and shall have a frame type 3, position 3 hinge with a type 2 locking handle; single and multi-blade volume dampers shall be in accordance with figures 2-14 and 2-15 respectively and shall have operator extensions when provided on externally insulated ducts; air distribution device connections shall be in accordance with figure 2-16 and ceiling diffuser branch ducts shall be in accordance with figure 2-17.

U. Rectangular duct connections at all air moving equipment shall be flexible neoprene fabric and installed in accordance with figure 2-19.

V. Seal all non-welded duct joints of all SMACNA pressure classes with Hard-cast DT-cotton tape and duct sealer FTA-20 for indoor duct and duct sealer FTA-50 for exterior duct.

3.2 DUCT APPLICATION SCHEDULE

A. AIR SYSTEM	MATERIAL
Low Pressure Supply or return	Galvanized Steel
Return and Relief	Galvanized Steel
General Exhaust	Galvanized Steel
Outside Air Intake	Galvanized Steel
Kitchen Exhaust	16 Gauge Stainless Steel (welded)
Fume Hood Exhaust	16 Gauge Stainless Steel (welded)
Science Wet Lab Supply and Return	16 Gauge Stainless Steel (welded)
Shower Area Supply and Return	16 Gauge Stainless Steel (welded)

3.3 DUCT HANGERS AND SUPPORTS

A. All ducts shall be properly suspended or supported from the building structure. Hangers shall be galvanized steel straps or hot-dipped galvanized rod with threads pointed after installation. Strap hanger shall be attached to the bottom of the duct. The spacing, size and installation of hangers shall be in accordance with the recommendations of SMACNA, latest edition.

B. All duct risers shall be supported by angles or channels secured to the sides of the ducts at each floor with sheet metal screws or rivets. The floor supports may also be secured to ducts by rods, angles or flat bar to the duct joint or reinforcing. Miscellaneous steel supports for duct risers shall be provided under this Division.

3.4 ADJUSTING AND CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

END OF SECTION 233100

233113 - METAL DUCTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. HVAC air distribution ductwork.

B. Duct pressure testing.

1.2 RELATED WORK

A. Section 09900 - Painting: Weld priming, weather resistant, paint or coating.

B. Section 15140 - Supports and Anchors: Sleeves.

C. Section 15250 - Mechanical Insulation.

D. Section 15910 - Duct Accessories.

E. Section 15990 - Testing, Adjusting and Balancing.

F. Section 013300 Submittals.

G. Section 01524 Construction Waste Management

H. Section 01352 LEED Requirements

I. Section 01611 Environmental Management

J. Section 01570 Pollution Prevention and Control

1.3 REFERENCES

A. ASHRAE – Fundamentals Handbook, Latest Version; Duct Design.

B. ASHRAE - HVAC Systems and Equipment Handbook, Latest Version; Duct Construction.

C. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.

D. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

E. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.

F. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

G. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.

H. SMACNA - Duct Construction Standards.

I. UL 181 - Factory-Made Air Ducts and Connectors.

J. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

K. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooling Equipment.

1.4 DEFINITIONS

A. WG - Water Gauge

B. Static Pressure - Total air pressure less velocity air pressure. Static pressure type is defines as positive or negative pressures relative to standard atmospheric conditions unless denoted otherwise.

C. Duct Size - Net inside clear dimensions after insulation. Where offsets or transitions are required, the duct shall maintain the equivalent area based on hydraulic diameter and rectangular duct size for equal flow, velocity and pressure drop as calculated by Huebscher Formula #30 and/or #31 in ASHRAE Duct Design Fundamentals Handbook and associated Friction Chart for round duct.

D. Pressure Classification - SMACNA standard classification system for ductwork applications not exceeding listed static pressure and velocity services. SMACNA standard static pressure classes are defined as follows:

Pressure Class	Operating Pressure (WG)	Pressure Type	Max Velocity (fpm)	Seal Class
½	< 1/2”	Any	< 2,000	C
1	>½” to 1”	Any	< 2,500	C
2	>1” to 2”	Any	< 2,500	B (note 1)
3	>2” to 3”	Any	<4,000	B
4	>3” to 4”	Positive Only	<4,000	A
6	>4” to 6”	Positive Only	As Indicated	A
10	>6” to 10”	Positive Only	As Indicated	A

Notes 1: Seal Class B required exceeding SMACNA minimum requirement.

1.5 SUBMITTALS

A. Refer to other applicable sections for additional coordination drawings, duct shop drawings and product data and conform to provisions of Division 1.

B. Shop Drawings:

1. Prepare and submit ductwork shop drawings prior to fabrication and installation of ductwork. Contract documents are schematic in nature and are not an acceptable substitute for ductwork shop drawings.

2. Include floor plans drawn to scale not less than 1”=1/4” over appropriate project backgrounds. Include duct elevations and sections where proposed duct configurations cannot be fully depicted in plan view.

3. Include relevant details such as duct size dimensions, pressure classification, sheet metal gages, joining methodology, duct construction technology, fittings and duct accessories prior to start of work.

4. Include coordination with the work of other applicable trades including architectural partitions, piping, electrical, lighting, and ceiling systems.

5. Indicate bottom of duct elevation dimensions.

6. Include details for offsets and transitions as required to permit ductwork to fit in the installation space allocated. Verify actual project field conditions and measurements as required.

7. Owner assumes no responsibility for reimbursing additional costs for duct revisions and/or rework required as a result of failure to prepare fully developed and detailed shop drawings.

C. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:

a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and protect products under provisions of Division 1.

B. Protect duct from exposure to weather. Do not store duct in uncovered areas.

C. Protect duct from contamination by covering openings until the time of installation. Maintain coverings over installed duct openings throughout construction progress until duct system is fully closed and complete.

D. Prevent entry into and/or habitation of ductwork by animals during storage and construction.

E. Restore ductwork to like-new condition or replace contaminated by lack of adequate protection at no additional cost to owner.

1.7 QUALITY CONTROL

A. Obtain manufacturer's inspection and acceptance of installation of duct at beginning of installation for factory prefabricated duct systems.

B. Provide 100% visual inspection of duct joint sealing prior to installation of thermal insulation coverings.

C. PRESSURE TESTING

1. Pressure test ducts rated for Pressure Class 3 inch or higher.

2. Conduct tests using procedures consistent with SMACNA HVAC Duct Leakage Test Manual.

3. Determine maximum acceptable rate of air leakage using duct leakage formula as follows:

$$F = C_L \times P^{0.65}$$

Where: F = Maximum permissible airflow leakage in cfm/100 sq. ft. duct surface

P = Ducts static pressure in inch WG

C_L = Leakage Class according to the table below

Duct Construction	Seal Class A	Seal Class B
Rectangular Construction	$C_L = 6$	$C_L = 12$
Round or Oval Construction	$C_L = 3$	$C_L = 6$

4. Conduct duct leakage tests witnessed in writing by owner's designated representative, independent TAB service, project commissioning authority, independent construction inspector, engineer of record, and/or authority having jurisdiction where required. Schedule testing with advance notification for test witness(s).

5. Correct and retest ducts failing leakage tests at no additional cost to owner.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 ACCEPTABLE MANUFACTURERS

A. Flexible Duct Runouts

1. Flex-master.

2. Thermaflex

3. JP Lamborn Co.

2.5 MATERIALS

A. General: Non-combustible and conforming to requirements for Class 1 air duct materials, or UL 181.

B. Non-Welded Steel Ducts: ASTM A525 galvanized steel sheet, lock-forming quality, having zinc coating of 1.25 oz per sq. ft. for each side in conformance with ASTM A90.

C. Welded Carbon Steel Ducts: ASTM 568 rolled carbon steel; SMAW, FCAW, or GMAW welded; minimum 18 gauge sheet metal thickness.

D. Welded Stainless Steel Ducts: ASTM A167, Type 304; GMAW welded; minimum 16 gauge sheet metal thickness.

E. Fasteners: Rivets, bolts, or sheet metal screws matching base duct materials.

F. Sealant: Non-hardening, water resistant, fire resistive, suitable for applications and compatible with mating materials

1. High solids mastics - high density type with excellent adhesions and elasticity suitable for sealing fillets, groves, and flanges.

2. Liquid sealants - formulated specifically for duct applications containing not more than 60% volatiles suitable for filling voids 1/16 inch or less. Provide taped joint reinforcement for liquid sealants except machine fabricated longitudinal seams and slip-type joints.

3. Reinforcing tapes - suitable for use with liquid sealed joints only. Pressure sensitive adhesive tape sealing systems are not acceptable without liquid mastic overcoat.

4. Gaskets: soft elastomeric butyl rubber with adhesive backing suitable for use with flanged joints.

5. Liquid sealants containing not more than 50% volatiles. May be used for slip type joint assembly to fill voids up to 1/16 inch clearance.

G. Hangers

1. Strap: Steel, galvanized

2. Rod: Steel, galvanized; continuously threaded.

2.6 CONSTRUCTION

A. GALVANIZED STEEL RECTANGULAR DUCT

1. Single or double wall construction as indicated by application.

2. Minimum 26 gauge sheet metal thickness

3. Longitudinal seams complying with the following industry standards:
   a. Inside Groove Seam
   b. Sliding Seam
   c. Pittsburgh Lock
   d. Button-Punch Snap Lock

4. Transverse joints complying with the following industry standards:
   a. Drive Slip
   b. S Slip
   c. Reinforced Bar-S Slip
   d. Pocket Joint
   e. Flanged Systems (Ductmate, MEZ, or equal) comprised of;
      1) Rolled flanges with integral mastic seals
      2) Bolted preformed corner pieces
      3) Sealing gaskets
      4) Flange joint drive cleats

5. Sealing Requirements
    a. Class A – All transverse joints, longitudinal seams, and duct wall penetrations
    b. Class B – All transverse joints and longitudinal seams
    c. Class C – All transverse joints

6. except that all duct joints and longitudinal seams for all SMACNA classes of duct shall be sealed with U.L. Listed Hardcast DT-tape and sealant FTA-20.

B. GALVANIZED STEEL ROUND OR OVAL DUCT

1. Single or double wall construction as indicated by application.

2. Minimum 26 gauge sheet metal thickness

3. Longitudinal seams complying with the following industry standards:
    a. Continuous interlocking spiral wound
    b. Continuously seam welded
    c. Butt seam welded
    d. Gore locked seam

4. Transverse joints complying with the following industry standards:
    a. Pipe & fitting coupled slip joint with radial fasteners
    b. Swedge sleeve
    c. Welded flanged & gasketed

C. WELDED LOW CARBON STEEL DUCT

1. Minimum 16 gauge thickness for grease laden exhaust service

2. Minimum 18 gauge thickness for services other than grease laden exhaust

3. Fully welded construction complying with one of the following industry standards
    a. Shielded metal arc welding (SMAW)
    b. Flux core arc welding (FCAW)
    c. Gas metal arc welding (GMAW)

4. Fully welded longitudinal joints and transverse seams for grease laden kitchen exhaust applications.

5. Welded longitudinal seams with gasketed flanged transverse joints for applications other than grease laden kitchen exhaust.

D. WELDED STAINLESS STEEL DUCT

1. Minimum 16 gauge thickness for laboratory exhaust service

2. Minimum 18 gauge thickness for services other than laboratory exhaust

3. Welded construction complying with industry standard gas metal arc welding (GMAW)

4. Fully welded longitudinal joints and transverse seams with gasketed flanged connections at equipment connections only for laboratory exhaust applications.

5. Welded longitudinal seams with gasketed flanged transverse joints for applications other than labratory exhaust.

E. FLEXIBLE ROUND DUCT

1. Flexmaster type 5M insulated or equal.

2. Complant with NFPA 90A & 90B

3. U.L. 181 Class 1 listed

4. ASTM E96 Proceedure A rated for 0.05 Perm

5. Interlocking spiral wire of galvanized steel or aluminum construction

6. Aluminum foil, fiberglass, & aluminized polyester trilaminate liner

7. Rated to 6 inches WG positive and 1 inches WG negative

8. Insulated with 1" thick fiberglass insulation meeting R4.2

9. Reinforced metalized outer vapor barrier

F. DOUBLE WALL THERMAL DUCT FOR INTERIOR APPLICATIONS

1. Shop fabricated or factory prefabricated double wall duct systems consisting of continuous inner and outer wall metal duct sections with integral thermal insulation preinstalled in the annular space separating the inner and outer wall sections.

2. Reference Section 230713 HVAC Insulation, or other applicable Division 23 Sections for specific insulation requirements by application.

3. Paintable outer surface suitable for use in aesthetically exposed applications.

4. Comply with requirements of Galvanized Steel Rectangular, Round, and Oval Duct as applicable.

5. Provide double wall systems complete with all fittings, taps, and accessories.

G. DOUBLE WALL THERMAL DUCT FOR EXTERIOR EXPOSED APPLICATIONS

1. Shop fabricated or factory prefabricated double wall duct systems consisting of continuous inner and outer wall metal duct sections with integral thermal insulation preinstalled within the annular space separating the inner and outer wall sections.

2. Galvanized steel inner wall with welded stainless steel outer wall fabricated in flanged sections.

3. Reference Section 230713 HVAC Insulation, or other applicable Division 23 Sections for specific insulation requirements by application.

4. Inner duct wall complying with requirements of Galvanized Steel Rectangular, Round, and Oval Duct as applicable. Outer duct wall complying with requirements of Welded Stainless Steel Duct.

5. Provide double wall systems complete with all fittings, taps, and accessories.

H. DOUBLE WALL ACOUSTICAL DUCT

1. Shop fabricated or factory prefabricated double wall duct systems consisting of perforated inner and continuous outer wall metal duct sections with integral thermal acoustic insulation preinstalled in the annular space separating the inner and outer wall sections.

2. Provide inner duct with 3/32 inch diameter perforation holes staggered at 3/16 inch on center.

3. Reference Section 230713 HVAC Insulation, or other applicable Division 23 Sections for specific insulation requirements by application.

4. Paintable outer surface suitable for use in aesthetically exposed applications.

5. Conform to the requirements of galvanized steel rectangular, round, and oval duct as applicable.

6. Provide double wall systems complete with all fittings, taps, and accessories.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Fabricate and support in accordance with SMACNA Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gages, reinforcing, and sealing for pressures indicated.

B. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No reduction of equivalent duct area is permitted except by reviewed shop drawings.

C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

D. Construct duct fittings per SMACNA standard details.

1. Provide typical supply, return and exhaust duct as detailed by SMACNA Section II fittings and other construction.

2. The interior surface of all duct shall be smooth. No sheet metal parts, tabs, angles, or anything else may project into the ducts for any reason, except as specified to be so. All seams and joints shall be external.

3. Provide 90 degree elbows constructed in accordance with SMACNA Figure 2-2, style RE-1 radius elbow (center line radius = 1.5 times duct height or width), space permitting; or style RE-2 square throat with turning vanes (provide duct access panel up stream of turning vanes for cleaning purposes) where required.

4. Where rectangular elbows are used, provide single thickness turning vanes in accordance with SMACNA Figure 2.3; single wall type with trailing edge for duct velocities up to 1500 fpm and double wall turning vanes above 1500 fpm duct velocity.

5. Provide parallel flow branches constructed in accordance with SMACNA Figure 2-7.

6. Provide expanded 45 degree entry type rectangular duct branch connections.

7. Provide spin-in type round branch duct connections in accordance with SMACNA Figure 2-8.

8. Provide offsets and transitions in accordance with SMACNA Figure 2-9.

9. Provide round spin-in fittings with locking quadrant volume dampers for all round duct connections to rectangular ducts. Spin-in and flex duct shall be same size as air distribution device neck diameter. Secure flex duct to spin-in and air distribution device neck with stainless steel worm gear clamps and seal vapor barrier. Suspend flex duct from structure above; round and flexible duct installations shall be as detailed by SMACNA in section III round, oval and flexible duct. Flexible duct supports shall be constructed and installed in accordance with SMACNA figures 3-9 and 3-10.

10. Duct access doors shall be constructed in accordance with figure 2-12 and shall have a frame type 3, position 3 hinge with a type 2 locking handle; single and multi-blade volume dampers shall be in accordance with figures 2-14 and 2-15 respectively and shall have operator extensions when provided on externally insulated ducts; air distribution device connections shall be in accordance with figure 2-16 and ceiling diffuser branch ducts shall be in accordance with figure 2-17.

11. Rectangular duct connections at all air moving equipment shall be flexible neoprene fabric and installed in accordance with figure 2-19.

12. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

13. All duct shall be fabricated in a manner to prevent the seams or joints being cut for the installation of air distribution devices.

14. Provide crimps in direction of air flow where crimp joints with bead are used for joining round duct sizes 6 inch smaller.

E. Where required, provide ducts with "ESS"-drive joints or flat seams to allow crossing of duct or installation of other equipment or piping requiring tight clearances. Raise ducts where required to allow installation of other duct or equipment using 45 degree radius elbows (center line radius = 1.5 times duct height) to offset.

F. Provide openings in duct where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal well and closure device to ensure against air leakage. Where openings are provided in insulated duct, install insulation material inside a metal ring.

G. Connect fan coil units to low pressure OA intake ducts with short length of flexible duct. Hold in place with corrosion resistant clamp or strap.

H. Connect air distribution devices to low pressure ducts with 6 feet maximum, 4 feet minimum, length of flexible duct. Hold in place with corrosion resistant strap or clamp.

I. All rectangular duct located exposed on roof shall have top horizontal surface "crowned or sloped" to prevent water from ponding.

3.2 DUCT APPLICATION SCHEDULE

A. Unless indicated otherwise, provide duct systems complying with the following application schedule:

AIR SYSTEM	CONSTRUCTION	MATERIAL	Pressure Class
Main Supply Above Ceiling or Concealed	Single Wall	Galvanized Steel	Per AHU ESP, 3” Class Minimum
Main Supply Exposed in Unoccupied Spaces	Single Wall	Galvanized Steel	Per AHU ESP, 3” Class Minimum
Main Supply Exposed in Occupied Spaces	Double Wall	Galvanized Steel	Per AHU ESP, 3” Class Minimum
Main Supply Exposed Exterior	Single Wall	Welded Carbon Steel	Per AHU ESP, 3” Class Minimum
Downstream Supply Above Ceiling or Concealed	Single Wall	Galvanized Steel	Per Terminal ESP
Downstream Supply Exposed in Occupied Spaces	Double Wall	Galvanized Steel	Per Terminal ESP
Draw-thru Transfer, Return, or Relief	Single Wall	Galvanized Steel	1” Class

Pressurized Transfer, Return, or Relief	Single Wall	Galvanized Steel	Per Fan ESP
Draw-thru O/A Intake Above Ceiling or Concealed	Single Wall	Galvanized Steel	1” Class
Draw-thru O/A Intake Exposed in Occupied Spaces	Double Wall	Galvanized Steel	1” Class
Pressurized O/A Intake Above Ceiling or Concealed	Single Wall	Galvanized Steel	Per Fan ESP, 2” Class Minimum
Pressurized O/A Intake Exposed in Occupied Spaces	Double Wall	Galvanized Steel	Per Fan ESP, 2” Class Minimum
General Exhaust	Single Wall	Galvanized Steel	Per Fan ESP, 1” Class Minimum
Grease Laden Kitchen Exhaust	Single Wall	Welded Carbon Steel	Per Fan ESP, comply with local code
Kitchen Dishwasher Exhaust	Single Wall	Welded Stainless Steel	Per Fan ESP, 18 Gauge Minimum
Laboratory Exhaust (General & Fume Hood)	Single Wall	Welded Stainless Steel	Per Fan ESP. 16 Gauge Minimum

3.3 DUCT HANGERS AND SUPPORTS

A. All duct shall be properly suspended or supported from the building structure.

B. The spacing, size and installation of hangers shall be in accordance with the recommendations of SMACNA, latest edition.

C. Hangers shall be galvanized steel straps or hot-dipped galvanized rod with threads pointed after installation. Hangers shall be attached to the bottom of the duct.

D. Provide double nuts and lock washers on threaded rod supports

E. All duct shall be mounted tight to underside of structure and shall be top level with bottom and side transitions only, except that allowance shall be made for duct to be externally insulated, which shall be mounted 3" below structural beams and joists or other obstruction to allow installation of the external duct insulation.

F. All duct risers shall be supported by angles or channels secured to the sides of the ducts at each floor. Secure floor supports to duct using rods, angles or flat bar to the duct joint or

reinforcing. Provide miscellaneous steel supports for duct risers as required at no additional cost to owner.

G. Where ducts pass through walls in exposed areas, provide framed openings constructed of welded metal angles. All angles shall be carried around all four sides of the duct or group of ducts.

3.4 ADJUSTING AND CLEANING

A. Clean duct system by vacuuming and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.5 TESTING

A. Pressure test ductwork per Quality Control requirements.

END OF SECTION 233113

233300 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Barometric relief dampers.
3. Manual volume dampers.
4. Control dampers.
5. Fire dampers.
6. Duct-mounted access doors.
7. Flexible connectors.
8. Flexible ducts.
9. Duct accessory hardware.

B. RELATED SECTIONS:

1. Section 013300 Submittals.
2. Section 01524 Construction Waste Management
3. Section 01352 LEED Requirements
4. Section 01611 Environmental Management
5. Section 01570 Pollution Prevention and Control

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
   a. Special fittings.
   b. Manual volume damper installations.
   c. Control damper installations.
   d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
   e. Duct security bars.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

D. Source quality-control reports.

E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

F. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal’s Standard GS-11.
   b. Submit manufacturer’s certification that products comply with Green Seal’s Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

1.5 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2. 1 MATERIALS

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

C. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).

2. Exposed-Surface Finish: Mill phosphatized.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed and exposed ducts.

E. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

F. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.

G. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

H. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2. 2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. Pottorff; a division of PCI Industries, Inc.
5. Ruskin Company.
6. American Warming and Ventilating.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: 0.063-inch- thick extruded aluminum with welded corners and mounting flange.

F. Blades: Multiple single-piece blades, maximum 6-inch width, 0.025-inch- thick, roll-formed aluminum noncombustible with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Neoprene, mechanically locked.

I. Blade Axles:

1. Material: Stainless steel.
2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.

4. Chain pulls.

5. Screen Mounting: Front mounted in sleeve.
   a. Sleeve Thickness: 20-gage minimum.
   b. Sleeve Length: 6 inches minimum.

6. Screen Material: Aluminum.

7. Screen Type: Bird.

8. 90-degree stops.

2. 3 BAROMETRIC RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.; a division of Mestek, Inc.

2. American Warming and Ventilating; a division of Mestek, Inc.

3. Greenheck Fan Corporation.

4. Lloyd Industries, Inc.

5. Nailor Industries Inc.

6. Pottorff; a division of PCI Industries, Inc.

7. Ruskin Company.

8. American Warming and Ventilating.

B. Suitable for horizontal or vertical mounting.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 2-inch wg.

E. Frame: 0.063-inch- (thick extruded aluminum], with welded corners and mounting flange.

F. Blades:

1. Multiple, 0.025-inch-thick, roll-formed aluminum.

2. Maximum Width: 6 inches (150 mm).

3. Action: Parallel.

4. Balance: Gravity.

5. Eccentrically pivoted.

G. Blade Seals: Neoprene.

H. Blade Axles: Nonferrous metal.

I. Tie Bars and Brackets:

1. Material: Aluminum

2. Rattle free with 90-degree stop.

J. Return Spring: Adjustable tension.

K. Bearings: Synthetic.

L. Accessories:

1. Flange on intake.

2. Adjustment device to permit setting for varying differential static pressures.

2. 4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Air Balance Inc.; a division of Mestek, Inc.
   b. American Warming and Ventilating; a division of Mestek, Inc.
   c. McGill AirFlow LLC.
   d. METALAIRE, Inc.
   e. Nailor Industries Inc.
   f. Pottorff; a division of PCI Industries, Inc.
   g. Ruskin Company.
   h. Trox USA Inc.
   i. American Warming and Ventilating.

2. Standard leakage rating, with linkage outside air stream.

3. Suitable for horizontal or vertical applications.

4. Frames:
   a. Hat-shaped, galvanized channels, 0.064-inch minimum thickness.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:
   a. Multiple or single blade.

b. Parallel- or opposed-blade design.
c. Stiffen damper blades for stability.
d. Galvanized, 0.064 inch thick.

6. Blade Axles: Nonferrous metal.

7. Bearings:
   a. Oil-impregnated bronze.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

2. 5 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following:

1. American Warming and Ventilating.

2. Greenheck Fan Corporation.

3. METALAIRE, Inc.

4. Nailor Industries Inc.

5. Pottorff; a division of PCI Industries, Inc.

6. Prefco; Perfect Air Control, Inc.

7. Ruskin Company.

B. Type: Static; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum4000-fpm velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Curtain type with blades outside air stream fabricated with roll-formed, 0.034-inch thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch thick, as indicated, and of length to suit application.

2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

K. Furnish and install where shown on the drawings or required by the Specifications, fire dampers meeting the following requirements.

L. Each fire damper shall be constructed and tested in accordance with Underwriters Laboratories Safety Standard 555. All dampers shall possess a 1-1/2 hour or 3 hour (as appropriate for the construction shown in the architectural drawings) protection rating, 165 or 212 degree F fusible link, and shall bear a U.L. label in accordance with Underwriters Laboratories labeling procedures. Fire dampers shall be constructed such that the damper frame material and the curtain material shall be galvanized.

M. Fire dampers shall be curtain blade or multi-blade type and the damper shall be so constructed that the blades are either out of the air stream or installed in an oversized sleeve to provide a 100 percent free area of the duct in which the damper is housed.

N. The damper manufacturer's literature submitted for approval prior to the installation shall include performance data developed from testing in accordance with AMCA 500 Standards and shall show the pressure drops for all sizes of dampers required at anticipated air flow rates. Maximum pressure drop through fire damper shall not exceed 0.05 inch water gauge.

O. Fire dampers shall be equipped for vertical or horizontal installation as required by the locations shown in the drawings. Fire dampers shall be installed in wall and floor openings utilizing steel sleeves, angles and other material and practices required to provide an installation equivalent to that utilized by the manufacturer when the respective dampers were tested by Underwriters Laboratories. Mounting angles shall be a minimum of 1 1/2 inch by 1 1/2 inch by 14-gauge and bolted, tack welded or screwed to the sleeve at maximum spacings of 12 inches and with a minimum of two connections at all sides. Mounting angles shall overlap at least equal to the gauge of the duct defined by the appropriate SMACNA Duct Construction Standard, latest edition, and as described in NFPA 90A. The entire assembly, following installation, shall be capable of withstanding 6" water gauge static pressure.

P. The damper installation shall be in accordance with the damper manufacturer's instructions.

Q. All fire dampers shall comply with the specification as written above and shall be Ruskin Model IBD2 (Style C, CR or CO), Greenheck Model FD-150 (Type C, CR or CO), or Pottorff.

R. The contractor shall completely seal the assembly to the building components using Hardcast 1602 sealant tape to allow for expansion and contraction of the sleeve and damper assembly.

S. Dampers shall be UL labeled for use in dynamic systems. Closure reading shall be 110% of the maximum design airflow at the point of installation. The minimum closure pressure rating shall be 8” wg for airflow in either direction.

T. Combination Fire/Smoke Dampers

1. Furnish and install where shown on the Drawings, or as required by the Specifications, combination fire/smoke dampers meeting the following requirements.

2. Each combination fire/smoke damper shall be 1 1/2 hour fire rated under UL Standard 555, 4th Edition, and shall be further classified by Underwriters Laboratories as a Leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this Specification. Testing and UL qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be no higher than Leakage Class I (4 cfm per square foot at one inch water gauge pressure and 8 cfm per square foot at 4 inches water gauge pressure). The maximum air pressure drop through each combination fire/smoke damper shall not exceed 0.10 inch water gauge at the design air quantity. (Note that this may require a larger damper than the connected duct size.)

3. The damper frame shall be a minimum of 20-gauge galvanized steel formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in an extruded hole in the frame or an extruded frame raceway. The dampers may be either parallel or opposed blade type. The blades shall be constructed with a minimum of 14-gauge equivalent thickness. The blade edge seal material shall be able to withstand 450 degrees F. The jamb seals shall be flexible stainless steel compression type or lap seal type.

4. In addition to the leakage ratings specified herein, the combination fire/smoke dampers and their operators shall be qualified under UL555S to an elevated temperature of 250 degrees F. Electric operators shall be installed by the damper manufacturer at the time of damper fabrication. The damper and operator shall be supplied as a single entity which meets all applicable UL555 and UL555S qualifications for both dampers and operators. The manufacturer shall provide a factory assembled sleeve. The sleeve shall be a minimum of either 20-gauge for dampers where neither width nor height exceeds 48 inches or 16-gauge where either dimension equals or exceeds 48 inches.

5. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4 inches water gauge in the closed position, and 2500 fpm air velocity in the open position.

6. Each combination fire/smoke damper shall be equipped with a UL Classified Firestat /releasing device. The firestat/releasing device shall electrically and mechanically lock the damper in a closed position when the duct temperatures exceed 165 degrees F and still allow the appropriate authority to operate the damper as may be required for smoke control functions. The damper must be operable while the temperature is above 250 degrees F. The actuator/operator package shall include two damper position indicator switches linked directly to damper blade to provide capability of remotely indicating damper position. One switch shall close when the damper is fully open, and the other

switch shall close when the damper is fully closed. The Firestat/releasing device and position indicator switches shall be capable of interfacing electrically with the smoke detectors, building fire alarm systems, and remote indicating/control stations.

7. The damper releasing device shall be mounted within the airstream. The device shall be activated and the damper shall close and lock when subjected to duct temperatures in excess of approximately 285 degrees F.

8. Motors for operation of smoke dampers shall be smoke system fail safe, spring return normally open supplies and normally closed returns, or as indicated in the plans, and shall be furnished and installed by the damper manufacturer as required by the U.L. rating mentioned above. Motors shall be electric or pneumatic to match the type of temperature control system specified elsewhere in this specification. All required relays, EP switches, wiring piping and other labor and material necessary to completely interconnect the smoke detector system shall be furnished by the Contractor.

9. Each damper shall be furnished in a square or rectangular configuration. The Contractor shall furnish and install sleeves manufactured by the approved damper manufacturer for each damper. The sleeves shall be constructed with square or rectangular to square, rectangular, round, or oval adapters as required. Dampers shall be installed in the sleeves in accordance with manufacturers U.L. installation instructions. The entire assembly, following installation, shall be capable of withstanding 6" W.G. static pressure.

10. All combination fire/smoke dampers shall comply with the specification as written above and shall be Ruskin Model FSD-60, Greenheck Model FSD-33, or Pottorff.

11. The contractor shall completely seal the assembly to the building components using Hardcast 1602 sealant tape to allow for expansion and contraction of the sleeve and damper assembly.

12. Dampers shall be UL labeled for use in dynamic systems. Closure reading shall be 110% of the maximum design air flow at the point of installation. The minimum closure pressure rating shall be 8” wg for air flow in either direction.

2. 6 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.

2. Flexmaster U.S.A., Inc.

3. Greenheck Fan Corporation.

4. McGill AirFlow LLC.

5. Nailor Industries Inc.

6. Pottorff; a division of PCI Industries, Inc.

7. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:
   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

3. Number of Hinges and Locks:
   a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.

2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.

3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.

4. Factory set at 10-inch wg.

5. Doors close when pressures are within set-point range.

6. Hinge: Continuous piano.

7. Latches: Cam.

8. Seal: Neoprene or foam rubber.

9. Insulation Fill: 1-inch thick, fibrous-glass or polystyrene-foam board.

2. 7 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.

2. McGill AirFlow LLC.

3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; [polyethylene] [aluminized] vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.

2. Maximum Air Velocity: 4000 fpm.

3. Temperature Range: Minus 10 to plus 160 deg F.

4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2004.

C. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.

2. Maximum Air Velocity: 4000 fpm.

3. Temperature Range: Minus 20 to plus 210 deg F.

4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2004.

D. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear actionin sizes 3 through 18 inches to suit duct size.

2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2. 8 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2. 9 LOW PRESSURE TAPS (CONICAL BELL MOUTH FITTINGS)

A. Conical fittings may be used for duct taps and shall include quadrant dampers on all lines to air devices (diffusers and grilles), even though a volume damper is specified for the air device. (This does not apply to medium pressure duct.) Spin-in fittings shall be sealed at the duct tap with a gasket, or compression fit, or sealed with sealant specified for medium pressure ductwork. The location of spin-in fittings in the ducts shall be determined after dual or single duct terminal units are hung or the location of the light fixtures is known so as to minimize flexible duct lengths and sharp bends.

B. The conical fitting shall be made of at least 26-gauge galvanized sheet metal. The construction to be a two-piece fitting with a minimum overall length of 6 inches and shall be factory sealed for high pressure requirements. Average loss coefficient for sizes 6, 8, and 10 shall be less than 0.055.

C. Each to be provided with minimum 24-gauge damper plate with locking quadrant operator and sealed end bearings. Damper blade shall be securely attached to shaft to prevent damper from rotating around shaft.

D. Provide flange and gasket with adhesive peel-back paper for ease of application. The fitting shall be further secured by sheet metal screws spaced evenly at no more than 4 inches on-center with a minimum of four screws per fitting.

E. The conical bellmouth fitting shall be Series 3000G as manufactured by Flexmaster U.S.A., Inc., or Buckley Air Products, Inc., 'AIR-TITE'.

PART 3 - EXECUTION

3. 1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

3. 2 DAMPERS

A. Furnish and install dampers where shown on the Drawings and wherever necessary for complete control of the air flow, including all supply, return and exhaust branches, "division" in main supply, return and exhaust ducts, each individual air supply outlet and fresh air ducts. Where access to dampers through a fixed suspended ceiling is necessary, the Contractor shall be responsible for the proper location of the access doors.

B. Splitter dampers shall be fabricated of steel not lighter than 16-gauge. The leading edge of the damper shall be hemmed. Each splitter shall be a minimum of 12" long or 1-1/2 times the width

of the smaller of the two branches it controls, whichever is greater. Dampers shall be carefully fitted, and shall be controlled by locking quadrants equal to Ventlok No. 555 on exposed uninsulated ductwork, No. 644 on exposed externally insulated ductwork and No. 677 (2-5/8" diameter) chromium plated cover plate for concealed ductwork not above lay-in accessible ceilings. Furnish and install end bearings for the damper rods on the end opposite the quadrant when No. 555 or No. 644 regulators are used, and on both ends when No. 677 regulators are used.

C. On concealed ductwork above lay-in accessible ceilings use Ventlok No. 555 or No. 644 locking quadrant for splitter dampers.

D. Dampers larger than three (3) square feet in area shall be controlled by means of rods hinged near the leading edge of the damper with provisions for firmly anchoring the rod and with end bearings supporting the axle.

E. Volume dampers shall be equal to those of American Foundry. Blades shall not exceed 48 inches (48") in length or twelve inches (12") in width and shall be of the opposed interlocking type. The blades shall be of not less than No. 16-gauge galvanized steel supported on one-half inch (1/2") diameter rust-proofed axles. Axle bearings shall be the self-lubricating ferrule type.

F. Install all dampers furnished by the Temperature Control Manufacturer in strict accordance with the manufacturer's recommendations and requirements of these Specifications.

G. All adjustable dampers installed in externally insulated ductwork shall be installed with Ventlok No. 639, or equal, elevated dial operators. Insulation shall extend under the elevated dial. All adjustable dampers installed in internally insulated ductwork shall be installed with Ventlok No. 635, or equal, dial operators. All damper shaft penetrations in the ductwork shall be installed with Ventlok #609 end bearings.

H. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

2. Install aluminum volume dampers in aluminum ducts.

I. Set dampers to fully open position before testing, adjusting, and balancing.

J. Install test holes at fan inlets and outlets and elsewhere as indicated.

K. Install fire dampers according to UL listing.

L. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.

2. Upstream from duct filters.

3. At outdoor-air intakes and mixed-air plenums.

4. At drain pans and seals.

5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.

6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.

7. At each change in direction and at maximum 50-foot spacing.

8. Upstream and downstream from turning vanes.

9. Upstream or downstream from duct silencers.

10. Control devices requiring inspection.

11. Elsewhere as indicated.

M. Install access doors with swing against duct static pressure.

3. 3 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

2. Inspect locations of access doors and verify that purpose of access door can be performed.

3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.

4. Inspect turning vanes for proper and secure installation.

5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

233416 - FANS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish and install roof and wall exhausters and cabinet and ceiling exhaust fans for mechanical systems.

1.2 RELATED SECTIONS

A. Section 016600 – Product Storage and Handling Requirements.

B. Section 016613 – Product Storage and Handling Requirements for Hazardous Materials.

C. Section 016616 – Product Storage and Handling Requirements for Toxic Materials.

D. Section 220526 – Hangers and Supports for Plumbing Piping and Equipment.

E. Section 220543 – Vibration and Seismic Control for Plumbing and Piping Equipment.

F. Section 233100 – HVAC Ducts and Casings.

G. Section 233416 – Centrifugal HVAC Fans.

H. Section 230593 – Testing, Adjusting, and Balancing for HVAC.

I. Section 230513 – Common Motor Requirements for HVAC.

J. Coordinate with Commissioning Requirements indicated in Section 019113. This contractor is responsible to comply with all requirements for the above section.

K. Section 013300 Submittals.

L. Section 01524 Construction Waste Management

M. Section 01352 LEED Requirements

N. Section 01611 Environmental Management

O. Section 01570 Pollution Prevention and Control

1.3 REFERENCES

A. AMCA 99 – Standards Handbook.

B. AMCA 210 – Laboratory Methods of Testing Fans for Rating Purposes.

C. AMCA 300 – Test Code for Sound Rating Air Moving Devices.

D. AMCA 301 – Method of Publishing Sound Ratings for Air Moving Devices.

E. SMACNA – Low Pressure Duct Construction Standard.

1.4 SUBMITTALS

A. Include fan curves with specified operating point clearly plotted.

B. Include sound power levels for both fan inlet and outlet at rated capacity.

C. Indicate special coating when required.

D. Provide operation and maintenance manual.

E. Operation and Maintenance Data: For centrifugal fans to include in emergency, operation, and maintenance manuals.

F. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal’s Standard GS-11.
   b. Submit manufacturer’s certification that products comply with Green Seal’s Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.5 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300.

C. Fabrication: Conform to AMCA 99.

1.6 MAINTENANCE

A. Provide twelve (12) months maintenance of all materials and equipment under this section. Cost of the twelve (12) month normal and preventive maintenance shall be included within this scope of work.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
    a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 MANUFACTURERS

A. Greenheck.

B. Cook.

C. Penn Barry

D. Acme

2.5 ROOF EXHAUSTERS

A. Centrifugal or Axial Fan Unit: Backward inclined or airfoil design, v-belt or direct driven, with spun aluminum housing, resilient mounted motor and drive assembly, 1/2-inch mesh, 16 gauge aluminum bird screen; square base to suit roof curb with continues curb gaskets; secured to roof curb with cadmium plated or stainless steel bolts and screws, as indicated in Drawings.

B. Roof Curb: 14 inch with continuously welded seams, built-in cant strip, 1 inch insulation and curb bottom, hinged curb adapter sand factory installed door mailer strip. Where scheduled, provide interior baffle with acoustic insulation and increase curb height as required.

C. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

D. Back draft Damper: Gravity activated, aluminum multiple blade construction, felt edged with nylon bearings.

E. Sheaves: Cast-iron or steel, dynamically balanced, bored to fit shafts and keyed; adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid position; and will not overload motor when adjusted to maximum pitch; fan shaft with self-aligning pre-lubricated ball bearings.

F. Apply three coats of air dried Heresite coating both internal and external to all roof exhausters from corrosive areas.

G. Motors: In total compliance with Section 230513.

2.6 UP-BLASTS EXHAUST FANS

A. Centrifugal Fan Unit: Non-overloading backward inclined or airfoil design, v-belt driven, with spun aluminum housing, resilient mounted motor and drive assembly located out of airstream; square base to suit roof curb with continues curb gaskets; secured with cadmium plated or stainless steel bolts and screws.

B. Motor enclosures: Totally enclosed fan cooled

1. Motors are heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase.

2. Mounted on vibration isolators, out of the airstream

3. For motor cooling there shall be fresh air drawn into the motor compartment through an area free of discharge contaminants.

4. Accessible for maintenance.

C. Shafts and Bearings:

- Fan shaft shall be ground and polished solid steel with an anti corrosive coating.
- Permanently sealed bearings or pillow block ball bearings.
- Bearing shall be selected for a minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
- Bearings are 100 percent factory tested
- Fan Shaft first critical speed is at least 25 percent over maximum operating speed

D. Roof Curb: 14 inch high aluminum construction with continuous seams, built-in cant strip and factory installed mailer strip. Roof curb shall match fan and shall be supplied by fan manufacturer. Provide sloped roof curb as required for installed equipment to set level.

E. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

F. Grease Collector: Provide grease trough and collectors for kitchen hood fans.

G. Sheaves: Cast-iron or steel, dynamically balanced, bored to fit shafts and keyed; adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid position; and will not overload motor when adjusted to maximum pitch; fan shaft with self-aligning pre-lubricated ball bearings. Drive shall be designed for 165% of rated horsepower capabilities.

H. Motors: In total compliance with Section 230513.

2.7 KITCHEN SUPPLY AIR FAN

A. Kitchen Supply Fan shall be as manufactured by Greenheck or approved equal provided all specifications are met. Greenheck Model KSF equipment is used as the basis of design.

B. Unit shall be of internal frame type construction of galvanized steel. All frames and panels shall be G90 galvanized steel. All metal-to-metal surfaces exposed to the weather shall be sealed, requiring no caulking at job site. Unit base to be designed for curb mounting. Unit base shall over hang the curb. Curb is recessed under the unit for a positive seal against water run-off. All components shall be easily accessible through removable doors. Permatector corrosion resistant exterior finish available for outdoor units.

C. Weather hood shall be the same finish as the unit and shall be sized for low intake velocities, preventing entrainment of moisture.

D. Filters shall be mounted in a straight or V-bank arrangement such that velocities across the filters do not exceed 550 feet per minute. Filters shall be 1 inch or 2 inch aluminum mesh and easily removable.

E. Centrifugal fans shall be double width, double inlet. Fan and motor shall be mounted on a common base and shall be internally isolated. All blower wheels shall be statically and dynamically balanced. Ground and polished steel fan shafts shall be mounted in permanently sealed ball bearing pillow blocks. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged speeds.

F. Motors shall be energy efficient, complying with EPACT standards, for single speed ODP and TE enclosures. Motors shall be permanently lubricated, heavy duty type, matched to the fan load and furnished at the specified voltage, phase and enclosure. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be fully machined cast, 10 horse power and less shall be supplied with an adjustable drive pulley.

G. Control center shall include magnetic motor starter with thermal overload protection and manual reset, control circuit fusing, control transformer for 24 VAC circuit, integral door interlocking disconnect switch and distribution terminal strip. All internal electrical components shall be prewired for single point power connection. All electrical components shall be UL listed, approved or classified where applicable and wired in compliance with the National Electrical Code. Contactors and Class 20 adjustable overload protection shall be standard.

2.8 SOURCE QUALITY CONTROL

A. The following tests must be conducted at the project site.

1. Vibration test as described in Section 016600 – Product Storage and Handling Requirements, Section 016613 – Product Storage and Handling Requirements for Hazardous Materials, and Section 016616 – Product Storage and Handling Requirements for Toxic Materials.

B. The following listed tests must be conducted at the manufacturer=s test facility.

1. Vibration test as described in Section 230593 – Testing, Adjusting, and Balancing for HVAC.

2. Sound test under AMCA Guidelines and Conditions. The sound power levels must not exceed those indicated on Drawings.

2.9 FUME HOOD MIXED-FLOW INDUCED DILUTION FANS (GREENHECK, COOK OR EQUAL)

A. Impellers shall be mounted directly to the motor shaft to provide a direct drive arrangement 4 type fan. Motors shall be isolated from the primary exhaust air stream and shall be visible and accessible from the fan exterior for inspection and service.

B. Mixed flow impellers shall consist of combination axial/backward curved blades and shall be of welded steel construction. The impellers shall have non-stall and non-overloading performance characteristics with stable operation at any point on the fan curves.

C. Stationary discharge guide vane sections shall be provided to increase fan efficiencies.

D. Fan dynamic balance not to exceed 0.5 mil., peak to peak, at the blade pass area when operating at fan frequency. Vibration isolation shall be limited to rubber-in-shear pad type isolators.

E. Fan assemblies shall be designed for mounting on conventional roof curb without the need for guy wire supports.

F. Discharges shall include twin FRP nozzles with passive third central stacks that are capable of generating aspiration. The FRP shall be chemically and UV resistant.

G. Steel entrainment wind bands shall provide secondary induction of outside air. Induction shall take place downstream of the fan impeller and shall not influence BHP or static pressure requirements. Wind bands shall discharge up to 270% of the design flow rates. The manufacturer shall publish discharge volumes for all fans at specified primary exhaust flow.

H. A non-ferrous inlet bell shall be provided in order to reduce sparking in the event of a motor bearing failure.

I. Fans shall be modular construction and capable of being assembled on the roof.

J. PTFE gaskets shall be provided at all companion flanged joints.

K. Fasteners shall be 316 stainless steel.

L. A bolted access door shall be provided for impeller inspection on each fan.

M. Fans and accessories shall have internal drain systems to prevent rain water from entering building duct systems.

N. Electric motors shall be TEFC Mill & Chemical duty with a 1.15 service factor and an L-50 bearing life of 200,000 hours. Motors shall have sealed bearings up through a 256T NEMA frame. Motors on BS-1 and larger fans shall be C-Face and foot mounted.

O. A NEMA 3R non-fused disconnect switch shall be provided, mounted and wired to the motor.

P. Coatings-All steel and aluminum surfaces shall prepared for coating by blasting or chemical etching. Coating will be:

1. Epoxy (4-5 mils) for protection against weather and dry chemical fumes.
2. Epoxy (8-10 mils) for protection against weather, chemical vapors and splashes.

2.10 ACCESSORIES

A. Inlet mixing plenums shall be provided by the fan manufacturer. Each plenum shall be sized to support the weight and performance requirements of the number of fans listed on the schedule. Multiple fan plenums shall be double wall construction with structural stiffeners or shall be continuously welded, heavy gauge single wall construction. Single fan plenums shall be of continuously welded, heavy gauge steel construction. All plenums shall be capable of supporting the fan(s) without guy wires or supports. The plenums shall include hinged access doors and safety screens over primary air inlets. The primary air inlets shall be located on the bottom or side as noted on construction drawings. Coatings shall be the same as specified for the fans. Unless otherwise specified, plenums shall be suitable for mounting on roof curbs.

B. Stainless safety screens shall be supplied over bottom primary air inlets.

C. Bypass dampers shall be provided with all mixing plenums for outside make-up air with primary exhaust. Dampers will be:

1. Louver/damper combinations, aluminum construction, manual locking quadrant.

2. Opposed blade low leakage airfoil control dampers with extended shaft for connection to an operator. The dampers shall be aluminum construction. Rain hoods shall be provided with each damper. The dampers shall be controlled by a (hand quadrant/20 psi pneumatic/24V electric) operators. The operators shall be provided by controls manufacturer.

3. Barometric controlled dampers, adjustable up to 3.0” pressure. Rain hood shall be provided with each damper.

D. Low leakage isolation dampers shall be constructed of aluminum airfoil extrusions and coated with epoxy. Operators shall be 2 position, spring return and shall be 20 PSI pneumatic/24V/110V electric unless variable frequency drives are specified. The electric operator shall be factory wired (via a transformer when required) to the fan disconnect switch to open when the fan is energized and close via a spring return when de-energized. When the fan ships separate from the plenum, all wiring and conduit shall be factory supplied for easy connection in the field.

E. Vortex breakers shall be provided on all side inlet and multiple fan plenums.

F. Inlet spray nozzle(s) shall be mounted at fan inlet to provide wash down capability of fan while operating. Spray nozzles to be suitable for water or stream. Nozzles to be piped to the exterior of the fan with threaded end for field connection. All piping and nozzle components shall be stainless steel construction.

G. A 14 gauge galvanized steel roof curb shall be provided to support the fans/plenums. The curb shall be minimum 14 gauge and canted for rigid in wind loads. The curb shall be _” high. The curb shall include a rigid fiberglass liner wood nailer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer’s instructions.

B. Secure roof exhausters with 1/2" x 2” S.S. lag screws roof curb.

C. Install flexible ductwork connections when fan connects to ductwork.

D. Provide al ventilating and exhaust fans with integral vibration isolation.

E. Water test ventilators after installation.

3.2 PAINTING

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

C. Install line-sized piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain.

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Provide equipment with factory finish in accordance with the manufacturer’s standards. Touch scratches and marks from handling and installation with masking enamel to match manufacturer’s color.

B. Where exhaust fans are required to have Heresite coating, have units factory finished with required number of coats prior to shipping to the job site.

END OF SECTION 233416

233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Round ceiling diffusers.
2. Rectangular and square ceiling diffusers.
3. Perforated diffusers.
4. Louver face diffusers.
5. Jet flow diffusers.
6. Linear slot diffusers.
7. Related Sections:
8. Division 08 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
9. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

B. Related Sections:

1. Section 013300 Submittals.
2. Section 01524 Construction Waste Management
3. Section 01352 LEED Requirements
4. Section 01611 Environmental Management
5. Section 01570 Pollution Prevention and Control

1.3 SUBMITTALS

A. First three paragraphs below are defined in Division 01 Section "Submittal Procedures" as "Action Submittals."

B. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

C. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

D. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

E. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.

2. Method of attaching hangers to building structure.

3. Size and location of initial access modules for acoustical tile.

4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

5. Duct access panels.

F. Source quality-control reports.

G. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and

chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.

b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11

c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.

a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

PART 2 - PRODUCTS - REFER TO DRAWINGS FOR SCHEDULE.

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

2.5 ACCEPTABLE MANUFACTURERS

A. Titus

B. Price

C. Krueger

D. Tuttle & Bailey

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 233716 - TEXTILE / FABRIC DUCTWORK

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of non-metal ductwork is indicated on drawings and by requirements of this section.

B. Types of non-metal ductwork required for this project include the following:

1. Textile Air Dispersion Products.

1.2 QUALITY ASSURANCE

A. Building Codes and Standards:

1. Product must be Classified by Underwriter's Laboratories in accordance with the 25/50 flame spread / smoke developed requirements of NFPA 90-A and UL 2518. Also Classified by UL-C (Canada) S102.2, BS 5867 Part 2, 1980; GB8624-2006.
2. All product sections must be labeled with the logo and classification marking of Underwriter's Laboratories.

B. Design & Quality Control

1. Manufacturer must have documented design support information including duct sizing; vent, orifice, and/or nozzle location; vent, orifice, and/or nozzle sizing; length; and suspension. Parameters for design, including maximum air temperature, velocity, pressure, and textile permeability, shall be considered and documented.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's specifications on materials and manufactured products used for work of this section.

B. Building Code Data: Submit UL file number under which product is Classified by Underwriter's Laboratories for both NFPA 90-A and UL 2518.

C. Provide detailed drawings confirming configuration of Textile Dispersion System (diameter, lengths, airflow, pressure, and textile permeability).

D. Provide detailed installation instructions for components to be installed.

E. Provide warranty and maintenance documentation.

1.4 WARRANTY

A. Manufacturer must provide a 10 Year Product Warranty for products supplied for the fabric portion of this system as well as a Design and Performance Warranty.

1.5 DELIVERY, STORAGE AND HANDLING

A. Protect textile air dispersion system and Hoops (IHS) components from damage during shipping, storage, and handling.

B. Where possible, store products inside and protect from weather. Where necessary to store outside, store above grade and enclose with a vented waterproof wrapping.

PART 2 - PRODUCTS

2.1 MANUFACTURER

Subject to compliance with requirements, choose one of the following:

A. DuctSox® Corporation
Phone: (866) DUCTSOX or (563) 588-5300
FAX: (866) 398-1646 or (563) 588-5330
www.DuctSox.com

2.2 TEXTILE AIR DISPERSION SYSTEM

A. Hoops (IHS) System: Air diffusers shall be constructed with an internal retention system.

1. System shall consist of an internal 360-degree hoop system, spaced 5’ on center.
2. The system shall be installed with a one-track suspension system located 1.5” above top-dead-center of the textile system.
3. System attachment to U-Track shall be made using Gliders spaced 12 inches.
4. Available for diameters from 8” – 60”.
5. One row suspension option (must specify if multiple on same project)
    a. U-Track suspension hardware to include 8’ sections of aluminum track, aluminum splice connectors, track endcaps and vertical cable support kits – consisting of a length of cable with cable connectors. Radius aluminum track must be included for all horizontal/flat radius sections.
        1) U-Track suspension
            i. Galvanized steel cable
        2) Support lengths available in 5’(standard), 10’, 15’, & 30’

B. TEXTILE

1. Verona
    a. Textile Construction: Filament/filament twill polyester, fire retardant in accordance with UL 2518.
    b. Air Permeability: 2 (+2/-1) CFM/ft^2 per ASTM D737, Frazier
    c. Weight: 6.8 oz. /yd^2 per ASTM D3776
    d. Warranty: 10 years
2. Textile Color
    a. Standard: blue, white, tan, red, green, silver, black
    b. Custom

C. TEXTILE SYSTEM FABRICATION REQUIREMENTS:

1. Textile system to be constructed in modular lengths (zippered) with proper radial securing clips along the length of the system.
2. Integrated air dispersion shall be specified and approved by manufacturer. Nozzles are not allowed.
    a. Orifices
        1) Air dispersion and extended throws are accomplished by orifices and permeable fabric. Dispersion orifice sizing, up to 5-inch diameter (design dependent).
        2) Diameter, quantity, and location of reinforced orifices to be specified and approved by manufacturer.
3. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via. zip screw fastener – supplied by contractor.
4. Inlet connection includes zipper for easy removal / maintenance.
5. Lengths to include required intermediate zippers as specified by manufacturer.
6. System to include Adjustable Flow Devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 – 0.60 in w.g. static pressure.
7. End cap includes zipper for easy maintenance.
8. Each section of the textile shall include identification labels documenting order number, section diameter, section length, piece number, code certifications and other pertinent information.

D. DESIGN PARAMETERS:

1. Textile air diffusers shall be designed from 0.25” water gage minimum to 3.1” maximum, with 0.5” as the standard.
2. Textile air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).
3. System overall design: diameter, length, airflow, operating static pressure and dispersion shall be designed or approved by the manufacturer.
4. Do not use textile diffusers in concealed locations.
5. Use textile air dispersion systems only for positive pressure air distribution components of the mechanical ventilation system.

PART 3 - INSTALLATION

3.1 INSTALLATION OF TEXTILE AIR DISPERSION SYSTEM

A. Install chosen suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.

3.2 CLEANING AND PROTECTION

A. Clean air handling unit and ductwork prior to the DuctSox system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.

B. Temporary Closure: At ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering which will keep the system clean until installation is completed.

C. If DuctSox systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

END OF SECTION 233716

234100 - FILTERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Disposable media filters.

B. Filter frames.

C. Filter gauges.

1.2 RELATED SECTIONS

A. Section 237300 – Indoor, Central-Station Air-Handling Units.

B. Section 233100 – HVAC Ducts and Casings.

C. Section 233600 – Air Terminal Units.

D. Section 013300 Submittals.

E. Section 01524 Construction Waste Management

F. Section 01352 LEED Requirements

G. Section 01611 Environmental Management

H. Section 01570 Pollution Prevention and Control

1.3 REFERENCES

A. UL 900 – Test Performance of Air Filter Units.

B. ASHRAE 52 – Method of Testing Air Cleaning Devices used in General Ventilation for Removing Particulate Matter.

1.4 SUBMITTALS

A. Include filter media, filter performance data, filter assembly and filter frames.

B. Provide Operation and Maintenance manual.

C. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

1. Recycled Content:
   a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.

2. Local/Regional Materials:
   a. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site.
   b. Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the project site.

3. VOC data:
   a. Submit manufacturer's product data for joint compounds. Indicate VOC and chemical component limits of the product. Submit MSDS highlighting VOC and chemical component limits. VOC contents and chemical component limits must be less than the limits of Green Seal's Standard GS-11.
   b. Submit manufacturer's certification that products comply with Green Seal's Standard GS-11
   c. Submit environmental data in accordance with Table 1 of ASTM E2129 for products provided under work of this Section.

4. Submit the following according to Conditions of the Construction Contract.
   a. Product data. Unless otherwise indicated, submit the following for each type of product provided under work of this Section:

5. General: Submit additional LEED submittal requirements included in other sections of the Specifications.

6. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.

1.5 QUALITY ASSURANCE

A. Provide filter media that is UL 900 listed, Class 2, as approved by local authorities.

B. Provide all filters as product of one manufacturer.

C. Assemble filter components to form filter banks from products of one manufacturer.

1.6 EXTRA MATERIALS

A. Provide one spare set of disposable media filters at project final acceptance for each piece of equipment requiring filters.

1.7 MAINTENANCE

A. Provide twelve (12) months maintenance of all materials and equipment under this section. Cost of the twelve (12) month normal and preventive maintenance shall be included within this scope of work.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation. During construction, if the air units operate at any time, minimum MERV 13 filters shall be installed and kept clean.

B. Provide two sets of belts and three sets of filters for each unit. One set of filters to be installed when unit is started up and shall be protected from construction debris with additional media either at the first bank of filters, or covering each air intake (outside air and return air). Second set of filters to be installed when test and balance activities begin. At substantial completion shall inspect filters to determine if the third set should be installed or delivered to school operations personnel. Tag to identify associated unit.

PART 2 - PRODUCTS

2.1 ENVIRONMENTALLY PREFERABLE PRODUCTS

A. Provide environmentally preferable products to the greatest extent possible.

1. To the greatest extent possible, provide products and materials that promote stewardship of the earth's resources, promote good indoor environmental quality (IEQ), and promote efficiencies in operational performance.

B. Provide products listed on the EPA Comprehensive Procurement Guidelines to the greatest extent practicable.

C. Provide products listed on the USGBC Directory of Products and Services to the greatest extent possible.

2.2 RECYCLED CONTENT

A. Provide recycled content products to the greatest extent possible.

1. To the greatest extent possible, provide materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% of the total value of the materials in the project.

2.3 REGIONAL MATERIALS

A. Provide Regional materials and products to the greatest extent possible that are extracted and manufactured within the region.

1. Provide materials and products that use a minimum of 20 % of building products that are manufactured regionally within a radius of 500 miles from the project site.
   a. Manufacturing refers to the final assembly of components into the building product that is furnished and installed by the tradesman.

2. Of the regionally manufactured materials used and documented, use a minimum of 50% of building materials and products that are extracted, harvested or recovered (as well as manufactured) within 500 miles of the project site.

2.4 MANUFACTURERS

A. American Air Filter.

B. Cam-Farr.

C. Continental.

2.5 PANEL FILTERS

A. All air filters shall be listed as (Class 1, Class 2) in accordance with Underwriters Laboratories, Inc., Building Materials Director requirements, except ultra-high efficiency filters, (HEPA or ULPA,) shall be manufactured of materials that are so listed by UL. All filters other than the ultrahigh efficiency type are to be rated in accordance with ASHRAE Test Standard 52-76 and performance characteristics are to be published in the manufacturer's literature. When specified performance characteristics are not published in the manufacturer's literature, the submittal data shall include certified documentation of performance by an approved independent test laboratory.

B. Permanent, Washable: Viscous coated, high velocity filters. The net velocity through the filters shall not exceed 500 fpm. Filters shall be 2" (two inches) thick and the initial clean resistance to air flow shall not exceed 0.10" (one tenth inch) w.g. Filters shall be installed in side access or front access frames, as shown on the drawings. Filters in front access frames shall be furnished with lift handles. Furnish one complete set of spare filters for each system.

C. Sectional, Renewable Media: Air filters shall be 2" (two inches) thick adhesive coated glass fiber media pads enclosed in sectional frames of not less than 16 (sixteen) gauge galvanized steel and equipped with a quick opening mechanism for changing filter media. The airflow capacity of the filters shall be based on a net filter face velocity not exceeding 350' (three hundred and fifty feet) per minute with an initial resistance no greater than 0.10" (one tenth inch) water gauge. When used as pre-filters, and mounted in the same holding frames as higher efficiency secondary air filters, the airflow capacity may be based on 500' per minute with an initial resistance not to exceed 0.17" water gauge. Filters shall have an average arrestance of not less than 70 to 75% when tested in accordance with ASHRAE Test Standard 52.

D. Replaceable, Dry Type, Moderate Efficiency: Filters shall be of the pleated media, disposable type, 2" (two inches) deep in direction of airflow, Class 1 MERV 8. Each filter cell shall utilize a nonwoven, lofted cotton media with a net effective area of not less than 7.0 square feet of media per 1.0 square feet of filter face area, a media support grid, and enclosing high wet

strength cell sides. The 96% free area welded wire support grid shall be continuously bonded to the leaving air face of the media to properly support the radially tapered, pleated media in the air stream through the life span of the filter. The media itself shall be cemented to the inside perimeter of the cell sides to prevent bypass of unfiltered air. Filter efficiency shall average not less than 25 to 30% when tested in accordance with ASHRAE Test Standard 52-76. Initial clean resistance to air flow shall not exceed 0.30" w.g. at 500 fpm filter face velocity. The 24" x 24" size shall be certified to have a dust holding capacity of not less than 265 grams of ASHRAE Test Dust when operated at 500 fpm to a final resistance of 1.0" w.g.

E. Replaceable, Dry Type, Medium and/or High Efficiency (minimum MERV 13): Filters shall be 12" deep of the extended surface, supported pleat type. Each filter shall consist of high density, micro fine glass fiber media, media support grid, contour stabilizers, and enclosing galvanized steel frame. Media shall be laminated to a nonwoven synthetic backing to form a lofted surface for maximum dust holding capacity. The edges of the media shall be continuously bonded to the internal surfaces of the galvanized steel frame to prevent bypass of unfiltered air. Filter efficiency shall average not less than 80 to 85% when tested in accordance with ASHRAE Test Standard 52-76. Filters shall be 24" x 24" x 12" deep with an initial clean resistance not to exceed 0.35 inches w.g. at 500 fpm face velocity. The filters shall be certified to have a dust holding capacity of not less than 700 grams of ASHRAE Test Dust when operated at 500 fpm face velocity to a final resistance of 1" w.g.

F. Fabricate filter frames and supporting structures of 16 gauge galvanized steel or extruded aluminum T-section construction with necessary gasketing between frames and walls.

G. Standard Sizes: Provide for interchangeability of filter media of other manufacturers; for panel filters, size for required installation of filter media minimum 2 inch thick; for extended surface and high efficiency particulate filters, provide for upstream mounting.

H. Side Servicing Housing: Flanged for connection of ductwork, of reinforced 16 gauge galvanized steel; access doors with continuous gasketing and positive locking devices on both sides; extended aluminum tracks or channels for primary or secondary filters with positive sealing gaskets.

2.6 FILTER GAUGES

A. Each individual filter or filter bank handling 2,000 cfm or more shall be equipped with a diaphragm actuated dial and pointer type gauge with zero adjustment capability. The range of the scale shall be no greater than 1" w.g. above the filter manufacturer's recommended final resistance for the type of filter to which the gauge is being applied. Each gauge shall be provided with an adjustable signal flag, two static pressure tips with compression fittings, two three way vent valves with compression fittings, two lengths of aluminum tubing, and a mounting plate with screws.

B. Provide dry contact switch to indicate high-pressure limit (adjustable) for connection by others to FCMS system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer’s instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Do not operate fan system until filters temporary or permanent are in place. Replace temporary filter used during construction.

D. Install static pressure tips upstream and downstream of filers. Mount on outside of filter housing of filter plenum, in accessible position. Adjust and level.

E. Provide differential pressure sensor at filter bank of each air handling unit.

END OF SECTION 234100

238133 - UNITARY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish and install and install direct expansion air condition system, including:

1. Air handling/ fan coil unit.
2. Outdoor condensing unit.
3. Plenum/ pedestal.
4. Thermostat.

1.2 RELATED SECTIONS

A. Section 220700 – Plumbing Piping Insulation

A. Section 230700 – HVAC Piping Insulation.

B. Section 230993 –Direct-Digital Control System for HVAC.

C. Section 230593 – Testing, Adjusting, and Balancing for HVAC.

D. Coordinate with Commissioning Requirements indicated in Section 019113. This contractor is responsible to comply with all requirements for the above section.

1.3 REFERENCES

B. ARI 240 – Air Source Unitary Heat Pump Equipment.

A. ARI 270 – Sound Rating of Outdoor Unitary Equipment.

1.4 SUBMITTALS

C. Include product data and schematic layouts showing condensing units, air handling/ fan coil unit, refrigerant piping and accessories required for complete system. Include complete pipe sizing data.

A. Include rated capacities, dimensions, weights, accessories, required clearances, electrical requirements, wiring diagrams and location and size of field connections.

B. Include manufacturer’s installation instructions.

C. Provide operation and maintenance manual.

1.5 QUALITY ASSURANCE

1.6 WARRANTY

A. Provide 1 year whole unit parts only warranty.

B. Provide five-year manufacturer's replacement warranty on compressor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Carrier.

B. Trane.

C. Daikin

2.2 SYSTEM DESCRIPTION

D. Provide split conditioning system consisting of indoor air handling/ fan coil unit, outdoor condensing unit, refrigerant piping, fittings and accessories, and controls. Factory assembled components and test unit.

A. Heating and Cooling Capacities: As indicated on Drawings.

B. Refrigerant shall be R-410A.

2.3 AIR HANDLING/FAN COIL UNIT

E. Basic Unit:

1. Fabricated exterior unit casing of heavy gauge galvanized steel, painted with epoxy based enamel paint. Provide color chart for color selection by Architect.

2. All unit panels must be removable with a minimum 2 inch microbial resistant and glass fiber thermal insulation liner with sealed edges.

3. Fabricate fan deck of galvanized steel. Fabricate drain pans of 304 stainless steel externally insulated with fire retardant, closed cell foam insulation.

4. Provide liquid sensor at the shallowest part of the pan with all corresponding controls within the drain pan. Upon the presence of liquid, the sensor shall de-energize the unit and send an alarm signal to the BAS.

5. Provide with integral double deflection supply grilles and hinged bar return grilles, unless otherwise indicated on the drawings to have ductwork connections with 1" duct collars, and one inch filter frame.

B. Coils:

1. Construct coils with 2" O.D. copper tubes with aluminum fins mechanically bonded to the tubes.

1. Test al coils for design working pressure of 250 psig @ 200EF.

2. Heating and cooling coils shall be sized as required to meet or exceed the capacities indicated on the drawings.

C. Fans: Centrifugal, forward-curved, double-width wheels. Mount frame on vibration isolators.

D. Motors: Resilient mounted, three-speed, permanent split capacitor type in total compliance with Section 230513 – Common Motor Requirements for HVAC.

E. Filters: 1 inch disposable with galvanized holding frame in total compliance with Section 234100 – Particulate Air Filtration.

2.4 AIR COOLED CONDENSING UNITS

F. Provide air cooled condensing units as scheduled; self-contained, packaged, factory assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver and screens.

A. Provide corrosion resistant materials for unit parts which come in contract with refrigerant.

B. Provide timer conduits to prevent rapid cycling of compressor.

C. Fabricate cabinet from galvanized steel, with baked enamel finish; provide removable access doors or panels with quick fasteners.

D. Compressor: Hermetically sealed or semi-hermetic type, 1750 rpm, resiliently mounted with positive lubrication, crankcase heater, cylinder un-loaders for capacity modulation, motor overload protection, service valves, filter direr, suction and discharge valves, with gauge ports, and high and low pressure safety controls.

E. Condenser:

1. Seamless copper tubing with aluminum fins coil.

2. Provide condenser fans which discharge, vertically and have direct fan resiliently mounted with guard and motor.

3. Provide fan motor with permanently lubricated ball bearing type with built-in current and overload protection.

F. Provide unit with high and low pressure cutouts for compressor, non-recycling pump down, reset relay and oil pressure safety (7 ½ ton units and larger). Provide with controls to permit operation down to 0 degree F ambient temperature at minimum compressor load.

2.5 PIPING

G. Provide one refrigerant lint filter dryer and outside pressure taps in each refrigerant circuit.

2.6 CONTROLS

H. Refer to Section 230993 –Direct-Digital Control System for HVAC.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Verify proper refrigerant charge and operating pressures. Supplement factory charge (R-410) if necessary.

C. Mount unit in safe and accessible location for maintenance.

END OF SECTION 238133

260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Coordinate with Commissioning Requirements indicated in Section 019113. This Contractor is responsible to comply with all requirements for the above section.

1.2 SUMMARY

A. Section Includes:

1. Summary of Work.
2. Submittals, Analysis and Device Schedules.
3. Record Documents.
4. Operating and Maintenance Manuals.
5. General Electrical Product Requirements.
6. General Electrical Installation Requirements.
7. Electrical equipment coordination and installation.
8. Sleeves for raceways and cables.
9. Sleeve seals.
10. Grout.
11. Common electrical installation requirements.

B. Provide all work required for complete electrical and ancillary system as indicated on the drawings and in these specifications. This may include, but is not necessarily limited to; panelboards, transformers, cabinets, motor controllers, circuit breakers, fuses, disconnect switches, surge suppression, fire alarm system, Lighting Control System, interior and exterior lighting, parking lot lighting, lamps, relay panels, contactors, controls, wiring devices, wire and cable, grounding and bonding, lightning protection, equipment wiring system, conduit, raceways, boxes, supporting devices, identification, fire stopping, testing, excavating, concrete equipment bases, concrete duct encasements, conduit sleeves and supports, anchors, vibration and sound isolation, access panels, record drawings, installation permits, inspections by

governing authorities, electrical work of certain temporary facilities and services, cutting-and-patching work, utility connection coordination, start-up of electrical systems and equipment, training of Owner's operating personnel, operating and maintenance manuals, final cleaning of electrical and similar work.

C. Except where otherwise indicated, electrical drawings prepared by Engineer (contract drawings) are diagrammatic in nature and may not show locations accurately for various components of electrical systems. It is the intention of the Construction Documents to establish the types and functions of the systems, but not to set forth each and every item essential to the functioning of any system. The Contractor shall make necessary changes or additions as may be reasonably inferred from the construction documents for a complete operating system as required and record these on the record documents at no cost to the Owner.

D. Contractor shall visit site prior to submitting his proposal and become familiar with the conditions under which the Work is to be performed, and correlate site observations with the requirements of the Contract Documents. Errors, inconsistencies or omissions discovered shall be reported to the Architect/Engineer at once.

E. All electrical products and installations shall comply with the latest additions of the following standards where applicable:

1. ADA - AMERICANS WITH DISABILITIES ACT
2. ANSI - AMERICAN NATIONAL STANDARDS INSTITUTE
3. ASTM - AMERICAN SOCIETY FOR TESTING AND MATERIALS
4. CBM - CERTIFIED BALLAST MANUFACTURERS
5. ETL - ELECTRICAL TESTING LABORATORIES
6. FM - FACTORY MUTUAL
7. ICEA - INSULATED CABLE ENGINEERS ASSOCIATION
8. IEEE - INSTITUTE OF ELECTRONICS AND ELECTRICAL ENGINEERS
9. NEC - NATIONAL ELECTRICAL CODE
10. NECA - NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION
11. NEMA - NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
12. NESC - NATIONAL ELECTRICAL SAFETY CODES
13. NFPA - NATIONAL FIRE PROTECTION ASSOCIATION
14. NETA - INTERNATIONAL ELECTRICAL TESTING ASSOCIATION

15. OSHA - OCCUPATIONAL SAFETY AND HEALTH ASSOCIATION

16. UBC - UNIFORM BUILDING CODE

17. IBC – INTERNATIONAL BUILDING CODE

18. ICC – INTERNATIONAL CODE COUNCIL

19. IECC – INTERNATIONAL ENERGY CONSERVATION CODE

20. ISO – INTERNATIONAL ORGANIZATION FOR STANDARDIZATIONUL

21. UNDERWRITERS LABORATORIES, INC.

22. TAS – TEXAS ACCESSIBILITY STANDARDS

23. STATE ENERGY CONSERVATION CODE

24. MUNICIPAL OR COUNTY CODES. In the event of conflicts between codes or standards, the more stringent requirements shall govern.

F. All work and materials shall be warranted as indicated in Division 1.

G. Contractor is responsible for filing and paying for all fees and obtaining necessary permits and certificates of inspection, and shall deliver all certificates of inspection to Owner, and include copies with maintenance manuals.

1.3 DEFINITIONS

A. NRTL: Nationally Recognized Testing Laboratory, including United Laboratories (UL) and Intertek (ETL).

1.4 SUBMITTALS

A. General Submittal Requirements:

1. All submittals shall be in accordance with Division 1 requirements.

1. Submit number of copies indicated in Division 1 or 6 copies, whichever is greater.

2. Applicability: Wherever it is indicated that shop drawings, samples, manufacturer's brochure, certification, test, copy of standard operating instructions, manual, extra stock, or warranty is required, appropriate submittal is required regardless of whether it is specified as "submittal"; Engineer’s decision shall be final.

3. Do not purchase equipment until submittals have been reviewed by Engineer with no exceptions taken.

4. Signed Commitments: Do not proceed with transfer of electrical systems to Owner for operation until warranties, performance certifications, maintenance agreements and similar commitments to be signed by Contractor and other entities have been executed and transmitted to Engineer (for Owner's records).

5. Response to Submittals: Where standard product data have been submitted in fulfillment of project requirements, it is recognized that submitter has already determined that products fulfill specified requirements, and that submittals are for engineer's information only, but will be returned without action where observed to be non-complying with requirements. Where uniquely prepared information is submitted, it is recognized to represent preparer's interpretation or solution to specified requirements, subject to Engineer's concurrence and appropriate action as indicated in Division 1.

6. Submittals shall be signed by the General Contractor and Subcontractor responsible for this work.

7. The Engineer's review of submittals is solely for general conformance with the design concept. The Engineer's review does not relieve the Contractor from total responsibility for quantities, errors, omissions or compliance with the intent of the original contract documents. Review and approval by the Contractor is required before fabrication, shipment or installation.

B. Substitutions: Electrical submittals are not opportunities for gaining acceptance of substitutions. Any variance from the contract documents shall be identified in accordance with Division 1 requirements. Substitutions will be reviewed only for those reason identified in Division 1 and only if the procedures identified in Division 1 are followed. Any variances from the contract documents in the submittals which are not identified by the Contractor in accordance with the procedures of Division 1 and subsequently not identified by the Engineer's review shall be corrected by the Contractor at no cost to the Owner. Substitution request would only be considered if product is equal or better than what listed. No substitution will be allowed for fire alarm system and any electrical products and equipment.

C. Coordination Drawings: Prior to any submittals being reviewed, the Contractor shall provide the coordination drawings indicated in Division 1. In accordance with Division 1, the coordination drawings shall show work in and above ceilings and in mechanical and electrical rooms with horizontal and vertical dimensions to avoid interference with structural framing, ceilings, partitions and other services. The coordination drawings shall be to a scale of 1/4" = 1'-0" or larger. Coordination drawings in the buildings shall include but not be limited to all Electrical rooms with size and location, major electrical equipment and accessories, switchgear and clearances, HVAC ductworks in rooms, plumbing, air grilles, light fixtures, communications equipment, access panels, transformers, switchboards, panelboards, control panels, fire alarm equipment, code clearances for equipment, manufacturers required maintenance clearance for equipment, concrete equipment pads, exterior wall penetrations, foundation penetrations, and fire rated wall penetrations.

D. Short Circuit Analysis: Prior to any electrical submittals being reviewed, the Contractor shall perform short-circuit analysis of the specified electrical power distribution system. This analysis shall include:

1. A calculation of the maximum RMS symmetrical three-phase short-circuit current available at each panel location in the electrical system. The results shall represent the highest short-circuit currents to which the equipment might be subjected under the reported system conditions. The short circuit currents shall be calculated with the aid of a computer. The Contractor shall obtain necessary information from the utility to do this prior to furnishing equipment and coordinate with manufacturer to meet the greater of minimum required rating and rating indicated on Drawings.

1. Appropriate motor short-circuit contribution such that the calculated values will represent the highest short-circuit current to which the equipment will be subjected under fault conditions.

2. A tabular computer printout of equipment supplied by the electrical ratings of the electrical equipment supplied by the electrical manufacturer, the calculated short-circuits currents, X/R ratios, and notes regarding the adequacy or inadequacy of the equipment.

3. A computer printout of input circuit data including cable lengths, number of cables per phase, cable impedance values, insulation types, transformer impedances, X/R ratios and other circuit information as related to the short-circuit calculations.

4. A bus-to-bus computer printout listing the maximum available short-circuit current in RMS symmetrical amperes and the X/R ratio of the fault current. This printout shall have an accompanying printout explaining how to interpret the short-circuit results.

5. A computer-generated system one-line diagram clearly identifying individual equipment buses, bus numbers used in short-circuit analysis, cable and bus connections between the equipment and calculated maximum short-circuit current at each bus location.

6. A discussion section evaluating the adequacy or inadequacy of the equipment, with recommendations as required for improvements to the system.

7. Any inadequacies shall be called to the attention of the engineer and recommendations made for improvements.

8. Six (6) bound copies of the completed short-circuit analysis sealed by a Texas Licensed Professional Electrical Engineer shall be submitted for the Engineer to review.

E. Protective Device Time-Current Coordination Analysis: Prior to any electrical equipment submittals being reviewed, the Contractor shall perform a protective device time-current coordination analysis of the specified electrical power distribution system. This analysis shall include:

1. A determination of settings, ratings, or types for the over-current protective devices supplied. Where necessary, an appropriate compromise shall be made between system protection and service continuity with:
    a. System protection shall be more important than service continuity. The time current condition analysis shall be performed with the aid of a computer.

2. Computer generated log-log plots containing the time current characteristics of over-current devices. A sufficient number of log-log plots shall be provided to indicate the degree of system protection and coordination. The log-log plots shall include transformer ANSI withstand point and inrush currents of transformers where appropriate. Series rated devices shall not be acceptable.

3. Computer printouts to accompany the log-log plots containing descriptions for each of the devices shown on the plot, setting of the adjustable devices, device numbers to simplify locations of the devices on the system one-line diagram and short circuits where shown.

4. A tabular computer printout of the suggested settings of the adjustable over-current protective devices, the equipment where the devices are located, the device number corresponding to the device on the system one-line diagram and the number of the time-current log-log graphs where they are illustrated.

5. A computer generated system one-line diagram clearly identifying individual equipment buses, the bus numbers, the device numbers and the maximum available short-circuit at each bus which shall include short-circuit current motor contributions.

6. A discussion section evaluating the degree of system protection and service continuity with over-current devices, with recommendations as required for increased protection or coordination.

7. Any inadequacies shall be called to the attention of the engineer and recommendations made for improvements.

8. Six bound copies of the completed protective device time-current coordination analysis for the engineer.

F. Over-current Device Schedule: Prior to any electrical submittals being reviewed, Contractor shall provide a schedule for each piece of equipment required by Divisions 11, 14, 21, 22, 23, 25, 27, and 28 in coordination with subcontractors providing equipment under these sections. Submittals shall reflect required coordination by having related Contractor's signatures on the submittals. This means that electrical requirement for chiller as an example, shall be coordinated by BOTH Electrical and Mechanical subcontractors, and Over-Current Device Schedule submitted shall be signed by both Contractors. For each piece of equipment actually supplied, the schedule shall indicate the full load amps (FLA), the minimum circuit amps (MCA), and the maximum over-current protection device (MOCPD). The schedule shall also indicate if the equipment is required to be protected by fuses only, thermal magnetic breaker only, HACR breakers only or any combination thereof. It shall also indicate if the equipment requires single point or multiple point of connections and hoe the Contractor is proposing to meet the requirements if different than construction documents. It shall explicitly indicate the required number of conductors, disconnect switch sizes and numbers (if required), and acceptable conduit sizes and number. These modifications shall be reflected in the electrical equipment submittal. Required changes shall be made at no cost to the Owner.

G. After the coordination drawings, short circuit analysis coordination analysis and over-current device schedule are submitted, the products in Division 26 shall be submitted in the groups identified below. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other trades. Submittals for each group will be returned without review unless all sections are included. Sections will not be reviewed separately. At the Engineer's discretion, when a re-submittal is required for one section, any other sections within each group may require re-submittal. Contractor shall expedite submittals and re-submittals as required to allow for the Engineer's review time specified in Division 1. The groups of equipment shall be divided as follows:

1. Raceways, Conductors and Miscellaneous Equipment
    a. Fire stopping
    b. Conduit
    c. Raceways, Multi-outlet Assemblies, Wireways and Auxiliary Gutters
    d. Wires and Cables
    e. Outlet Boxes
    f. Wiring Devices
    g. Cabinets and Enclosures
    h. Grounding and Bonding
    i. Supporting Devices
    j. Electrical Identification
    k. Lightning Protection Systems

2. Distribution Equipment
    a. Distribution Switchboards
    b. Enclosed Switches
    c. Dry Type Transformers
    d. Distribution Panelboards
    e. Branch Circuit Panelboards
    f. Enclosed Motor Controllers
    g. Motor Control Center
    h. Variable Speed Drives

3. Electrical Controls

4. Lighting Fixtures
    a. Interior and Building Lighting Fixtures

5. Specialty Systems
    a. Transient Voltage Surge Suppression
    b. Fire Alarm System
    c. Intercom System
    d. Cable TV System
    e. Local sound reinforcement System

6. Testing

a. Field Electrical Testing

H. Shop Drawings: Prepare electrical shop drawings to accurate scale except where diagrammatic representations are specifically indicated. Show clearance dimensions of critical locations, and show dimensions of spaces required for operation and maintenance of equipment. Show conduit layouts and wire/cable connections and other electrical service connections and show interfaces with other work, including structural support. Indicate by note, portions of electrical work shown on shop drawings which deviates from indication of work in contract documents, and explain reasons for deviations. Show how such deviations coordinate with interfacing deviations on shop drawings for other portions of work, currently or previously submitted. Show wiring diagrams, erection, setting, weights, capacities, speeds, outputs, consumption, efficiencies, voltages, amperages, hertz, phases, noise levels, etc.

I. Samples: Engineer's review of required sample submittals will be limited to observation of general type, pattern, and finish; and will not include testing and inspection of submitted samples, except for those specifically indicated for that purpose in the contract documents. Compliance with specified requirements remains the exclusive responsibility of the Contractor.

J. Manufacturer's Data: Where pre-printed data covers more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black pen to indicate which variations are to be provided. Delete or mark-out all portions or pre-printed data which are not applicable. Where operating ranges are shown, mark data to show portions of range required for project application. Expansion or elaboration of standard data to describe non-standard product must be processed as shop drawing data to describe non-standard product. For each product include manufacturer's production specifications, installation or fabrication instructions, nearest source of supply (including telephone number), sizes, weights, speeds, operating characteristics, ratings, conduit and wire/cable connection sizes and locations, statements of compliance with required standard and governing regulations (include manufacturer's signed statements if not covered in printed data), performance data (where applicable) and similar information needed to confirm compliance with requirements.

K. Manufacturer's Certification: Each manufacturer is required to review the system design as related to the proper operation of his equipment, including electrical requirements, automatic controls, mechanical systems and equipment locations and related items. With shop drawings submit a letter from the manufacturer stating that his equipment will operate satisfactorily under the design conditions. The manufacturer's representative shall review the final installation at the site and submit a second letter stating that the equipment operates satisfactorily as installed. Furnish certification for the systems listed in each section of Division 26.

1. Test Reports: The Contractor for various sub-systems shall submit proposed testing procedure for their system, subject to review and approval and owner acceptance. The contract will not be declared to be substantially complete until the functional operation of the subsystems have been demonstrated and verified and reports have been provided, reviewed and accepted. The project will not be declared substantially complete until the following has taken place:

2. The “As-Built” drawings have been submitted, reviewed, and accepted by OWNER CM-PA/Bond Office.

3. The various systems have been commissioned and accepted. This will include the following systems:
   a. Building Fire Alarm System
   b. Clock System
   c. Television Distribution System
   d. Building Computer Network
   e. Surveillance and Security System
   f. Intercom/Telephone

L. Submit test report signed and dated by firms performing test, and prepare in manner specified in standard or regulation governing test procedure as indicated. Provide notarized executions on test reports.

M. Warranties: Refer to Division 1 for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements. A minimum of one-year warranty period is required for all materials and equipment. Warranty period starts upon first beneficial use or acceptance by OWNER whichever comes first.

1. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; names, addresses and telephone numbers and procedures for filing a claim and obtaining warranty services.

2. Where pre-printed and published warranty includes substantial deviation from required warranty (as judged by Engineer), product is automatically disqualified from use on project, except where manufacturer prepares and issues specific project, warranty on product, stating that it is in lieu of published warranty, and is executed by authorized officer, and complies with requirements.

N. Load Current and Overload Relay Heater List: Compiled by Contractor after motors have been installed. Arrange to demonstrate selection of heaters to suit actual motor nameplate full load currents.

1.5 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1. In addition to the requirements specified in Division 1, indicate installed conditions for:

1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; access panels; and fuse and circuit breaker size and arrangements.

1. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

2. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

3. Underground cabling and conduits both interior and exterior, drawn to scale and fully dimensioned.

4. Work concealed behind or within other work, in a non-accessible arrangement.

5. Mains and branches of wiring/cabling systems, with switchboards, panelboards, and control equipment and devices located and numbered with terminals and connections located, and with equipment requiring maintenance located.

6. Grounding systems including primary, secondary and special.

B. Execution: Each installer or other entity responsible for recording installed work shall record firm name, signature and date on each drawing so marked.

C. Prior to transmittal of corrected drawings, obtain three (3) sets of blue-line prints of each drawing in each set, regardless of whether corrections were necessary, and include in transmittal (two (2) sets are for Owner's use, and one (1) is for Engineer's records).

1.6 OPERATING AND MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1. In addition to the requirements specified in Division 1, provide the following.

B. Submit sets prior to final inspection, in electronic PDF format.

C. Contents:

1. Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractor, and major equipment suppliers.

1. Operation and maintenance instructions, arranged by system.

2. Project documents and certificates.

3. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

4. Manufacturer's original printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions. (Copies are not acceptable).

5. Maintenance procedures for routine preventative maintenance and troubleshoot; disassembly, repair, and re-assembly; aligning and adjusting instructions.

6. Servicing instructions and lubrication charts and schedules.

7. Warranty information including any corrections made during submittals.

8. Replacement parts list.

9. List of tools and accessories needed for maintenance.

1.7 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

1. To provide for ease of disconnecting the equipment with minimum interference to other installations.

2. To allow right of way for piping and conduit installed at required slope.

3. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.1 GENERAL MANUFACTURER QUALIFICATION

A. Production Experience: For all electrical equipment, manufacturer shall be firm with not less than five (5) years successful production experience. Experience means production of units similar to those required, as judged by Engineer. Comply with longer-period experience requirements specified in other Division 26 sections of these Specifications. Product shall be new and design for quiet, vibration free operation.

2.2 GENREAL ELECTRICAL PRODUCT REQUIREMENTS

A. Standard Products: Provide not less (quality) than manufacturer's standard products as specified by published product data. Do not assume that available off-the-shelf condition of product complies with requirements; as example, specific finish or color may be required.

B. Unencumbered Purchases: Avoid purchases and use of products which are encumbered with questionable title transfers, patent rights, trade union restrictions, code compliance, non-listings as "approved products" for compliance with governing regulations, duties due, embargoes and similar possible encumbrances, claims or seller’s interest.

1. Purchasing: Do not purchase specific electrical materials and equipment for project until completion of submittals.

C. Condition of Products: Except as otherwise indicated, provide new electrical products, free of defects and harmful deterioration at time of installation. Do not use units, which have been subjected to destructive testing, or other high-limits testing except where pre-tested products are specified. Comply with Division 1 requirements for exposure or visual display limitations against trademarks and manufacturer's names. Provide each product complete with trim, accessories, finish, guards, safety devices and similar components specified or recognized as integral parts of products, or required by governing regulations.

D. Assembly and Testing: To greatest extent possible and unless otherwise indicated, complete fabrication, assembly, finishing and testing of products prior to delivery to project. Notify Engineer not less than one week in advance of pre-installation testing to be performed in response to project requirements. Engineer reserves right to be present at tests of electrical products; however, neither their absence nor presence relieves the Contractor of responsibility for compliance with requirements.

E. Uniformity: Where multiple units of generic product are required for single major system of electrical work, e.g., cable trays, lighting systems, provide identical products by same manufacturer, without variations.

1. Limitations: Product/manufacturer uniformity does not apply to conduit and fittings, 600V electrical wire, sheet metal, steel bar stock, welding rods, solder, factory applied paint between different systems, fasteners, motors for unalike equipment units, and similar items used in work, and except as otherwise indicated.

F. Product Compatibility, Options: Where more than one product selection is specified, selections are Purchaser's or Installer's options, except do not provide products which are not compatible with previously purchased or installed products which must interface with selections. Provide electrical adaptations as needed for interfacing of selected products in work.

G. Quality Assurance: Provide products listed by and installed in accordance with all references in each section under quality assurance any other applicable requirements.

H. Elevation Requirements: Electrical equipment provided shall perform at mean elevation of 1000 feet above sea level.

l. Listing: Provide products that are listed by a NRTL.

2.3 SLEEVES FOR RACEWAYS AND CABLES

A. Retain one of first two paragraphs below for penetrations through exterior walls above and below grade.

B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

C. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop, unless otherwise indicated.

D. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:
   a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
   b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.4 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

2.5 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 GENERAL ELECTRICAL INSTALLATIONS

A. The Contractor shall provide all necessary items for a complete operating system.

B. Provide all electrical systems required by and in accordance with Division 26.

C. Perform work for other divisions as required for electrical installations or coordinate such work with other trades which includes but is not necessarily limited to:

1. Division 1: Cutting and Patching, Temporary Controls, Submittals, Facility Start-up, Contract Close Out, Record Documents, etc.

2. Division 2: Trenching, Backfilling, Compaction, Demolition, etc.

3. Division 3: Concrete Formwork.

4. Division 5: Metal Fabrications.

5. Division 6: Rough Carpentry.

6. Division 7: Joint Sealers and Fire Stopping

7. Division 8: Electric Door Hardware and Access Doors
   a. Deviation: Contractor is encouraged to coordinate and combine electrical access with mechanical access, and has the option to not add electrical access panels if acceptable coordination can be achieved.

8. Division 9 - Painting: In addition to Division 9, paint electrical equipment factory applied paint surfaces damaged during installation with paint purchased from equipment manufacturer to match each damaged surface.

9. Divisions 11 and 13: Laboratory Furniture, Electronic Systems, Intercoms, etc.

10. Division 15 for motors, controls, accessories, and connections.

D. Verify all dimensions by field measurements.

E. Arrange for chases, sleeve, slots, and openings in other building components during progress of construction, to allow for electrical installations.

F. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

G. Where mounting heights or locations are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom and working clearances possible, but not less than required by Code.

H. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings and manufacturer's instructions, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.

I. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

J. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

K. Install J-boxes for all other equipment requiring access or maintenance, which are concealed behind surfaces so that these devices can be serviced from the access panels. Where practical, group J-boxes and equipment so that they can be accessed from the same panel or door. If additional panels are needed, panels must be submitted for approval.

L. Cut, remove and legally dispose of selected electrical equipment, components, and materials, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new work.

M. The A/E reserves the right to make relocations up to 6 feet of outlets, boxes, cabinets, lighting, etc. before finished rough-in at no cost to the Owner.

N. Contractor shall notify design prime consultant and associated owner representative when he requests an inspection by the City Inspector.

3.2 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.4 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.5 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protection and Identification: Deliver products to project properly identified with names, model numbers, types, grades, compliance labels and similar information needed for distinct identification; adequately packaged or protected to prevent deterioration during shipment, storage and handling. Store in dry, well ventilated, indoor space, except where prepared and protected by manufacturer specifically for exterior storage.

3.7 DAMAGED EQUIPMENT

A. The following will be rejected (even after final installation) and must be replaced with same as original at no cost to Owner:

1. Dented, deformed, stepped-on, or otherwise physically damaged enclosures.

2. Stripped cover plate screws and the holes they screw into.

3. Door hinges that do not operate smoothly.

B. The following will require field repair to original condition:

1. Minor scratches to equipment enclosure finishes.

3.8 TEMPORARY WIRING

A. The electrical Contractor shall arrange for and provide all necessary equipment, outlets, temporary lights, metering and communications as required during the construction period for temporary electrical service to the project.

B. It shall be the responsibility of the electrical Contractor to consult with all other trades on the project in order to determine the voltage of temporary electrical service required to operate the construction equipment to be employed and to provide such services to the project.

C. It shall be the responsibility of the electrical Contractor to make all arrangements for, and to furnish and install, any and all temporary wiring, switches, and structures which may be required to maintain service continuity during the entire construction period. Temporary power and lights shall be UL listed and shall include a ground wire, a guard and a proper means of support.

D. All temporary installations shall be performed in accordance with the current edition of the National Electrical Code. All machinery and equipment powered by electricity shall have effective electrical equipment grounding provided with all electrical circuits.

3.9 UTILITIES

A. This Contractor shall examine the site and shall verify, to his own satisfaction, the location and elevation of all utilities, and shall adequately inform himself as to their relation to the work before entering into a contract.

B. Existing utility lines shown within the scope of this project to be abandoned or removed shall be performed as directed by the Owner, and/or utility companies.

C. Existing utility lines not shown on the drawings but encountered during construction shall be protected, relocated or capped as directed by the Owner, and/or utility companies. All precautions shall be exercised to prevent damage to existing lines not shown, but should work become necessary, it must be authorized prior to execution except in an emergency situation.

D. Before beginning excavations of any nature whatsoever, the Contractor shall make an attempt to locate all underground utilities of every nature occurring within the bounds of the area to be excavated. The Contractor shall then proceed with caution in his excavation work so that no utility shall be damaged with a resultant loss of service.

E. Should any damage result to any utility through the Contractor's negligence or failure to comply with the above directive, he will be liable for such damage and for all expense incurred in the expeditious repair or replacement of such damaged utilities.

F. Repair of damaged utilities shall be to a condition equal to or better than the adjacent undamaged portion of such utility and to the complete satisfaction of the Owner and/or utility companies.

3.10 EXCAVATION

A. The Contractor shall perform all excavation of every description and of whatever substances encountered, to the depths indicated and/or required for the installation of all portions of the utilities systems. All excavated materials not required for fill or backfill shall be removed. All excavation shall be made by open cut. The banks of trenches shall be kept as nearly vertical as practicable and where required shall be properly shored and braced. Trenches shall be at least 12" wider and not more than 16" wider than the outside diameter of the conduit, and shall be excavated true to line so that a clear space greater than 6" and less than 8" in width is provided on each side of the conduit or duct bank.

B. Except at locations where the excavation of rock from bottom of trenches is required, care shall be taken not to excavate below the depths indicated. Where rock excavation is required, the rock shall be excavated to a minimum over-depth of 4" below the trench depths indicated on the drawings or as specified. The over-depth rock excavation shall be back-filled with loose, moist earth and thoroughly tamped.

C. Whenever wet or otherwise unstable soil that is incapable of supporting the conduit duct bank, pole base or pad is encountered in the trench bottom, such soil shall be removed to a depth required. The trench bottom shall be filled with course sand, fine gravel, or other suitable material.

D. Backfill with earth under pole bases, pads or other buried structures will not be permitted, and any unauthorized excess excavation below the levels indicated for foundation of such structures shall be filled with sand, gravel or concrete at the expense of the Contractor.

E. All grading in the vicinity of excavations shall be controlled to prevent surface ground water from flowing into the excavations. Any water accumulated in the excavations shall be removed by pumping or by other approved method. During excavation, material suitable for backfilling shall be stacked in an orderly manner a sufficient distance back from the edges of trenches to avoid overloading and to prevent slides or cave-ins.

3.11 BACK-FILLING

A. Trenches shall not be back filled until all required tests are performed and until the utilities systems as installed conform to the requirements specified.

B. Trenches shall be carefully back filled with the excavated materials approved for back filling. This material shall consist of earth, loam, sandy clay, sand and gravel, soft shale, or other approved materials, free from large clods of earth or stones, deposited in thoroughly and carefully tamped 6" layers, until the conduit has a cover as specified. Broken rock, broken concrete or pavement, and large boulders shall not be used as backfill material.

C. Settling the backfill with water will be permissible and will be a requirement when so directed.

D. Any trenches across roadways or other areas to be paved shall be back filled with flowable fill (CLSM) or approved equal (ashes combined with concrete) in such manner as to permit the rolling and compaction of the filled trench. Together with the adjoining earth, shall provide required bearing value so that paving of the area can proceed immediately after the backfilling is completed.

3.12 CLOSEOUT PROCEDURES

A. General Coordination: Refer to Division 01 sections and individual Specification sections for coordination of electrical closeout work with variable loads on electrical system. Coordinate taking of final photographs (if any) with electrical closeout, so that maximum detail of work as finally accepted is shown. Sequence closeout procedures properly, so that work will not be endangered or damaged, and so that every required performance with be fully tested and demonstrated.

B. System Performance Test Runs: Coordinate test runs of electrical systems with test runs of equipment served thereby (heating, air conditioning, plumbing, etc.). Check each item in each system to determine that it is set for proper operation. With Owner's Representative and Engineer present, operate each system in test run of appropriate duration to demonstrate compliance with performance requirements. During or following test runs, make final corrections or adjustments of systems to refine and improve performances where possible, including noise and vibration reductions, elimination of hazards, better response of controls, signals and alarms, and similar system performance improvements. Provide testing or inspection devices as may be reasonably requested for Engineer's observation of actual system

performances. Demonstrate that controls and items requiring service or maintenance are accessible.

C. Cleaning and Lubrication: After final performance test run of each electrical system, clean system both externally and internally. Comply with manufacturer's instructions for lubrication of both power and hand-operated equipment, and remove excess lubrication. Touch-up minor damage to factory-painted finishes and other painting specified as electrical work; refinish work where damage is extensive.

D. General Operating Instructions: In addition to specific training of Owner's operating personnel specified in individual Division 26 work sections, and in addition to preparation of written operating instructions and compiled maintenance manuals specified in Division-26 Sections and elsewhere in these specifications, provide general operating instructions for each operational system and equipment item of electrical work. Coordinate instructions with instructions for mechanical work, elevators and other equipment where associated with electrical systems or equipment.

1. Describe each basic electrical system and functioning of its control system.

2. Explain identification system, mimic diagrams, signals, actuators, sensors, alarms, telecommunication systems, and similar audio/visual provisions.

3. Describe interfaces with mechanical equipment, including interlocks, sequencing, start-up, shut down, emergency, safety, system failure, security and similar provisions.

4. Outline basic maintenance procedures and major equipment turnaround requirements, including adjustments to optimize output and efficiency of electrical system.

5. Display and conduct "thumb-through" explanation of maintenance manuals, record drawings, spare part inventory, storage of extra materials, meter readings and similar service items.

E. Construction Equipment: After completion of performance testing and Owner's operating instructions and demonstrations, remove installer's tools, test facilities, construction equipment and similar devices and materials used in execution of work but not incorporated in work.

F. Security and Protection: During electrical work closeout phase, meet with Owner's operating representative frequently (daily where necessary) and agree upon status of operational responsibility for electrical systems (including securing provisions to prevent unauthorized operations, and including protective measures to ensure that systems are not neglected or misused.

PART 4 - CONTINUED SYSTEM OPERATIONS

A. Acceptance and Continued Services: Coordinate Owner's take-over of electrical systems with take-over of mechanical systems, including the provision of skilled electrical operating and maintenance personnel until time Owner's personnel take over operation of entire mechanical and electrical plant. Contractor shall continue consultation and services (beyond take-over

date) for electrical systems, matching required continued services on associated mechanical systems and equipment.

END OF SECTION 26 05 00

260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600V and less.
2. Connectors, splices, and terminations rated 600V and less.
3. Sleeves and sleeve seals for cables.

B. Related Sections include the following:

C. List below only products and equipment that the reader might expect to find in this Section but are specified elsewhere.

1. Division 27.

1.3 DEFINITIONS

A. Retain abbreviations that remain after this Section has been edited.

B. EPDM: Ethylene-propylene-dieneterpolymer rubber.

C. NBR: Acrylonitrile-butadiene rubber.

D. MCM: Thousand circular-mils.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Coordinate paragraph below with qualification requirements in Division 01 Section "Quality Requirements" and as supplemented in "Quality Assurance" Article.

C. Qualification Data: For testing agency.

D. Retain paragraph below if Contractor is responsible for field quality-control testing.

E. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Retain first paragraph and subparagraph below if Contractor is required to provide services of an independent testing agency in Part 3 "Field Quality Control" Article. Qualification requirements supplement those specified in Division 01 Section "Quality Requirements", which also includes the definition for NRTL.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

E. UL Compliance: Provide components which are listed and labeled by UL under the following standards.

1. UL Std. 83 - Thermoplastic-Insulated Wires and Cables.

2. UL Std. 4 - Armored Cable

3. UL Std. 1569 - Metal-Clad Cables

4. UL Std. 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.

5. UL 13 - Power limited circuit cables.

6. UL 1666 - Test for flame propagation height of electrical and optical-fiber cables installed vertically in shafts.

7. UL 910 - Test for flame propagation and smoke density values for and optical fiber cables used in spaces environmental air.

8. UL 1685 - Vertical tray fire propagation and smoke release test for and optical fiber cables.

F. NEMA WC-5: Thermoplastic-insulated wire and cable for the transmission and distribution of electrical energy.

G. Federal Specifications

1. J-C-30B (1) cable and wire, electrical (power, fixed installation).

1.6 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers, 600 Volt or Less Wire and Cable: Subject to compliance with requirements, provide products by one of the following:

1. Carol
2. South wire.
3. Triangle PCW
4. American Insulated Wire Corp
5. BFCC Brand
6. Senator Wire and Cable
7. Encore Wire Corporation

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN, XHHW, UF, USE and SO. All conductors are to be Copper wire or cable insulated for 600 V, color coded for the entire length. Use of electrical tape for marking is strictly prohibited.

1. Conductors shall be provided with insulation types indicated explicitly on drawings, and substitution is NOT acceptable without Engineer's approval.
2. Wiring BX and MC will not be acceptable for use on this project. MC may be used for light fixture whips only.
3. Where insulation type is not explicitly identified on drawings, branch circuit and feeder circuit conductors shall have THHN-THWN dual-rated insulation.

D. Multi-conductor Cable: Comply with NEMA WC 70 for armed cable, Type AC, metal clad cable, Type MC, mineral-insulated, sheathed cable, Type MI with ground wire.

2.2 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.

C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.4 SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:

1. Advance Products & Systems, Inc.

2. Calpico, Inc.

3. Metraflex Co.

4. Pipeline Seal and Insulator, Inc.

C. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Copper:

1. Solid for #10 AWG and smaller;

2. Stranded for #8 AWG and larger.

B. Aluminum:

1. Use only for distribution or service feeders where explicitly indicated on Drawings.

2. Use AA-8030 alloy only.

3. Stranded only

4. Minimum size: 250 MCM.

5. Provide compression lugs.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2 single conductors in raceway, unless specifically noted otherwise on Drawings.

B. Feeders to Switch Boards, Distribution-Class Panels, and Motor Control Centers located in central plant or main electrical room: Type XHHW-2 single conductors in raceway, unless specifically noted otherwise on Drawings.

C. Feeders to Distribution-Class Panels, Lighting-Class Panels, and distribution equipment located in any other area: Type THHN/THWN-2 dual-rated insulation conductors in raceway, unless specifically noted otherwise on Drawings.

D. Feeders to Emergency Equipment: Type RHW-2, unless specifically noted otherwise on Drawings.

E. Branch Circuits: Type THHN/THWN-2 dual-rated insulation conductors in raceway, unless specifically noted otherwise on Drawings.

1. Lighting Fixture Tails: A maximum of 6'-0" length of multi-conductor cable may be used for lighting fixture connection from above-ceiling junction boxes with Code-required support and minimum of one support point between junction box and fixture.

2. Wiring Devices: Multi-conductor cable is not acceptable for use in connection of wiring devices and associated boxes.

3. Equipment: Multi-conductor cable is not acceptable for use in connection of equipment by any Division.

F. Control Circuits: Type THHN/THWN-2 in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway. Do not re-pull wires/conductors that been used. Do not use rope hitches for pulling attachment to wire or cable.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

G. All wire shall be installed in conduit or raceways.

H. All circuits shall have a hot, neutral and green ground wire unless otherwise indicated.

I. Provide #12 conductors and #12 grounds minimum to all 20 amp devices unless otherwise indicated.

J. Provide #10 conductors and #10 grounds minimum to all 30 amp devices unless otherwise indicated.

K. Provide #10 minimum conductors for 120/208V 20 amp circuits for which the distance from the panelboard to the first device is greater than 100 feet.

L. Provide #10 minimum conductors for 277/480V 20 amp circuits for which the distance from the panelboard to the first device is greater than 200 feet and for all general lighting circuits with continuous load greater-than-or-equal-to 3.0 kVA.

M. Do not install wires in conduit until entire system of conduit and outlet boxes is permanently in place.

N. Exercise care when installing wire in conduit so as to prevent injury to the conductor insulation. Mechanical means of pulling shall not be used unless approved. Conductors shall be pulled using UL non-flammable listed lubricant when necessary. Do not re-pull wires/conductors that been used.

O. Whenever wiring leaves the conduit and terminates at a terminal board, the wiring shall be formed and laced with plastic wire ties. Conductors are to be installed neat, order and workmanlike manner and also comply per NEC 70; Article 312.

P. In the event circuits feed through outlet boxes, provide splice and pigtail for device connection, with sufficient slack to pull splice out of box at least 6 inches (for inspection). Terminate the conductors around the terminal screws not at the back of the receptacle.

Q. Coordinate cable installation with other Work.

R. Pull conductors simultaneously where more than one is being installed in same raceway.

S. Splices:

1. Branch Circuits: Keep conductor splices to a minimum.

2. Motor Branch Circuits: Splices are not allowed in motor branch circuit feeders.

3. Relocation of Existing Lighting-Class Panels: Provide splices to existing branch circuits that are active and will remain in above-ceiling junction boxes sized appropriately for the quantity of conductors. Verify existing branch circuit feeder condition and ampacity and provide new feeders where existing violations exist. Match and extend branch circuit feeders from splice to new panel location and provide new branch circuit breaker as indicated in Panel Schedules to re-feed existing load.

4. Service Entrance Feeders: Splices are not allowed in any service entrance feeder(s). All conductors must be single length.

5. Distribution Feeders: Splices are not allowed in any distribution feeder(s) including, but not limited to feeders between switch boards, distribution-class panels, lighting-class panels, motor control centers, transformers, safety switches, and motor controllers and drives.

6. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced.

7. Use splice and tap connectors which are compatible with conductor material.

T. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than no.10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.

U. Home Runs: except where specifically indicated, provide lighting branch circuit home runs with not more than three different line conductors and a common neutral in a single raceway for 4-wire, 3-phase systems.

V. Conductors may be run inn parallel in sizes 1/0 through 750 MCM where indicated and provided that all conductors of each phase are the same length and so arranged and terminated as to ensure equal division of the current between all paralleled phase conductors.

W. Feeders shall be installed in continuous pieces without splice.

X. Install a separate neutral for each circuit which serves GFCI or isolated ground receptacles.

Y. Each circuit originating from a GFCI type circuit breaker shall also have a separate neutral.

Z. Where specifically indicated, for receptacle branch circuits, provide a separate neutral conductor for each line conductor.

AA. Each circuit serving receptacles where data terminals are used shall have separate neutral.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B. Provide Documentation and records all torque terminations.

B. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack per Section 300.14.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.

2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3. Perform insulation resistance test for all branch and main circuit conductor. Perform test on each conductor with respect to ground and adjacent conductor. Applied potential shall be 1000 volts DC for one minute. Test values shall be evaluated and conductors with values less than 50 megohms shall be investigated. Replace any cable reading less than 1 megohm.

4. Provide torque test for all conductor terminations in transformers, switchboards; disconnect switches, panelboards, etc in accordance with NETA standards. Record test result in accordance with item D below.

5. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each termination of cables and conductors No. 3 AWG and larger. Remove box and equipment covers so terminations are accessible to portable scanner.
   a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   b. Record of Infrared Scanning: Prepare a certified report that identifies terminations checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.

2. Test results that comply with requirements.

3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

E. Cleaning:

1. Clean the area around and on top of the equipment.

END OF SECTION 260519

260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:

1. Underground distribution grounding.

2. Common ground bonding with lightning protection system.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Retain paragraph and subparagraphs below to require that Contractor provide drawings to locate significant grounding features. Division 01 Sections "Project Record Documents" and "Operation and Maintenance Data" require submittals to be included in those documents for use by maintenance forces throughout the life of the Project.

C. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Test wells.

2. Ground rods.

3. Ground rings.

4. Grounding arrangements and connections for separately derived systems.

5. Grounding for sensitive electronic equipment.

D. Qualification Data: For testing agency and testing agency's field supervisor.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at ground rings grounding connections for separately derived systems based on NFPA 70B.
    a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
    b. Include recommended testing intervals.
    c. Records documentation is required for all testing.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience, certified and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

    1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

A. Acceptable Manufacturers: Erico, Copper weld, Cad weld, Bundy

2.2 CONDUCTORS

A. Insulated Conductors: All conductors are to be Copper wire or cable insulated for 600 V,color coded for the entire length. Use of electrical tape for marking is strictly prohibited.

B. Bare Copper Conductors: Only where specifically indicated on Drawings.

    1. Solid Conductors: ASTM B 3.

    2. Stranded Conductors: ASTM B 8.

    3. Tinned Conductors: ASTM B 33.

    4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor and 1/4 inch in diameter.

    5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.

2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.

D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

2.3 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.4 GROUNDING ELECTRODES

D. Ground Rods: Copper-bonded steel; 3/4 inch diameter by 10 feet length; minimum 13 mil plating thickness.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.

2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

3. Install grounding conductor from main service to the grounding bus. The minimum conductor used per Article 250.

E. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.

4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.

C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten

to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.
8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

B. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

F. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.

2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

G. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

1. Use same-manufacturer, matched driving tool to drive ground rods without deformation. “Mushroomed” or otherwise deformed rods will be field-rejected.

2. Replace grounding rods that are deformed at no cost to Owner.

3. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated.

4. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.

1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each indicated item, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.

2. Bury ground ring not less than 24 inches from building foundation.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

B. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal and at individual ground rods. Make tests at ground rods before any conductors are connected.
   a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 1 Ω.

2. Power Distribution Units or Panelboards Serving Electronic Equipment: 0.5 Ω.

3. Substations and Pad-Mounted Equipment: 0.5 Ω.

4. Manhole Grounds: 5 Ω.

D. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.

2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. Retain abbreviations that remain after this Section has been edited.

B. EMT: Electrical metallic tubing.

C. IMC: Intermediate metal conduit.

D. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

3. Trapeze hangers. Include Product Data for components.

4. Steel slotted channel systems. Include Product Data for components.

5. Nonmetallic slotted channel systems. Include Product Data for components.

6. Equipment supports.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Retain this Article to specify default product requirements for basic supporting devices. Items to be supported include raceways, cables, wireways, cable trays, busways, boxes, cabinets, equipment, and other electrical products. Where support materials or workmanship is unique to a particular product, specify unique features that are the exception to these default requirements in the Section that specifies the product. Coordinate specifications for supporting devices with structural engineer and with Drawings.

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. Thomas & Betts Corporation.
   e. Unistrut; Tyco International, Ltd.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA

5. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch diameter holes at a maximum of 8 inches o.c., in at least 1 surface.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. Fabco Plastics Wholesale Limited.

3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.

4. Fitting and Accessory Materials: Same as channels and angles except metal items may be stainless steel.

5. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in

riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.

7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

E. All conduits shall be installed in uniformity, neat and equal space.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.

7. To Light Steel: Sheet metal screws.

8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Requirements of Division 26 "BASIC ELECTRICAL REQUIREMENTS" apply to this Section

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. EPDM: Ethylene-propylene-dieneterpolymer rubber.

D. FMC: Flexible metal conduit.

E. IMC: Intermediate metal conduit.

F. LFMC: Liquidtight flexible metal conduit.

G. LFNC: Liquidtight flexible nonmetallic conduit.

H. NBR: Acrylonitrile-butadiene rubber.

I. RNC: Rigid nonmetallic conduit.

J. RMC: Rigid metal conduit.

1. RGS: Rigid galvanized steel conduit.

2. RAL: Rigid aluminum conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Manufacturer's instructions: indicate application conditions, limitations, and maximum conductor fill.

C. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

Custom enclosures and cabinets.

1. For handholes and boxes for underground wiring, including the following:
   a. Duct entry provisions, including locations and duct sizes.
   b. Frame and cover design.
   c. Grounding details.
   d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
   e. Joint details.

D. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.

2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

E. Qualification Data: For professional engineer and testing agency.

F. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70, UL 5 surface metal electric raceways and fittings Guide RJPR, UL 870 wire way, auxiliary gutters and associated fittings.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Acceptable Manufacturers: Triangle, Republic, Carlen, Centex, Western Tube Appleton, Crouse Hinds, Steel City, OOZY. Gender, Race

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. Rigid Steel Conduit: ANSI C80.1.

C. Rigid Aluminum Conduit: ANSI C80.5.

D. IMC: ANSI C80.6.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

F. EMT: ANSI C80.3.

G. FMC: Full wall, low-carbon steel with electrogalvanized Zinc coating. Reduced wall not acceptable.

H. LFMC: Flexible steel conduit with PVC jacket and UL bonded strip for grounding.

I. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: compression type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anamet Electrical, Inc.; Anaconda Metal
b. Electri-Flex Co.
c. Triangle PCW, Inc

5. Steel set screw fittings for electrical conduit are allowed only for EMT located in conditioned spaces.

J. All exterior raceways shall be rigid galvanized steel, unless specifically indicated otherwise on Drawings.

K. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.

2. Anamet Electrical, Inc.; Anaconda Metal Hose.

3. Arnco Corporation.

4. CANTEX Inc.

5. CertainTeed Corp.; Pipe & Plastics Group.

6. Condux International, Inc.

7. ElecSYS, Inc.

8. Electri-Flex Co.

9. Lamson & Sessions; Carlon Electrical Products.

10. Manhattan/CDT/Cole-Flex.

11. RACO; a Hubbell Company.

12. Thomas & Betts Corporation.

C. ENT: NEMA TC 13.

D. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated on Drawings.

E. LFNC: UL 1660.

F. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.

G. Fittings for LFNC: UL 514B.

H. All underground raceways shall be Schedule 40 PVC, unless otherwise indicated on Drawings.

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arnco Corporation.

2. Endot Industries Inc.

3. IPEX Inc.

4. Lamson & Sessions; Carlon Electrical Products.

C. Description: Comply with UL 2024; flexible type, approved for general-use installation.

2.4 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.

2. Hoffman.

3. Square D; Schneider Electric.

4. Tanco.

5. General Electric.

6. Westinghouse/Cutler Hammer.

C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, 12, 3R, unless otherwise indicated. Provide electrical wire ways of grades and number of channels for each

type of service as indicated. Comply with U.L. 870 "Wire way, Auxiliary Gutters and Associated Fittings." And NEC 366.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

E. Connectors: Provide wireway connectors suitable for "lay-in" conductors, with connector covers permanently attached that removal is not necessary to utilize the lay-in feature. Connectors shall be grounding bushing, raintight and seal the opening to prevent water getting t inside the boxes, junction, and wireway

F. Wireway Covers: Lay-In Wire ways: Construct lay-in wire ways with hinged covers with components UL-listed, including lengths, connectors, and fittings. Select units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Construct units to be capable of sealing cover in closed position with sealing wire. Provide wire ways with knockouts.

G. Finish: Protect sheet metal parts with rust inhibiting coating and baked enamel finish. Plate finish hardware to prevent corrosion. Protect screws installed toward inside of wireway with spring nuts to prevent wire insulation damage. Use paint ANSI61- grey color.

H. Rain tight Wireway: Construct rain tight lay-in wire ways with hinged covers with components UL-listed, including lengths, connectors and fittings. Design units to allow fastening hinged cover closed without use of parts other than standard lengths, fittings and connectors. Construct units to be capable of sealing cover in closed position with sealing wire. Provide wireway units with knockouts only in bottom of troughs.

1. Construction: 16-gauge galvanized sheet metal parts for 4" x 4" to 6" x 6" sections, and 14-gauge parts for 8" x 8" and larger sections. Provide knockouts only in bottom of troughs, with suitable adapters to facilitate attaching to other NEMA 3R enclosures. Do not use gasketing that can rip or tear during installation or would compromise rain tight capability of the trough area and damage wire insulation.

2. Finish: Provide 14-gauge and 16-gauge galvanized sheet metal parts with corrosion-resistant phosphate primer and baked enamel finish. Plate hardware to prevent corrosion.

2.5 NONMETALLIC WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hoffman.

2. Lamson & Sessions; Carlon Electrical Products.

C. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.

D. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

E. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.6 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Thomas & Betts Corporation.
   b. Walker Systems, Inc.; Wiremold Company (The).
   c. Wiremold Company (The); Electrical Sales Division.

3. Multi outlet assemblies shall be used to provide power and/or low potential services as shown on the building plans.

4. The Electrical Contractor shall provide and install all surface metal raceways and appropriate fittings to provide safe and complete installation. The surface metal raceway and fittings shall be the two-piece with receptacles and data outlets (if any) as indicated.

5. When power and data are indicated, the raceway shall afford the capability of being divided into two equal but separate wiring compartments to facilitate installation of power and low potential wiring. "Separate compartments are to be identified by sharply contrasting colors of the interior finish of the divider."

6. A full line of fittings for the surface metal raceway shall be available. This shall include but not limited to elbows (90, internal and external), couplings for joining raceway sections, wire clips for holding conductors or cables in place, blank end fittings for closing open ends of the raceway, transition connectors to other surface metal communications (if any). All openings shall be grommet. Voice/Data connections (if any) shall be provided with interchangeable LAN adapters. When power and data are indicated, device brackets

to install single or two gang devices within the raceway and combination receptacle and telephone outlet covers shall be available.

7. The surface metal raceway and fittings shall meet all requirements of the NEC Article 376 and 380, and shall be listed by Underwriter's Laboratories, Inc. in full compliance with their standard for surface metal raceways and fittings (UL-5).

8. Multi outlet assemblies shall be Wiremold 2000 series with 5-15R simplex receptacles 18" on center.

9. Verify finish color with architect.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Butler Manufacturing Company; Walker Division.
   b. Enduro Systems, Inc.; Composite Products Division.
   c. Hubbell Incorporated; Wiring Device-Kellems Division.
   d. Lamson & Sessions; Carlon Electrical Products.
   e. Panduit Corp.
   f. Walker Systems, Inc.; Wiremold Company (The).
   g. Wiremold Company (The); Electrical Sales Division.

3. Multi outlet assemblies shall be used to provide power and/or low potential services as shown on the building plans.

4. The Electrical Contractor shall provide and install all surface metal raceways and appropriate fittings to provide safe and complete installation. The surface metal raceway and fittings shall be the two-piece with receptacles and data outlets (if any) as indicated.

5. When power and data are indicated, the raceway shall afford the capability of being divided into two equal but separate wiring compartments to facilitate installation of power and low potential wiring. "Separate compartments are to be identified by sharply contrasting colors of the interior finish of the divider."

6. A full line of fittings for the surface metal raceway shall be available. This shall include but not limited to elbows (90, internal and external), couplings for joining raceway sections, wire clips for holding conductors or cables in place, blank end fittings for closing open ends of the raceway, transition connectors to other surface metal communications (if any). All openings shall be grommet. Voice/Data connections (if any) shall be provided with interchangeable LAN adapters. When power and data are indicated, device brackets to install single or two gang devices within the raceway and combination receptacle and telephone outlet covers shall be available.

7. The surface nonmetal raceway and fittings shall meet all requirements of the NEC Article 376 and 380, and shall be listed by Underwriter's Laboratories, Inc. in full compliance with their standard for surface metal raceways and fittings (UL-5).

8. Multi outlet assemblies shall be Wiremold NM2000 series with 5-15R simplex receptacles 18" on center.

9. Verify finish color with architect.

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.

2. EGS/Appleton Electric.

3. Erickson Electrical Equipment Company.

4. Hoffman.

5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.

6. O-Z/Gedney; a unit of General Signal.

7. RACO; a Hubbell Company.

8. Robroy Industries, Inc.; Enclosure Division.

9. Scott Fetzer Co.; Adalet Division.

10. Spring City Electrical Manufacturing Company.

11. Thomas & Betts Corporation.

12. Walker Systems, Inc.; Wiremold Company (The).

13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Metal Floor Boxes: Cast or sheet metal rectangular.

F. Nonmettalic Floor Boxes: Cast or sheet metal rectangular.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

2. Nonmetallic Enclosures: Plastic.

J. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.

3. Key latch to match panelboards.

4. Metal barriers to separate wiring of different systems and voltage.

5. Accessory feet where required for freestanding equipment.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.

2. Color of Fram and Cover: Green.

3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

5. Cover Legend: Molded lettering, "ELECTRIC." as indicated for each service.

6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. CDR Systems Corporation.
   d. NewBasis.

C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. Christy Concrete Products.
   d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

2.9 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.10 SLEEVE SEALS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.

2. Calpico, Inc.

3. Metraflex Co.

4. Pipeline Seal and Insulator, Inc.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

2. Pressure Plates: Plastic. Include two for each sealing element.

3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.11 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.

2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated in Drawings:

1. Roof-Top Conduit penetrating through roof: RAL.

2. Aboveground, otherwise: RGS.

3. Underground:
   a. Primary conduits to utility pad-mounted transformer: per Utility Standards.
   b. RNC, Type EPC-40-PVC, direct buried

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC limited to ≤ 72”.

5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

6. Application of Handholes and Boxes for Underground Wiring:
   a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
   b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Non-Deliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
   c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin structurally tested according to SCTE 77 with 3000-lbf vertical loading.

B. Comply with the following indoor applications, unless otherwise indicated in Drawings:

1. Exposed, Not Subject to Physical Damage: IMC.

2. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
   a. Mechanical rooms.
   b. Central Plants

3. Concealed in Ceilings and Interior Walls and Partitions:
   a. Trade size ≤ 1-inch: EMT or IMC.
   b. Trade size > 1-inch: IMC or RGS.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment):
   a. At dry locations ≥ 84” above finished floor to bottom of equipment: FMC
   b. Otherwise: LFMC.

5. Damp or Wet Locations: RGS, RAL, or IMC.

6. Raceways for Communications: EMT or IMC.

7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, galvanized steel in damp or wet locations, unless otherwise noted on Drawings.

C. Minimum Raceway Size:

1. Power and Fire Alarm:
   a. Above grade: 3/4-inch trade size.
   b. Below grade: 1-inch trade size.

2. Communication:
   a. Above grade: 1-inch trade size.
   b. Below grade: 1-1/2-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Do not install aluminum conduits in contact with concrete.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions, NEC 366, NEC 380, and NEC 376. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Use flat-head screws, clips, and straps to fasten raceway base to surfaces. Mount plumb and level.

C. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

D. Wireway and Auxiliary Gutter Supports: Provide steel channel as specified in Section 260529.

E. Close ends of wireway and unused conduit openings.

F. Ground and bond raceway and wireway under provisions of Section 260526.

G. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

H. Complete raceway installation before starting conductor installation.

I. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

J. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

K. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

L. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

M. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.

2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

O. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

Q. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.

2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.

3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

R. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where otherwise required by NFPA 70.

S. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
   c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
   d. Attics: 135 deg F temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.

3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

T. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures of 3/4 inch size minimum, equipment subject to vibration, noise transmission, or movement; and for transformers and motors are limited to no more than 4 feet in length.

1. Use LFMC in damp or wet locations subject to severe physical damage.

2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

U. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall.

V. Set metal floor boxes level and flush with finished floor surface.

W. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

X. Label and marked all junction boxes, pull boxes, cabinets and conduits leaving and entering any of the boxes, cabinets, and panelboards.

Y. Boxes, junction, pull, cabinets, panelboards and other cabinets shall be rigidly supported with cross bars, Unistrut, all-thread, and any approved that will prevent from moving.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.

2. For Service entrance conduit shall be buried not less 48 inches depth from the top of the conduit to finish grade. For feeder conduit shall be buried not less 36 inches depth from the top of the conduit to finish grade. For branch conduit shall be buried not less 24 inches depth from the top of the conduit to finish grade unless subject to vehicle traffic. The conduits are to be level to the ground.

3. Install backfill as specified in Division 31 Section "Earth Moving."

4. After installing conduit, the conduit shall be supported anchor to the ground with a 3/4inch EMT crossways on every 4 feet intervals then backfill and compact with sand fill. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After

placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with 95% compaction.

5. Install manufactured sweep 90-degree RMC duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.

6. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches of concrete.
   b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
   c. Wrap elbow and first 12” of vertical conduit with Scotch #51 tape (no substitutions), 20-mil thick, 4” wide tape applied two full laps at each start and end of wrap, and 1” overlap for intermediate laps.
   d. Use special-radius elbow, minimum 24” radius unless otherwise indicated on Drawings.

7. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing those 24 inches o.c. align planks along the width and along the centerline of conduit.

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.

2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.8 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Conduit, ducts, and duct accessories for concrete-encased duct banks.
2. Hand-holes and boxes.
3. Manholes.

1.3 DEFINITION

A. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Duct-bank materials, including separators and miscellaneous components.
2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Accessories for manholes, hand-holes, boxes.
4. Warning tape.
5. Warning planks.

B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:

1. Duct entry provisions, including locations and duct sizes.
2. Reinforcement details.

3. Frame and cover design and manhole frame support rings.

4. Ladder details.

5. Grounding details.

6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.

7. Joint details.

C. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

1. Duct entry provisions, including locations and duct sizes.

2. Cover design.

3. Grounding details.

4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

D. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.

1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.

2. Drawings shall be signed and sealed by a qualified professional engineer.

E. Product Certificates: For concrete and steel used in pre-cast concrete manholes and handholes, as required by ASTM C 858.

F. Qualification Data: For professional engineer and testing agency.

G. Source quality-control test reports.

H. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store pre-cast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support pre-cast concrete units only at designated lifting or supporting points.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than two (2) weeks in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Owner's written permission.

1.8 COORDINATION

A. Coordinate layout and installation of ducts, manholes, hand-holes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, hand-holes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and hand-holes, and as approved by Architect.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Furnish cable-support stanchions, arms, and insulators, and associated fasteners in quantities equal to 10 percent of quantity of each item installed.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Refer to Section 26 05 33.

B. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

C. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ARNCO Corp.
2. Beck Manufacturing.
3. Cantex, Inc.
4. CertainTeed Corp.; Pipe & Plastics Group.
5. Condux International, Inc.
6. ElecSys, Inc.
7. Electri-Flex Company.
8. IPEX Inc.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT; a division of Cable Design Technologies.
11. Spiraduct/AFC Cable Systems, Inc.

B. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used for supporting ducts during concreting or backfilling.
   a. Carlon “Snap-N-Stac” combination spacers, interlocking type with 3” separation and reducers as required.
2. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."

3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.
   a. Color: Red dye added to concrete during batching.
   b. Mark each plank with "ELECTRIC" in 2-inch- high, 3/8-inch- deep letters.

C. Concrete Encasement:

1. Encased in minimum 3” of 5000 PSI conc

2.3 PRECAST CONCRETE HANDHOLES AND BOXES

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Carder Concrete Products.
2. Christy Concrete Products.
3. Elmhurst-Chicago Stone Co.
4. Oldcastle Precast Group.
5. Riverton Concrete Products; a division of Cretex Companies, Inc.
6. Utility Concrete Products, LLC.
7. Utility Vault Co.
8. Wausau Tile, Inc.

B. Comply with ASTM C 858 for design and manufacturing processes.

C. Structural Rating: AASHTO HB 17, H-20.

D. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of hand-hole or box.

1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
2. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
3. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
   a. Cover Hinges: Concealed, with hold-open ratchet assembly.
   b. Cover Handle: Recessed.

4. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.
   a. Cover Hinges: Concealed, with hold-open ratchet assembly.
   b. Cover Handle: Recessed.

5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

6. Cover Legend: Molded lettering.

7. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.

8. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
   a. Extension shall provide increased depth of 12 inches.
   b. Slab: Same dimensions as bottom of enclosure and arranged to provide closure.

9. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
   a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
   b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
   c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

10. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
    a. Type and size shall match fittings to duct or conduit to be terminated.
    b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.

11. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.4 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Description: Comply with SCTE 77.

1. Color: Gray.

2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.

3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

5. Cover Legend: Molded lettering, as indicated for each service.

6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.

7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

8. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. CDR Systems Corporation.
   d. NewBasis.

C. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. Christy Concrete Products.
   d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
   a. Carson Industries LLC.
   b. Christy Concrete Products.
   c. Nordic Fiberglass, Inc.

2.5 PRECAST MANHOLES

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Carder Concrete Products.

2. Christy Concrete Products.

3. Elmhurst-Chicago Stone Co.

4. Oldcastle Precast Group.

5. Riverton Concrete Products; a division of Cretex Companies, Inc.

6. Utility Concrete Products, LLC.

7. Utility Vault Co.

8. Wausau Tile, Inc.

B. Structural Rating: AASHTO HB 17, H-20.

C. Comply with ASTM C 858 and with interlocking mating sections, complete with accessories, hardware, and features.

1. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
   a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.

b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

2. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
a. Type and size shall match fittings to duct or conduit to be terminated.
b. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.

D. Concrete Knockout Panels: 1-1/2 to 2 inches thick, for future conduit entrance and sleeve for ground rod.

E. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.6 CAST-IN-PLACE MANHOLES

A. Description: Underground utility structures, constructed in place, complete with accessories, hardware, and features. Include concrete knockout panels for conduit entrance and sleeve for ground rod.

B. Materials: Comply with ASTM C 858 and with Division 03 Section "Cast-in-Place Concrete."

C. Structural Design Loading: As specified in Part 3 "Underground Enclosure Application" Article.

2.7 UTILITY STRUCTURE ACCESSORIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bilco Company (The).

2. Campbell Foundry Company.

3. Carder Concrete Products.

4. Christy Concrete Products.

5. East Jordan Iron Works, Inc.

6. Elmhurst-Chicago Stone Co.

7. McKinley Iron Works, Inc.
8. Neenah Foundry Company.
9. NewBasis.
10. Oldcastle Precast Group.
11. Osburn Associates, Inc.
12. Pennsylvania Insert Corporation.
13. Riverton Concrete Products; a division of Cretex Companies, Inc..
14. Strongwell Corporation; Lenoir City Division.
15. Underground Devices, Inc.
16. Utility Concrete Products, LLC.
17. Utility Vault Co.
18. Wausau Tile, Inc.

C. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.

1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, 29 inches.
   a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.

2. Cover Legend: Cast in. Selected to suit system.
   a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
   b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.
   c. Legend: "COMMUNICATION" for communications, data, and telephone duct systems.

3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
   a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. where packaged mix complying with ASTM C 387, Type M, may be used.

D. Manhole Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.

E. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch diameter eye, and 1-by 4-inch bolt.

1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

F. Pulling Eyes in Non-concrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch diameter eye, rated 2500-lbf minimum tension.

G. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.

1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

H. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.

1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

I. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

J. Cable Rack Assembly: Steel, hot-dip galvanized, except insulators.

1. Stanchions: T-section or channel; 2-1/4-inch nominal size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.

2. Arms: 1-1/2 inches wide, lengths ranging from 3 inches with 450-lb minimum capacity to 18 inches with 250-lb minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.

3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

K. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.

1. Stanchions: Nominal 36 inches high by 4 inches wide, with minimum of 9 holes for arm attachment.

2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches with 450-lb minimum capacity to 20 inches with 250-lb minimum capacity. Top of arm shall be nominally 4 inches wide, and arm shall have slots along full length for cable ties.

L. Duct-Sealing Compound: Non-hardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding

temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

M. Fixed Manholes Ladders: Arranged for attachment to wall of manhole. Ladder and mounting brackets and braces shall be fabricated from hot-dip galvanized steel.

N. Cover Hooks: Heavy duty, designed for lifts 60 lbf and greater. Two required.

2.8 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Non-concrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.

2. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Cables Over 600 V: RNC, NEMA Type EPC-80-PVC, in concrete-encased duct bank, unless otherwise indicated. This includes Electric Utility Primary Duct Banks.

B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-80 -PVC, in concrete-encased duct bank, unless otherwise indicated.

C. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-80-PVC, installed in concrete-encased duct bank, unless otherwise indicated.

D. Wrap all RGS with 2 layers of Scotch wrap which will come in contact with concrete.

3.2 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less:

1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.

2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Non-deliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.

3. Units in Sidewalk and Similar Applications with a Safety Factor for Non-deliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.

4. Units Subject to Light-Duty Pedestrian Traffic only: Fiberglass-reinforced polyester resin structurally tested according to SCTE 77 with 3000-lbf vertical loading.

B. Manholes: Precast or cast-in-place concrete.

1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.

2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

3.3 EARTHWORK

A. Excavation and Backfill: Comply with Division 31 Section "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary top soiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32 Sections "Turf and Grasses" and "Plants."

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting and Patching."

3.4 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated and 25ft horizontally for above 600v cables.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.

2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.

3. Grout end bells into structure walls from both sides to provide watertight entrances.

E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit and RMC sweep 90 degree elbow at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26 Section "Common Work Results for Electrical."

F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

G. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.

H. Concrete-Encased Ducts: Support ducts on duct separators.

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not more than 6 feet apart. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
   a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations or use other specific measures to prevent expansion-contraction damage.
   b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.

3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.

6. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches (between power and signal ducts.

7. Depth: Install top of duct bank at least 36 inches below finished grade in areas not subject to deliberate traffic, and at least 48 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.

8. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.

9. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
   a. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches of concrete.
   b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.

10. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

l. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.

2. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.

3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earth Moving" for pipes less than 6 inches in nominal diameter.

4. Install backfill as specified in Division 31 Section "Earth Moving."

5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and

contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."

6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.

7. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.

8. Set elevation of bottom of duct bank below the frost line.

9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.

10. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

11. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

J. Inspection: Prior to or during inspection by Authority Having Jurisdiction for approval and prior to beginning concrete pour, Engineer shall inspect underground duct installation for Engineer approval.

3.5 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891, unless otherwise indicated.

2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.

3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.

2. Manhole Frame: In paved areas and traffic ways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.

3. Handhole Covers: In paved areas and traffic ways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.

4. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

D. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Install chimney, constructed of precast concrete collars and rings to support frame and cover and to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.

E. Waterproofing: Apply waterproofing to exterior surfaces of manholes after concrete has cured at least three days. Waterproofing materials and installation are specified in Division 07 Section "Elastomeric Sheet Waterproofing." After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

F. Damp proofing: Apply damp proofing to exterior surfaces of manholes after concrete has cured at least three days. Damp proofing materials and installation are specified in Division 07 Section "Bituminous Damp proofing." After ducts have been connected and grouted, and before backfilling, damp proof joints and connections and touch up abrasions and scars. Damp proof exterior of manhole chimneys after mortar has cured at least three days.

G. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

H. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

I. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.

3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and traffic ways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

E. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

F. For enclosures installed in asphalt paving and subject to occasional, non-deliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.

1. Concrete: 3000 psi, 28-day strength, complying with Division 03 Section "Cast-in-Place Concrete," with a troweled finish.

2. Dimensions: 10 inches wide by 12 inches deep.

3.7 GROUNDING

A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.

3. Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.9 TRENCHES:

A. Trenches shall be in as straight and direct a line as possible. Routes through unstable soil such as mud, shifting soils, or other hazards should be avoided. Underground conduit systems shall not be installed within 5 feet of any building foundation, swimming pool, etc., except for where service conduit merges to intercept the service equipment.

3.10 PVC INSTALLATION:

A. The ends of the conduit shall be plugged during construction to prevent the entrance of foreign matter.

B. All ends, joints and internal finish of the conduit shall be free of sharp edges or burrs which could damage the cable.

C. All buried joints shall be glued with cement as recommended by the conduit manufactures.

D. Any change in direction between lengths of straight rigid conduit greater than 5 degrees shall be made in electrical sweeps, or with a very gradual sweeping change of direction. Any single run of conduit will contain no more than two 90 degree sweeps. If the secondary runs of conduit are less than 150 feet in length then schedule 80, PVC sweeps are acceptable. For runs of conductor sized 500MCM and larger that exceed 150 feet in length, all sweeps shall be steel. For runs of conductor smaller than 500MCM size and that exceed 200 feet in length, all 90º sweeps shall be steel.

3.11 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 260543

260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels.
8. Miscellaneous identification products.
9. Identification of Boxes, Junction Boxes and Pull Boxes
10. Identification of Switchboards, Motor Control Center, Panelboard, transformers, disconnecting means, Timer and etc.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions riveted to the metal surface, and graphic features of identification products.

C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.

2. Legend: Indicate voltage and system or service type.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.

2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- high letters on 20-inch centers.

D. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

G. Tape and Stencil for Raceways Carrying Circuits More Than 600 V: 4-inch-wide black stripes on 10-inch centers diagonally over orange background that extends full length of raceway or duct and is 12 inches wide. Stop stripes at legends.

H. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

I. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:

1. Black letters on an orange field.

2. Legend: Indicate voltage and system or service type.

C. Colors for Raceways Carrying Circuits at More Than 600 V:

1. Black letters on an orange field.

2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- high letters on 20-inch centers.

D. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

A. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

D. Write-On Tags: Polyester tag, 0.010-inch-thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

E. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

A. Snap-Around, Color-Coding Bands: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pre-tensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

F. Write-On Tags: Polyester tag, 0.010-inch-thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

A. All conductors shall have the color of insulation for the entire length. Do not use electrical tape to identify the colors. This applies in all sizes.

2.5 FLOOR MARKING TAPE

A. 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.6 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.

2. Printing on tape shall be permanent and shall not be damaged by burial operations.

3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

A. Color and Printing:

4. Comply with ANSI Z535.1 through ANSI Z535.5.

5. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.

6. Inscriptions for Orange-Colored Tapes: TELEPHONE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.7 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.

2. 1/4-inch grommets in corners for mounting.

3. Nominal size, 7 by 10 inches.

D. Warning label and sign shall include, but are not limited to, the following legends:

E. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.8 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. No adhesive is strictly prohibited.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label. No adhesive is strictly prohibited.

C. Punch or drilled riveted Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch. No adhesive is strictly prohibited.

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch. No adhesive is strictly prohibited.

E. Stenciled Legend: In non-fading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

F. Only use drilled/punched riveted label on equipment.

2.9 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one-piece, self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:

1. Outdoors: UV-stabilized nylon.

2. In Spaces Handling Environmental Air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

J. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Identification of Electrical Systems

1. Identify all equipment and circuit breakers.

2. Identify all J-box covers with circuit numbers.

3. On all device wall plates, on inside of plate, indicate panel and circuit number feeding the device.

4. All electrical panels shall have type written panel schedule with room descriptions using actual room signage numbers.

5. Electrical systems shall be identified by painted junction boxes and covers with the following scheme:
   a. Lighting system: Yellow
   b. Emergency Power: Red
   c. 120V Power: Blue
   d. HVAC system power: Green

6. Electrical panel identification shall include the following:
   a. Panel Name
   b. Voltage
   c. Amperage
   d. General description such as: Lighting Area A or Power Area C. Refer to Drawings.
   e. Appropriately colored for emergency.
   f. Feeder panel designation must be clearly identified.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label. Install labels at 10-foot maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.

2. Power.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and hand-holes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
   a. New Conductors: Insulation shall be fully and continuously colored. Phase taping is not acceptable.
   b. Existing Conductors Re-terminated: Use Scotch #35 Vinyl Electrical Color-Coding Tape. No substitutions. Material to be 7-mil polyvinyl chloride (PVC), 3/4"-wide tape with UL-510 rating to 600 VAC. Field apply two full laps without offset at each start and finish, and with 3/8”-over-lap for all intermediate laps using 5 lb/in tension. Start tape no further than 1-1/4” from termination and provide minimum cover length of:
      1) #2 AWG and smaller conductors: 6 inches.
      2) #1/0 AWG and larger conductors: 8 inches.
   c. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral: White
5) Ground: Green

d. Colors for 480/277-V Circuits:
1) Phase A: Brown.
2) Phase B: Purple
3) Phase C: Yellow.
4) Neutral: Gray/White
5) Ground: Green

E. Install instructional sign including the color code for grounded and ungrounded conductors using adhesive-film-type labels.

F. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

H. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Limit use of underground-line warning tape to direct-buried cables.

2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

I. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.

2. Identify system voltage with black letters on an orange background.

3. Apply to exterior of door, cover, or other access.

4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
   a. Power transfer switches.
   b. Controls with external control power connections.

K. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

L. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

M. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
   a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled: Use punched, drilled riveted label or identifications
   a. Panelboards: Typewritten hard thick card stock paper directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Switchboards.
   e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   f. Substations.
   g. Emergency system boxes and enclosures.
   h. Motor-control centers.
   i. Enclosed switches.
   j. Enclosed circuit breakers.

k. Enclosed controllers.
l. Variable-speed controllers.
m. Push-button stations.
n. Power transfer equipment.
o. Contactors.
p. Remote-controlled switches, dimmer modules, and control devices.
q. Battery-inverter units.
r. Battery racks.
s. Power-generating units.
t. Monitoring and control equipment.

END OF SECTION 260533

260573 - OVERCURRENT PROTECTIVE DEVICE COORDINATION AND ARC FLASH STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes computer-based, fault-current, overcurrent protective device coordination selective studies, and arc flash study. Protective devices shall be set based on results of the protective device coordination selective study.

1. Coordination of series-rated devices is permitted where indicated on Drawings.

2. Retain a qualified professional/engineering firm to assist in the development and implementation of the arc flash and protection coordination selective study.

1.3 SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.

C. Qualification Data: For coordination-selective study specialist.

D. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed. Submittals may be in digital form.

1. Coordination- selective study input data, including completed computer program input data sheets.

2. Study and Equipment Evaluation Reports.

3. Coordination- Selective Study Report.

4. Electrical One-line diagram

1.4 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination- Selective Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision, Fort Bend County representative.

C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

D. Comply with IEEE 399 for general study procedures.

E. The entity shall have an employee that is certified, train and skilled to perform this type of test and be able to interpret the curve and settings.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Available Computer Software Developers: Subject to compliance with requirements, companies offering computer software programs that may be used in the Work include, but are not limited to, the following:

B. Computer Software Developers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. CGI CYME.

2. EDSA Micro Corporation.

3. ESA Inc.

4. Operation Technology, Inc.

5. SKM Systems Analysis, Inc.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399.

B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination selective study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

1. Product Data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.

2. Impedance of utility service entrance.

3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
   a. Circuit-breaker and fuse-current ratings and types.
   b. Relays and associated power and current transformer ratings and ratios.
   c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
   d. Generator kilovolt amperes, size, voltage, and source impedance.
   e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
   f. Busway ampacity and impedance.
   g. Motor horsepower and code letter designation according to NEMA MG 1.

4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

a. Special load considerations, including starting inrush currents and frequent starting and stopping.
b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
d. Generator thermal-damage curve.
e. Ratings, types, and settings of utility company's overcurrent protective devices.
f. Special overcurrent protective device settings or types stipulated by utility company.
g. Time-current-characteristic curves of devices indicated to be coordinated.
h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.

3.3 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:

1. Switchgear and switchboard bus.
2. Medium-voltage controller.
3. Motor-control center.
4. Distribution panelboard.
5. Branch circuit panelboard.

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 141, IEEE 241 and IEEE 242.

1. Transformers:
   a. ANSI C57.12.10.

b. ANSI C57.12.22.
c. ANSI C57.12.40.
d. IEEE C57.12.00.
e. IEEE C57.96.

2. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.

3. Low-Voltage Fuses: IEEE C37.46.

E. Study Report:

1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.

2. Show interrupting (5-cycle) and time-delayed currents (6 cycles and above) on medium and high voltage breakers as needed to set relays and assess the sensitivity of overcurrent relays.

F. Equipment Evaluation Report:

1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.

3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.4 COORDINATION SELECTIVE STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.

2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.

3. Calculate the maximum and minimum ground-fault currents.

B. Comply with IEEE 141 recommendations for fault currents and time intervals.

C. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

D. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

E. Coordination-Selective Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
a. Device tag.
b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
d. Fuse-current rating and type.
e. Ground-fault relay-pickup and time-delay settings.

2. Coordination Curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
a. Device tag.
b. Voltage and current ratio for curves.
c. Three-phase and single-phase damage points for each transformer.
d. No damage, melting, and clearing curves for fuses.
e. Cable damage curves.
f. Transformer inrush points.
g. Maximum fault-current cutoff point.

F. Completed data sheets for setting of overcurrent protective devices.

3.5 ARC FLASH STUDY

A. A detailed arc flash study shall be performed to determine potential arc flash incident energies, arc flash boundaries, shock hazard boundaries and proper personal protective equipment (PPE) for all energized electrical system equipment tasks for the electrical systems studied. The calculations shall comply with NFPA-70E 2009, and IEEE-1584. Bolted short circuit calculations

used in the above standards shall comply with ANSI C37.010, C37.13, C37.5, IEEE-141, and IEEE-399. The purpose of this study is to determine arc flash hazards in conformance with NFPA-70E and to provide a comprehensive software model of the electrical distribution system, which provides integral work permits and arc flash calculations in compliance with NFPA 70E Articles 130.1 and 130.3 for all equipment in the facility. The software program used in this study shall comply with the above standards. No substitutions in calculation methods will be allowed.

B. The arc flash study shall determine the following results for each system mode of operation developed in Section 1.3E (Modeling). The results shall be provided in spreadsheet format for each mode and electrical system location to provide easy viewing and comparison. Worst-case arc flash energy levels shall be flagged and the spreadsheet comparison table shall be capable of providing its output directly to high quality vinyl label printers. The calculations shall, as a minimum, include a comparison of both 100% and 85% arcing currents for low voltage equipment for each electrical system configuration or operating mode, indicating worst-case arc flash hazards. The spreadsheet results shall include:

1. Equipment name and voltage
2. Upstream equipment device name and ANSI function, i.e. 51/50, etc.
3. Equipment type, i.e. switchgear, MCC, Panel, VFD, etc.
4. Equipment arc gap
5. Bolted and estimated arcing fault current at the fault point (equipment) in symmetrical amperes. The estimated arcing current should be based on the arcing current equations used.
6. Trip time, opening time, and total clearing time (total Arc time) of the protective device
7. Worst-case arc flash boundary for each bus/equipment in the model
8. Worst-case arc flash hazard incident energy in cal/cm^2 for each bus/equipment in the model
9. Worst-case personal protective equipment (PPE) for each bus/equipment in the model
10. Working distances for up to five different distances showing items 7, 8, and 9 for each distance
11. Indicate “Danger/Hazardous” areas where incident energy is greater than 40 cal/cm2 and provide recommendations to reduced arc flash energy levels for these areas
12. Flag results where 85% arcing current provided worst-case results
13. Each mode of operation shall include a detailed write-up indicating areas where incident energy calculations and PPE requirements are higher than calculated in the normal operating mode.

C. Contractor shall provide a detailed arc flash analysis report including as a minimum:

1. Introduction

2. Methodology

3. Information Sources

4. Assumptions including generic substitutions when data cannot be field verified. This type of assumptions shall be documented in the report.

5. Arc Flash Energy and other consideration for various System Modes of Operation (maintenance mode, bus-tie, co-gen on/off, etc.)

6. Arc Energy at 100% and reduced currents

7. IEEE 1584-2002 Considerations.

8. Overcurrent Protective Device Changes, Replacements or Setting Changes implemented in study to reduce arc flash hazard exposure.

9. Explanation of Data in Arc Flash Hazard Report Tables

10. NFPA 70E Information
    a. Shock Hazards with covers removed.
    b. Shock Hazard Approach Boundaries.
        1) Limited Approach Boundary
        2) Restricted Approach Boundary
        3) Prohibited Approach Boundary
    c. Arc Flash Hazard Boundaries

11. Results of Arc Flash Hazard Analysis for high voltage, medium voltage and low voltage systems, including:
    a. Working distances.
    b. Energy Levels
    c. PPE Requirements
    d. Recommendations to reduce arc flash hazard energy and exposure.

12. Arc Flash Hazard Report

13. 3 Hard Copies
    a. 1 Electronic Copy in WORD or Excel format and PDF (5.0 or later)
    b. 1 Electronic copy in latest version of SKM format or its native software

14. Electronic file for Power System Modeling Software as developed and utilized for this analysis.

D. Contractor shall provide print labels for all equipment in the system from the project study file. Assume two (2) labels per equipment/bus in your estimate using 4" x 6" labels. The labels shall

be UV resistant vinyl labels (white with orange warning strip and black letters) conforming to ANSI-Z 535. The labels shall be printable directly from the power system software utilized for the study.

E. The software shall provide complete integration of the one-line, database, short circuit and PDC and Arc flash functions. Software using separate short circuit, PDC, TCC or arc flash programs is not allowed. Spreadsheet calculations are not allowed. The purpose of this section is to ensure that the arc flash hazard calculations comply with NFPA-70E and IEEE-1584, and that the calculations are programmed with necessary requirements to help eliminate possible errors in the arc flash calculations. The additional purpose is to establish a detailed software model of the compliance with the OSHA requirements and NFPA 70E mandates. This model will serve as an integral part of Fort Bend County safety program by providing integral work permits and arc flash calculations in compliance with NFPA-70E Article 130.1(A)(2) for each electrical equipment in the facility.

1. Arc flash calculations shall be performed with enhanced IEEE-1584 equations, which eliminate voltage discontinuities and the non-conservative/average results of the standard equations. The purpose of this requirement is to ensure that the calculated incident energies are closer to actual test results insuring a conservative calculation minimizing personnel risk.

2. Arc flash calculations shall be based on the fastest clearing upstream protective device protecting the equipment for single sources and the slowest upstream protective device for multiple sources. The calculations shall automatically compare all series and parallel upstream protective devices in the system to determine the fastest series device or a conservative parallel clearing time.

3. The arc flash calculations shall include arc flash boundary, incident energy, PPE requirements, and working distances.

4. The arc flash calculations shall include calculations for all operating modes to ensure the worse arc flash magnitude.

5. The arc flash calculations shall provide integral “Work Tasks” for the listed equipment types. The tasks shall be derived from 70E Table 130.7(C)(9)(a) and be specific to the equipment type. Listed equipment types shall include:
   a. Switchgear, Switchboards, Panelboards, MCC, VFD, UPS, ATS, Interrupting Switch, NEMA E2 Contactor, Conductor, Open Air for 100-200 volt equipment.
   b. Switchgear, Switchboards, Panelboards, MCC, VFD, UPS, ATS, Interrupting Switch, NEMA E2 Contactor, Conductor, Open Air for 200-1000 volt equipment.
   c. Switchgear, MCC, VFD, UPS, ATS, Interrupting Switch, NEMA E2 Contactor, Conductor, Open Air for 1.0-5.0 kV equipment.
   d. Switchgear, MCC, VFD, ATS, Interrupting Switch, NEMA E2 Contactor, Conductor, Open Air for 5.0-15.0 kV equipment.
   e. Interrupting Switch, Conductor, and Open Air for 138 kV equipment.

6. Work Tasks shall have a user-defined library that provides the following customizable features for each work task:

a. Work Tasks for each specific equipment type and voltage range
b. Working distance units English or Metric
c. Work distance for each task
d. V-rated gloves and tool requirements
e. Job description and procedures
f. Safe work practices description
g. Hazard Risk Category (HRC) reduction - HRC reduction can only be used based on a documented risk assessment as an integral part of a safety program.

END OF SECTION 260573

260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following lighting control devices:

1. Time switches.
2. Photoelectric switches.
3. Indoor occupancy sensors.
4. Lighting contactors.
5. Emergency shunt relays.

B. Related Sections include the following:

1. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.
2. Provide Settings requirements available from the Owner standpoint.
3. Provide the software that will support the lighting controllers.

4. Software must have the ability to detect outages or no power to a branch circuit and graphic indicators.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Intermatic, Inc.

2. Leviton Mfg. Company Inc.

3. Lightolier Controls; a Genlyte Company.

4. Lithonia Lighting; Acuity Lighting Group, Inc.

5. Watt Stopper (The).

B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

C. Electromechanical-Dial Time Switches: Type complying with UL 917.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Intermatic, Inc.
2. Lithonia Lighting; Acuity Lighting Group, Inc.
3. Novitas, Inc.
4. TORK.
5. Watt Stopper (The).

2.3 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Lighting.
2. Leviton Mfg. Company Inc.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Watt Stopper (The).

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.

7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.

C. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.

2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

2.4 OUTDOOR MOTION SENSORS (PIR)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

1. Bryant Electric; a Hubbell Company.

2. Hubbell Lighting.

3. Lithonia Lighting; Acuity Lighting Group, Inc.

4. Watt Stopper (The).

C. Performance Requirements: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as rain-tight according to UL 773A.

1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

2. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.
   b. Relay: Internally mounted in a standard weatherproof electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

3. Bypass Switch: Override the on function in case of sensor failure.

4. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc; keep lighting off during daylight hours.

D. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.

E. Lighting Fixture Mounted Sensor: Suitable for switching 300 W of tungsten load at 120- or 277-V ac.

F. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.

1. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.

2. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

2.5 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D

2. ASCO Power Technologies, LP; a division of Emerson Electric Co.

3. Eaton Electrical Inc.; Cutler-Hammer Products.

4. GE.

5. TORK.

B. Description: Electrically operated and mechanically held, combination type with non-fusible switch complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).

2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.

3. Enclosure: Comply with NEMA 250.

4. Provide with control and pilot devices matching the NEMA type specified for the enclosure.

C. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.

1. Monitoring: On-off status.

2. Control: On-off operation.

2.6 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multi-conductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

E. All conductors shall be installed in an enclosed by a metal raceway.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.

2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.

2. Operational Test: Verify operation of each lighting control device and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section "Network Lighting Controls."

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 260923

261100 - FIRE STOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Requirements of Division 26 "COMMON WORK RESULTS FOR ELECTRICAL" apply to this Section.

1.2 SECTION INCLUDES

A. Fireproof fire stopping materials.

1.3 SUBMITTALS: SUBMIT THE FOLLOWING IN ACCORDANCE WITH SECTION 260500.

A. Fireproof fire stopping materials.

B. Provide U.L. category and file numbers of products.

1.4 QUALITY ASSURANCE: COMPLY WITH THE FOLLOWING.

A. ASTM E814 (UL 1479) - Test Method of Fire Tests of Through-Penetration Fire stops.

B. NEC 300-21 and NEC 800-52(b).

C. Conform to applicable code for fire resistance ratings and surface burning characteristics.

D. Provide certificate of compliance from authority having jurisdiction indicating approval of combustibility.

1.5 SEQUENCING

A. Sequence work to permit fire stopping materials to be installed after adjacent and surrounding work is complete.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Flame-Safe FS500, FST600, FS900, FST900, or FSP1000.

B. Dow Corning 306548 Silicone RTV Foam.

C. 3M Fire Barrier Penetration Sealing Systems.

D. PENSIL 851, General Electric Company.

2.2 PERFORMANCE REQUIREMENTS

A. The requirements of this section shall be provided in addition to the requirements of Division 7.

B. Maintain required classification, fire, acoustic, and vapor barrier ratings for electrical installations penetrating walls, ceilings, and floors per ASTM E814 (UL 1479), NEC 300-21 and NEC 800-52(b).

1. Penetrations of classified area walls, ceiling and floors shall be sealed with the same material to maintain the integrity of area classification.

2. Penetrations of fire-rated walls, ceilings, and floors shall be sealed with a UL listed Through-Penetrations Fire-Stop System.

3. Penetrations of non-fire-rated walls, ceilings, and floors shall be filled and finished using the same finish material as the wall, ceiling, or floor.

4. Outlet box and lighting fixture installation in fire-rated walls, ceilings, and floors shall be in accordance with the UL Fire Resistance Directory.

C. Fire safety system shall not require de-rating the ampacity of electrical conductors.

D. Where mastic is used to seal the surface of the fire stop, the mastic shall be non-hardening.

E. Fire safety material shall not contract to allow transmission of smoke or water prior to exposure of a fire condition.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that openings are ready to receive the work of this section.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter which may affect bond of fire stopping material.

B. Remove incompatible materials which affect bond.

3.3 APPLICATION

A. Apply primer and materials in accordance with manufacturer's instructions.

B. Apply fire stopping material in sufficient thickness to achieve rating to uniform density and texture.

C. Install material at walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit, and other items requiring fire stopping.

D. Sleeves shall be of suitable length to accommodate fire stopping system used. Where conduit passes through a sleeve, the clearance around the conduit shall not be less than 1/2".

3.4 CLEANING

A. Clean adjacent surfaces of fire stopping materials.

3.5 PROTECTION OF FINISHED WORK

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 261100

262200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Harmonics Mitigating (Canceling) Transformers as indicated on Drawings:
    a. Delta-to-ZigZag 0-degree phase shift secondary.
    b. Wye-to-ZigZag 30-degree phase shift secondary.

1.3 SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Coordination Drawings: Provide coordination drawings as described in 26 05 00 paragraph 1.03(C).

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

D. Qualification Data: For testing agency.

E. Source quality-control test reports.

F. Field quality-control test reports.

G. Operation and Maintenance Data.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

D. Harmonics Canceling Transformers: NEMA ST-1, TP-1, TP-2 and IEEE-519-1992 compliance.

E. Comply with United States Department of Energy (DOE), United States Code (USC) and Code of Federal Regulations (CFR)

1. 42 USC - Energy Conservation Program for Consumer Products Other Than Automobiles

2. 10 CFR 431 – Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart K – Distribution Transformers

3. Appendix A to Subpart K of 10 CFR part 431 - Uniform Test Method for Measuring the Energy Consumption of Distribution Transformers

1.5 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General Purpose Dry-Type: Subject to compliance with requirements, provide products by one of the following:

1. Square D / Schneider Electric

2. Siemens

1. Eaton / Cutler Hammer

B. General Purpose Dry-Type: Subject to compliance with requirements, provide products by one of the following:

1. Powersmiths T1000-30H

2. Power Quality International

3. Mirus

3.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.

2. Coil Material: Copper, unless indicated otherwise in Drawings.

3. Core and coil designs shall be low loss type with minimum efficiencies per NEMA TP1 and 10 CFR §431.196(a)(2) (DOE 2016 requirements) when operated at 35% of full load capacity. Efficiency shall be tested in accordance with NEMA TP2 and 10 CFR §431.193.

D. Enclosures: NEMA 2 or 3R rating as required, unless otherwise indicated on Drawings.

1. Provide hinged doors with infrared scanning window.

2. Provide surge protection device (SPD).

3. Provide compression lug kit for all terminations.

E. Efficiencies:

Single phase		Three Phase	
kVA	Efficiency	kVA	Efficiency
15	97.7%	15	97.89%
25	98.0%	30	98.23%
37.5	98.2%	45	98.40%
50	98.3%	75	98.60%
75	98.5%	112.5	98.74%
100	98.6%	150	98.83%
167	98.7%	225	98.94%
250	98.8%	300	99.02%
333	98.9%	500	99.14%
		750	99.23%
		1000	99.28%

2.3 HARMONIC MITIGATING TRANSFORMERS

A. Single Output (Secondary):

1. DZ0 – Delta Primary, Zig-Zag Secondary, 0° phase shift.

2. YZ30 – Wye Primary (ungrounded neutral), Zig-Zag Secondary, 30° phase shift.

B. Insulation and Varnish systems: 220 deg. C. Class R, Epoxy polyester impregnation, 130°C Temperature Rise in 40°C Ambient.

C. All terminals. Including those for changing taps, must be readily accessible. Windings shall be continuous with terminations brazed or welded. 10KV BIL.

D. Compatible with all types of linear and non-linear current and future loads.

E. Impedance: Between 3.0% and 5.0% at rated KVA.

F. Zero sequence Impedance/reactance less than 0.95% and 0.3% respectively.

G. Zero sequence currents not coupled into primary windings.

H. Voltage Taps: Two (2) 2.5% above and four (4) 2.5% below nominal primary voltage.

I. Provide dual electrostatic shield.

2.4 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Cores: One (1) leg per phase.

C. Enclosure: Ventilated, NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

D. Taps for Transformers Smaller than 3 kVA: None.

E. Taps for Transformers 7.5 to 10 kVA: Two (2) 5 percent taps below rated voltage.

F. Taps for Transformers 15 kVA and Larger: Two (2) 2.5 percent taps above and four (4) 2.5 percent taps below normal full capacity.

G. Insulation Class: Class R (220 deg C), UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

H. Energy Efficiency for Transformers Rated 15 kVA and Larger:

1. Complying with NEMA TP 1, Class 1 efficiency levels.

2. Tested according to NEMA TP 2.

I. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for non-sinusoidal load current-handling capability to the degree defined by designated K-factor.

1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.

2. Indicate value of K-factor on transformer nameplate.

J. Wall Brackets: Manufacturer's standard brackets.

K. Fungus Proofing: Permanent fungicidal treatment for coil and core.

L. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

M. Low-Sound-Level Requirements: Maximum sound levels, when factory tested, shall be in according to IEEE C57.12.91.

2.5 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

2.6 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

C. Testing will also include recording of the voltages on the primary and secondary including the Impedance used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions. Working Clearance shall not be less than 4 feet in front of the front cover. Inform engineer if there is a potential clearance problem prior to rough-in.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer. Install a ground copper bar for all grounding connections. Single lug grounding is not permissible.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

F. Grounding electrode conductor will be installed in conduit and connected with Blackburn clamps. A connection will be made to building steel and a new driven copper ground rod.

3.2 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer. If ceiling mounting is utilized, a letter shall be obtained and approved by a structural engineer.

1. Brace wall-mounting transformers as specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems.

B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions.

C. Install ALL floor mounted transformers as indicated on 6” housekeeping pads 4” inches larger than transformer, complying with manufacturer's written instructions, applicable requirements of NEC, NESC, NEMA, ANSI and IEEE standards, and in accordance with recognized industry practices to ensure that products fulfill requirements. Provide NEC working clearance in front of transformers assuming they will require examination while energized.

D. Coordinate transformer installation work with electrical raceway and wire/cable work, as necessary for proper interface.

E. Install floor mounted units with bolts to equipment pad with neoprene/cork vibration mounts between transformer and pad. Comply with manufacturer's indicated installation method, if any.

F. Connect transformer units to electrical wiring system with flexible metal conduit or liquid tight flexible metal conduit. Comply with the requirements of other Division 16 sections.

G. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL STD 486A. Record torques on all terminations.

H. Back off shipping bolts on internal vibration isolators.

I. Provide complementary 0° and 30° phase-shift in as equal capacities for each bus as possible to maximize harmonic mitigation.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems." Install a ground copper bar to where all connections are made. Do not use single lugs. The GEC conductor shall be installed directly to XO terminal. Use grounding bushing.

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Carefully remove the wire insulation without damaging the copper wire strands and check all connections are to be tight.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

D. Remove and replace units that do not pass tests or inspections and retest as specified above.

E. Infrared (Baseline) Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.

2. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.

3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

F. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

G. Provide equipment grounding connections for power/distribution transformers, sizes per NEC. Tighten connections to comply with tightening torques specified in UL STD 486A to assure permanent and effective grounding.

H. Transformer Testing

1. Certified Test Reports in accordance with TP-1-2002 and TP-2.

2. Open Circuit transformer tests, for calculating percent zero-sequence impedances and reactance as follows:
   a. With the transformer's primary terminals open-circuited, make a low impedance connection between secondary Terminals X1, X2 and X3.
   b. Connect a variable 60HZ power source between Secondary Terminals X1, X2, X3 and X0, which includes precision revenue class voltage and current measurement instrumentation.
   c. Increase 60HZ voltage across Terminals X1, X2, X3 and Terminal X0 until >2/3 full-scale readings are obtained on the voltage and current meters. In no case can the current reading exceed the full load rating of the winding under test. The values may be lower since impedance and reactance are linear.
   d. Calculate impedance in Ohms based on the measured voltage and current values.
   e. Based on the measured voltage, as a percentage of the rated voltage of the windings, calculate percent zero-sequence impedance and reactance.

3. Closed Circuit Transformer Tests, for calculating transformer core and copper losses as follows:
   a. In accordance with e-Rated Transformer Corporation Standard Publications VAD1-2003 and VAD2- 2003.
   b. Measure Primary and Secondary voltage and current differences simultaneously, using ‘revenue class’ instrumentation and calculate excitation or no-load losses and impedances/load losses.
   c. Submit such reports as part of shop drawings submittals for each size typical transformers, based on tests done within a year or less time.
   d. Submit such reports for all the transformers for the project, prior to shipment.

4. Design, manufacturing and testing of these transformers, in compliance with most current NEMA, IEEE and Industry standards and practices.

5. Transformer Loss Calculations based on primary and secondary voltage and current differences measured simultaneously.

3.5 PROTECTION

A. Physically protect transformers against damage. All field-repairs to be performed by and approved by factory-authorized service representative at no added cost to Owner:

1. Touch-up scratches and removed paint with original factory paint.

2. Replace dented plates and panels.

3. Replace scratched, discolored, or otherwise damaged nameplate labels.

3.6 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results. All test reports on transformers shall be compile to one database and this must be submitted to the Owner.

A. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

B. Output Settings Report: Prepare a written report recording output voltage and tap settings.

3.7 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262200

262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.

2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

A. SPD: Surge protective device (suppressor).

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, switching and over-current protective device, surge suppression Protective device (SPD), accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

A. Coordination Drawings: Provide coordination drawings as described in 26 05 00 paragraph 1.03(C).

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.

2. Detail enclosure types and details for types other than NEMA 250, Type 1.

3. Detail bus configuration, current, and voltage ratings.

4. Short-circuit current rating of panelboards and over-current protective devices.

5. Include evidence of NRTL listing for series rating of installed devices.

6. Detail features, characteristics, ratings, and factory settings of individual over-current protective devices and auxiliary components.

7. Include wiring diagrams for power, signal, and control wiring.

8. Include time-current coordination curves for each type and rating of over-current protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of over-current protective device.

9. Fault current rating, brazing and bus rating

C. Qualification Data: For qualified testing agency.

D. Field Quality-Control Reports:

1. Test procedures used.

2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Panelboard Schedules: For installation in panelboards.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting over-current protective devices.

2. Time-current curves, including selectable ranges for each type of over-current protective device that allows adjustments.

1.5 QUALITY ASSURANCE

B. Source Limitations: Obtain panelboards, over-current protective devices, components, and accessories from single source from single manufacturer.

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

A. Handle and prepare panelboards for installation according to NEMA PB 1.

1.7 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.

2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no fewer than two weeks days in advance of proposed interruption of electric service.

2. Comply with NFPA 70E.

1.8 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock. All keys shall be turn-in to Owner.

2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.

3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface-mounted cabinets, as indicated on Drawings:

1. Rated for environmental conditions at installed location.
   a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
   b. Outdoor Locations: NEMA 250, Type 3R.
   c. Wash-Down Areas: NEMA 250, Type 4X stainless steel.
   d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
   e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Non-corrosive Liquids: NEMA 250, Type 5.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

4. Door in door Hinges: For ease of access to branch circuit wiring.

5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.

6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.

7. Finishes:

8. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pre-treating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
   a. Back Boxes: Same finish as panels and trim.

9. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn Copper, 98 percent conductivity.

2. Coating: Electroplated with Tin to a minimum thickness of 30 micron.

3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

5. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

6. Split Bus: Vertical buses divided into individual vertical sections.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Main and Neutral Lugs: Mechanical type.

3. Ground Lugs and Bus-Configured Terminators: Mechanical type.

4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

5. Sub-feed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

6. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

7. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and over-current protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Series-connected ratings are not acceptable.

2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D / Schneider Electric

2. Cutler-Hammer / Eaton

3. General Electric / ABB

4. Siemens

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Over-current Protective Devices for Circuit-Breaker Frame Sizes Larger than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

G. Branch Over-current Protective Devices: Circuit Breaker.

H. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D / Schneider Electric
2. Cutler-Hammer / Eaton
3. General Electric / ABB
4. Siemens

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker.

D. Branch Over-current Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

G. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Series-connected ratings are not acceptable.

2.4 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for over-current protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Equipment Mounting: Install panelboards on concrete bases, 4-inch nominal thickness.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.

2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to panelboards.

5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

E. Mount top of trim 90 inches above finished floor unless otherwise indicated.

F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box. Mount surface panelboards on 1-5/8 x 1-5/8 Unistrut not on wall surface.

G. Install over-current protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

H. Install filler plates in unused spaces.

I. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade. All empty conduits shall be enclosed or sealed.

J. All conduits, junction boxes, pull boxes and entering and leaving shall be marked or label with circuit numbers.

K. Conductors inside the panelboards shall be install neat, order and workmanlike manner. Comply and refer to NEC Article 312.

L. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

A. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

B. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

C. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Perform the following infrared scan tests and inspections and prepare reports:
   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
   c. Instruments and Equipment:
      1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

E. Panelboards will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection report, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

A. Set field-adjustable circuit-breaker trip ranges as indicated.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.

3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

B. Physically protect panelboards against damage. All field-repairs to be performed by and approved by factory-authorized service representative at no added cost to Owner:

1. Touch-up scratches and removed paint with original factory paint.

1. Replace dented plates and panels.

2. Repair or replace damaged or non-functional devices.

3. Replace scratched, discolored, or otherwise damaged nameplate or device identification labels.

3.1 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

B. Clean the outside and inside the switchboards free from dust.

END OF SECTION 262416

262713 - ELECTRICITY METERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes equipment for electricity metering by Owner.

1.3 DEFINITIONS

A. KY Pulse: Term used by the metering industry to describe a method of measuring consumption of electricity that is based on a relay opening and closing in response to the rotation of the disk in the meter.

B. PC: Personal computer.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For electricity-metering equipment.

1. Dimensioned plans and sections or elevation layouts.

2. Wiring Diagrams: For power, signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.

C. Field quality-control reports.

D. Operation and Maintenance Data. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Application and operating software documentation.

2. Software licenses.

3. Software service agreement.

4. Hard copies of manufacturer's operating specifications, design user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy Submittal.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, store, and handle modular meter center according to NECA 400.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than two weeks in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Owner's written permission.

1.8 COORDINATION

A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:

1. Comply with requirements of utilities providing electrical power services.

2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

1.9 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade his computer equipment if necessary.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY OWNER

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D / Schneider Electric
2. E-Mon
3. National Meter Industries
4. General Electric / ABB
5. Eaton

B. General Requirements for Owner's Meters:

1. Comply with UL 1244.
2. Meters used for billing shall have an accuracy of 1.0 percent of reading, complying with requirements in ANSI C12.20.
3. Enclosure: NEMA 250, Type 1 minimum, with hasp for padlocking or sealing.
4. Identification: Comply with requirements in Division 26 Section "Identification for Electrical Systems."
5. Memory Backup: Self-contained to maintain memory throughout power outages of 72 hours, minimum.
6. Sensors: Current-sensing type, with current or voltage output, selected for optimum range and accuracy for meters indicated for this application.
   a. Type: Split and solid core.
7. Current-Transformer Cabinet: Listed or recommended by metering equipment manufacturer for use with sensors indicated.
8. Building Automation System (BAS) Interface: One digital KY pulse to a user-definable increment of energy measurement. Match signal to BAS input and arrange to convey the instantaneous, integrated, demand level measured by meter to provide data for processing and possible programmed demand control action by destination system.

C. Kilowatt-hour Meter: Electronic three-phase meters, measuring electricity used.

1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.

2. Display: LCD with characters not less than 0.25-inch-high, indicating accumulative kilowatt-hours and current kilowatt load. Retain accumulated kilowatt-hour in a nonvolatile memory, until reset.

3. Display: Digital electromechanical counter, indicating accumulative kilowatt-hours.

D. Kilowatt-hour/Demand Meter: Electronic three-phase meters, measuring electricity use and demand. Demand shall be integrated over a 15-minute interval.

1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.

2. Display: LCD with characters not less than 0.25-inch-high, indicating accumulative kilowatt-hours, current time and date, current demand, and historic peak demand, and time and date of historic peak demand. Retain accumulated kilowatt-hour and historic peak demand in a nonvolatile memory, until reset.

E. Data Transmission Cable: Transmit KY pulse data over Class 1 control-circuit conductors in raceway. Comply with Division 26 Section "Control-Voltage Electrical Power Cables."

F. Software: PC-based, a product of meter manufacturer, suitable for calculation of utility cost allocation and billing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

C. Install modular meter center according to NECA 400 switchboard installation requirements.

3.2 IDENTIFICATION

A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Series Combination Warning Label: Self-adhesive type, with text as required by NFPA 70.

2. Equipment Identification Labels: Adhesive film labels with clear protective overlay. For residential meters, provide an additional card holder suitable for typewritten card with occupant's name.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Connect a load of known kilowatt rating, 15 kW minimum, to a circuit supplied by metered feeder.

2. Turn off circuits supplied by metered feeder and secure them in off condition.

3. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.

4. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at test-load connection. Record test results.

C. Electricity metering will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262713

262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Receptacles with integral surge suppression units.
4. Hospital Grade
5. Wall-box motion sensors.
6. Isolated-ground receptacles.
7. Snap switches and wall-box dimmers.
8. Wall-switch and exterior occupancy sensors.
9. Communications outlets.
10. Pendant cord-connector devices.
11. Cord and plug sets.
12. Floor service outlets, poke-through assemblies, service poles, and multi-outlet assemblies.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. SPD: Surge suppressor protective device.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configuration.

1. Cord and Plug Sets: Match equipment requirements.

1.7 EXTRA MATERIALS

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Service/Power Poles: One for every 10, but no less than one.

2. Floor Service Outlet Assemblies: One for every 10 but no less than one.

3. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.

4. TVSS Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Pass & Seymour/Legrand

2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).

3. Leviton Mfg. Company Inc. (Leviton).

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Pass & Seymour/Legrand ; 5381 (single), 5352 (duplex).
   b. Hubbell; HBL5351 (single), CR5352 (duplex).
   c. Leviton; 5891 (single), 5352 (duplex).

B. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Pass & Seymour; 63H
   b. Hubbell; HBL8300SG.
   c. Leviton; 8300-SGG.

2. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Pass & Seymour/Legrand; 2084.

2.4 TWIST-LOCKING RECEPTACLES

A. Single Receptacles: Comply with NEMA WD 1, NEMA WD 6 configuration and ratings as indicated on Drawings, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Pass & Seymour/Legrand
   b. Hubbell
   c. Leviton

2.5 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Pass & Seymour/Legrand; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
   b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
   c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).

C. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Pass & Seymour/Legrand; PS20AC1-L.
   b. Hubbell; HBL1221L.
   c. Leviton; 1221-2L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.6 WALL-BOX DIMMERS

A. Dimmer Switches: By same manufacturer of other devices to match dimming technology of connected light fixtures.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

2.7 OCCUPANCY SENSORS

A. Wall-Switch Sensors:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Pass & Seymour/Legrand
   b. Hubbell
   c. Leviton
   d. Watt Stopper

2. Description: Dual technology Passive-infrared type/Ultrasonic, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.

B. Long-Range Wall-Switch Sensors:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Hubbell; ATD1600WRP.
   b. Leviton; ODW12-MRW.
   c. Watt Stopper (The); DT-200.
   d. Pass & Seymour/Legrand

2. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft.

C. Wide-Range Wall-Switch Sensors:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Hubbell; ATP120HBRP.
   b. Leviton; ODWHB-IRW.
   c. Pass & Seymour; HS1001.
   d. Watt Stopper (The); CX-100-3.

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft.

2.8 COMMUNICATIONS OUTLETS

1. Provide outlet back boxes and conduit to accessible ceiling with pull-strings.

2. Devices and plates by Division 27.

2.9 WALL PLATES

A. Recessed single and combination types to be type 302/304 stainless steel.

B. Surface mounted outlets use electro-galvanized steel box covers matching box and outlet configuration.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant thermoplastic with lockable cover.

2.10 FLOOR SERVICE FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; System One.

B. Type: Modular, flush-type, dual-service units suitable for wiring method used.

C. Compartments: Barrier separates power from voice and data communication cabling.

D. Service Plate: Rectangular, solid brass, coordinate finish with Architect prior to ordering.

E. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

F. Voice and Data Communication Outlet: Keystone cover for devices by Division 27.

2.11 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: Ivory, or as selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

2. Wiring Devices Connected to Emergency Power System: Red.

3. TVSS Devices: Blue.

4. Isolated-Ground Receptacles: Orange.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided

by riding against outside of the boxes. Cut holes need not to be more than 1/8” inch in all sides of the box.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

4. Boxes and conduit shall be rigidly supported to the wall. Do not use spacer type supports.

5. Install wiring devices after all wall preparation, including painting, is complete.

6. Do not use extension ring in any applications.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300.14, without pigtails. Multiple duplex receptacles shall be use pigtail and use the screw terminals to terminate the wire not the back of the receptacle outlet.

4. Conductors shall be identified with circuit number at the box.

5. Existing Conductors:
   Cut back and pigtail or replace all damaged conductors.
   a. Straighten conductors that remain and remove corrosion and foreign matter.
   b. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

5. Use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.

7. When conductors larger than No. 12 AWG are installed on 20-A circuits, splice No. 12 AWG pigtails for device connections.

8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.

2. Verify that dimmers used for fan speed control are listed for that application.

3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

2. Receptacles: Label or marked the cover with panel and circuit number back and front cover.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.

2. Test Instruments: Use instruments that comply with UL 1436.

3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.

2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.

4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, panelboards, switchboards, enclosed controllers, and motor-control centers.

2. Plug fuses rated 125-V ac and less for use in plug-fuse-type enclosed switches, fuse-holders, and panelboards.

3. Plug-fuse adapters for use in Edison-base, plug-fuse sockets.

4. Spare-fuse cabinets.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
   a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
   b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

3. Current-limitation curves for fuses with current-limiting characteristics.

4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.

5. Coordination charts and tables and related data.

6. Fuse sizes for elevator feeders and elevator disconnect switches.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.

2. Current-limitation curves for fuses with current-limiting characteristics.

3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.

4. Coordination charts and tables and related data.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Comply with UL 248-11 for plug fuses.

1.5 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

1.6 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussmann, Inc.

2. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 PLUG FUSES

A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

2.4 PLUG-FUSE ADAPTERS

A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuse-holders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

2.5 SPARE-FUSE CABINET

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance: Class L, fast acting.

2. Feeders: Class L, fast acting

3. Motor Branch Circuits: Class RK1 and Class RK5, time delay.

4. Other Branch Circuits: Class J, fast acting.

5. Control Circuits: Class CC, fast acting.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install plug-fuse adapters in Edison-base fuse-holders and sockets. Ensure that adapters are irremovable once installed.

C. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Non-fusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers.
6. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).

4. Detail features, characteristics, ratings, and factory settings of individual over-current protective devices, accessories, and auxiliary components.

5. Include time-current coordination curves (average melt) for each type and rating of over-current protective device; include selectable ranges for each type of over-current protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Field quality-control reports.

1. Test procedures used.

2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Manufacturer's field service report.

G. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

2. Time-current coordination curves (average melt) for each type and rating of over-current protective device; include selectable ranges for each type of over-current protective device.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, over-current protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D / Schneider Electric

2. Cutler-Hammer / Eaton

3. General Electric / ABB

4. Siemens

B. Type HD, Heavy Duty, Six Pole, Single Throw, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

5. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.

6. Hook stick Handle: Allows use of a hook stick to operate the handle.

7. Lugs: Mechanical type, suitable for number, size, and conductor material.

8. Service-Rated Switches: Labeled for use as service equipment.

9. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D / Schneider Electric

2. Cutler-Hammer / Eaton

3. General Electric / ABB

4. Siemens

B. Type HD, Heavy Duty, Single Throw, 240, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Type HD, Heavy Duty, Six Pole, Single Throw, 240, 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Type HD, Heavy Duty, Double Throw, 240, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

E. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.

5. Hook-stick Handle: Allows use of a hook-stick to operate the handle.

6. Lugs: Mechanical type, suitable for number, size, and conductor material.

7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D / Schneider Electric

2. Cutler-Hammer / Eaton

3. General Electric / ABB

4. Siemens

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.

2. Long- and short-time pickup levels.

3. Long- and short-time time adjustments.

4. Ground-fault pickup level, time delay, and I^2t response.

F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

J. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.

2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.

3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.

5. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system, specified in Division 26 Section "Electrical Power Monitoring and Control."

6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

7. Under-voltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

8. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

10. Electrical Operator: Provide remote control for on, off, and reset operations.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

2. Outdoor Locations: NEMA 250, Type 3R.

3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, SS-304.

4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4X SS-304.

5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Non-corrosive Liquids: NEMA 250, Type 12.

6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Perform the following infrared scan tests and inspections and prepare reports:
   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.

c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection report, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

END OF SECTION 262816

262913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following enclosed controllers rated 600V and less:

1. Full-voltage manual.
2. Full-voltage magnetic.
3. Reduced-voltage magnetic.
4. Reduced-voltage solid state.
5. Multi-speed.

B. Related Section:

1. Division 26 Section "Variable-Frequency Motor Controllers" for general-purpose, ac, adjustable-frequency, pulse-width-modulated controllers for use on variable torque loads in ranges up to 200HP.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Over-current protective device.

G. SCR: Silicon-controlled rectifier.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

1. Show tabulations of the following:
   a. Each installed unit's type and details.
   b. Factory-installed devices.
   c. Nameplate legends.
   d. Short-circuit current rating of integrated unit.
   e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
   f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.

2. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Seismic Qualification Certificates: For enclosed controllers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Field quality-control reports.

F. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed controllers and installed components.

2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.

3. Manufacturer's written instructions for setting field-adjustable overload relays.

4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.

G. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

H. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than 10 days in advance of proposed interruption of electrical systems.

2. Indicate method of providing temporary utilities.

3. Do not proceed with interruption of electrical systems without Owner's written permission.

4. Comply with NFPA 70E.

1.8 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than 3 of each size and type.

2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than 2 of each size and type.

3. Indicating Lights: 2 of each type and color installed.

4. Auxiliary Contacts: Furnish 1 spare(s) for each size and type of magnetic controller installed.

5. Power Contacts: Furnish 3 spares for each size and type of magnetic contactor installed.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Square D.
   b. GE.
   c. Cutler-Hammer.

d. Asco

2. Configuration: Non-Reversing.

3. Surface mounting.

4. Red pilot light.

C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   a. Square D.
   b. GE.
   c. Cutler-Hammer.
   d. Asco

2. Configuration: Non-reversing.

3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button.

4. Surface mounting.

5. Not all manufacturers offer a green pilot light; pilot lights are not available in hazardous and some cast-type enclosures.

6. Red pilot light.

D. Magnetic Controllers: Full voltage, across the line, electrically held.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Square D.
   b. GE.
   c. Cutler-Hammer.
   d. Asco

2. Configuration: Non-reversing.

3. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.

4. Control Circuits: 120 V ac; obtained from integral CPT, with primary and secondary fuses and sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.

5. Solid-State Overload Relay:
   a. Switch or dial selectable for motor running overload protection.
   b. Sensors in each phase.
   c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
   d. Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
   e. Analog communication module.

6. External overload reset push button.

E. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
   a. Square D / Schneider Electric
   b. Cutler-Hammer / Eaton
   c. General Electric / ABB
   d. Siemens

2. MCP Disconnecting Means:
   a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
   b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
   d. N.C. alarm contact that operates only when MCP has tripped.
   e. Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.

3. MCCB Disconnecting Means:
   a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
   b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   d. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
   e. N.C. alarm contact that operates only when MCCB has tripped.

2.2 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1.

2. Outdoor Locations: Type 3R.

3. Kitchen and Wash-Down Areas: Type 4X, stainless steel.

4. Other Wet or Damp Indoor Locations: Type 4X-ss.

5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Non-corrosive Liquids: Type 12.

6. Hazardous Areas Indicated on Drawings: Type 9.

2.3 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy duty, oil-tight type.

B. N.C., N.O. auxiliary contact(s).

C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.

D. Phase-Failure, Phase-Reversal, and Under-voltage and Over-voltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable under-voltage, over-voltage, and time-delay settings.

E. Breather and drain assemblies, to maintain interior pressure and release condensation in Type 4X enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

F. Space heaters, with N.C. auxiliary contacts, to mitigate condensation in Type 3R enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

G. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.

H. Cover gaskets for Type 1 enclosures.

I. Terminals for connecting power factor correction capacitors to the load side of overload relays.

J. Spare control wiring terminal blocks, quantity as indicated; unwired.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

B. Floor-Mounted Controllers: Install enclosed controllers on 4-inch nominal-thickness concrete base. Comply with requirements for concrete base specified in Division 03 Section.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in each fusible-switch enclosed controller.

E. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses."

F. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

G. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

H. Install power factor correction capacitors. Connect to the line/load side of overload relays. If connected to the load side of overload relays, adjust overload heater sizes to accommodate the reduced motor full-load currents.

I. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with engraved nameplate.

3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices. Comply with requirements in Division 26 Section "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures. Use ‘Panduit’ where possible.

C. Connect selector switches and other automatic-control selection devices where applicable.

1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.

2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.

2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.

3. Test continuity of each circuit.

4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).

5. Test each motor for proper phase rotation.

6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

8. Perform the following infrared (thermo graphic) scan tests and inspections and prepare reports:
   a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each multi-pole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each multi-pole enclosed controller 11 months after date of Substantial Completion.
   c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer before increasing settings.

D. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage solid-state controllers.

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 262913

263213 - ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes packaged engine-generator sets for emergency power supply with the following features:

1. Gas engine.
2. Unit-mounted cooling system.
3. Unit-mounted and Remote-mounting control and monitoring.
4. Performance requirements for sensitive loads.
5. Outdoor enclosure.

B. Related Sections include the following:

1. Division 26 Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 DEFINITIONS

A. Retain abbreviation and terms that remain after this Section has been edited.

B. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

C. LP: Liquid petroleum.

1.4 SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:

1. Thermal damage curve for generator.

2. Time-current characteristic curves for generator protective device.

B. Coordination Drawings: Provide coordination drawings as described in 26 05 00 paragraph 1.03(C).

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.

2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.

4. Wiring Diagrams: Power, signal, and control wiring.

D. Manufacturer Seismic Qualification Certification: Submit certification that engine-generator set, batteries, battery racks, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Qualification Data: For manufacturer.

F. Source quality-control test reports.

1. Certified summary of prototype-unit test report.

2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.

3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.

4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.

5. Report of sound generation.

6. Report of exhaust emissions showing compliance with applicable regulations.

7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

I. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.

2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InternNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL), and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InternNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Comply with ASME B15.1.

G. Comply with NFPA 37.

H. Comply with NFPA 70.

I. Comply with NFPA 99.

J. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

K. Comply with UL 2200.

L. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

M. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Owner's written permission.

B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 5 to 40 deg C.

2. Relative Humidity: 0 to 95 percent.

3. Altitude: Sea level to 1000 feet.

1.7 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations for remote radiators. These items are specified in Division 07 Section "Roof Accessories."

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
Warranty Period: 5 years from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.

2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.

3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, are limited to the following:

1. Cummins

2. Caterpillar

3. Kohler

4. Aksa

5. Taylor

2.2 ENGINE-GENERATOR SET

A. Factory-assembled and -tested, engine-generator set.

A. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.

1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

B. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated.

2. Output Connections: Three-phase, four wire.

3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

4. Generators shall be designed with a 72 hour running capacity.

C. Generator-Set Performance:

1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.

2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.

3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.

4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.

6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.

7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.

8. Start Time: Comply with NFPA 110, Type 10, system requirements.

D. Generator-Set Performance for Sensitive Loads:

1. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.
   a. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.

2. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.

3. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 0.5 second.

4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.

5. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.

6. Transient Frequency Performance: Less than 2-Hz variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.

7. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.

8. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.

9. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.
    a. Provide permanent magnet excitation for power source to voltage regulator.

10. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.3 ENGINE

A. Depending on NFPA 110 class and local codes, LP-gas standby may not be required for natural gas-fueled systems. Verify requirements with authorities having jurisdiction.

A. Fuel: Natural gas with automatic LP-gas standby.

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm.

D. Lubrication System: The following items are mounted on engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.

2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.

3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

E. Engine Fuel System:

1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.

2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

3. Dual Natural Gas with LP-Gas Backup (Vapor-Withdrawal) System:
    a. Carburetor.
    b. Secondary Gas Regulators: One for each fuel type.
    c. Fuel-Shutoff Solenoid Valves: One for each fuel source.
    d. Flexible Fuel Connectors: One for each fuel source.

F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

G. Governor: Adjustable isochronous, with speed sensing.

H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.

1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.

3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.

4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
   a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and non-collapsible under vacuum.
   b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

I. Cooling System: Closed loop, liquid cooled, with remote radiator and integral engine-driven coolant pump.

1. Configuration: Vertical air discharge.

2. Radiator Core Tubes: Aluminum.

3. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.

4. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.

5. Fan: Driven by totally enclosed electric motor with sealed bearings.

6. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.

7. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

J. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

1. Minimum sound attenuation of 25 dB at 500 Hz.

2. Sound level measured at a distance of 10 feet from exhaust discharge after installation is complete shall be 85 dBA or less.

K. Air-Intake Filter: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

L. Select first option in paragraph below for smaller engine-generator sets. Retain second option for units 175 kW and larger.

M. Starting System: 24-V electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.

2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.

3. Cranking Cycle: As required by NFPA 110 for system level specified.

4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least twice without recharging.

5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.

6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.

7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.

8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
   a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
   b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
   c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
   d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.

e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.4 CONTROL AND MONITORING

A. This Article specifies the subsystem that monitors, protects, and controls the engine generator. See Editing Instruction No. 8 in the Evaluations.

A. Retain first paragraph below for automatically starting systems; retain second paragraph for manually starting systems.

B. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

C. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

D. Retain one of three paragraphs below to describe control and monitoring unit configuration. Coordinate retained paragraph with Drawings. Retain first paragraph unless special requirements justify significant extra cost of one of the other two configurations. See Evaluations.

E. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

F. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common wall-mounted control and monitoring panel.

G. Configuration: Operating and safety indications, protective devices, basic system controls, engine gages, instrument transformers, generator disconnect switch or circuit breaker, and other indicated components shall be grouped in a combination control and power panel. Control and monitoring section of panel shall be isolated from power sections by steel barriers. Panel features shall include the following:

1. Wall-Mounting Cabinet Construction: Rigid, self-supporting steel unit complying with NEMA ICS 6. Power bus shall be copper. Bus, bus supports, control wiring, and temperature rise shall comply with UL 891.

2. Switchboard Construction: Freestanding unit complying with Division 26 Section "Switchboards."

3. Switchgear Construction: Freestanding unit complying with Division 26 Section "Low-Voltage Switchgear."

4. Current and Potential Transformers: Instrument accuracy class.

5. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
   AC voltmeter.

6. AC ammeter.

7. AC frequency meter.

8. DC voltmeter (alternator battery charging).

9. Engine-coolant temperature gage.

10. Engine lubricating-oil pressure gage.

11. Running-time meter.

12. Ammeter-voltmeter, phase-selector switch(es).

13. Generator-voltage adjusting rheostat.

14. Fuel tank derangement alarm.

15. Fuel tank high-level shutdown of fuel supply alarm.

16. Generator overload.

H. Indicating and Protective Devices and Controls:

1. AC voltmeter.

2. AC ammeter.

3. AC frequency meter.

4. DC voltmeter (alternator battery charging).

5. Engine-coolant temperature gage.

6. Engine lubricating-oil pressure gage.

7. Running-time meter.

8. Ammeter-voltmeter, phase-selector switch(es).

9. Generator-voltage adjusting rheostat.

10. Coordinate five subparagraphs below with Drawings. See Evaluations for typical local and remote alarm indications and shutdowns.

11. Start-stop switch.

12. Overspeed shutdown device.

13. Coolant high-temperature shutdown device.

14. Coolant low-level shutdown device.

15. Oil low-pressure shutdown device.

16. Two subparagraphs below are optional devices.

17. Fuel tank derangement alarm.

18. Fuel tank high-level shutdown of fuel supply alarm.

19. Generator overload.

I. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

J. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals. Data system connections to terminals are covered in Division 26 Section "Electrical Power Monitoring and Control."

K. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.

1. Overcrank shutdown.

2. Coolant low-temperature alarm.

3. Control switch not in auto position.

4. Battery-charger malfunction alarm.

5. Battery low-voltage alarm.

L. Common Remote Audible Alarm: Signal the occurrence of any events listed below without differentiating between event types. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.

1. Engine high-temperature shutdown.

2. Lube-oil, low-pressure shutdown.

3. Overspeed shutdown.

4. Remote emergency-stop shutdown.

5. Engine high-temperature pre-alarm.

6. Lube-oil, low-pressure pre-alarm.

7. Fuel tank, low-fuel level.

8. Low coolant level.

M. Remote Alarm Annunciator: Comply with NFPA 99. An LED labeled with proper alarm conditions shall identify each alarm event and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

N. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.5 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Insulated-case, electronic-trip type; 100 percent rated; complying with UL 489.

1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.

2. Trip Settings: Selected to coordinate with generator thermal damage curve.

3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.

4. Mounting: Adjacent to or integrated with control and monitoring panel.

B. Generator Disconnect Switch: Molded-case type, 100 percent rated.

1. Rating: Matched to generator output rating.

2. Shunt Trip: Connected to trip switch when signaled by generator protector or by other protective devices.

C. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector shall perform the following functions:

1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.

2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.

3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.

4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

D. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

2.6 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

A. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

B. Electrical Insulation: Class H or Class F.

C. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

D. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

E. Enclosure: Drip proof.

F. Delete first paragraph below if instrument transformers are housed in control and power panel.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 12 percent, maximum.

2.7 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Level II sound resistant, Vandal-resistant, weatherproof steel housing, wind resistant up to 139 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

A. Description: Prefabricated or pre-engineered walk-in enclosure with the following features:

1. Construction: Galvanized-steel, metal-clad, integral structural-steel-framed building erected on concrete foundation.

2. Structural Design and Anchorage: Comply with ASCE 7 for wind loads.

3. Space Heater: Thermostatically controlled and sized to prevent condensation.

4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.

5. Hinged Doors: With padlocking provisions.

6. Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.

7. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.

8. Muffler Location: Within enclosure.

B. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.

1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.

2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.

C. Interior Lights with Switch: Factory-wired, vaporproof-type fixtures within housing; arranged to illuminate controls and accessible interior. Arrange for external electrical connection.

1. AC lighting system and connection point for operation when remote source is available.

2. DC lighting system for operation when remote source and generator are both unavailable.

D. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

2.8 MOTORS

A. General requirements for motors are specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

2.9 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: Standard neoprene.

B. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.

3. Minimum Additional Travel: 50 percent of required deflection at rated load.

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.10 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.11 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.

2. Full load run.

3. Maximum power.

4. Voltage regulation.

5. Transient and steady-state governing.

6. Single-step load pickup.

7. Safety shutdown.

8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.

9. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

A. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

A. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

B. Install packaged engine generator with restrained spring isolators having a minimum deflection of 1 inch on 4-inch high concrete base. Secure sets to anchor bolts installed in concrete bases. Concrete base construction is specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet. Flexible connectors and steel piping materials and installation requirements are specified in Division 23 Section "Hydronic Piping."

1. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints. Flexible connectors and piping materials and installation requirements are specified in Division 23 Section "Hydronic Piping."

D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

E. The location of the emergency power generator shall be away from fresh air intakes and other areas where fumes may enter the building.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Division 23 Sections. Drawings indicate general arrangement of piping and specialties.

A. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.

B. Connect engine exhaust pipe to engine with flexible connector.

C. Connect fuel piping to engines with a gate valve and union and flexible connector.

1. Natural-gas piping, valves, and specialties for gas distribution are specified in Division 23 Section "Facility Natural-Gas Piping."

2. LP-gas piping, valves, and specialties for gas piping are specified in Division 23 Section "Facility Liquefied-Petroleum Gas Piping."

D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

F. The following equipment shall be connected to the generator: fire alarm system, PA system, security system, kitchen freezers and coolers, gym light fixtures, energy management system, server room, A/C for server room, select administrative office receptacles, elevators, auditorium egress lighting, emergency lights, and select light fixtures. One 110v double duplex receptacle and one overhead light in each mechanical room, electrical room, and data closet shall be connected to the generator

3.4 IDENTIFICATION

A. Identify system components according to Division 23 Section "Identification for HVAC Piping and Equipment" and Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. Perform tests and inspections and prepare test reports.

D. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

E. Tests and Inspections:

1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.

3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
   a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
   b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
   c. Verify acceptance of charge for each element of the battery after discharge.

4. Verify that measurements are within manufacturer's specifications.

5. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

6. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.

7. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.

8. Exhaust Emissions Test: Comply with applicable government test criteria.

9. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases and verify that performance is as specified.

10. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.

11. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.

F. Coordinate tests with tests for transfer switches and run them concurrently.

G. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

H. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

I. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

J. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

K. Remove and replace malfunctioning units and retest as specified above.

L. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

M. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

N. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.

2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 263213

264313 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes field-mounted SPD's for low-voltage (120 to 600 V) power distribution and control equipment.

B. Related Sections:

1. Division 26 Section "Switchboards" for factory-installed SPD's.
2. Division 26 Section "Panelboards" for factory-installed SPD's.
3. Division 26 Section "Wiring Devices" for devices with integral SPD's.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. SVR: Suppressed voltage rating.

C. SPD: Surge Protective Device(s), both singular and plural.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.

B. Qualification Data: For qualified testing agency- (NRTL) National Recognized Testing Laboratory

C. Product Certificates: For SPD devices, from manufacturer.

D. Field quality-control reports.

E. Operation and Maintenance Data: For SPD devices to include in emergency, operation, and maintenance manuals.

F. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA or the equipment manufacturer to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

C. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.

D. Comply with UL 1283 and UL 1449 (current edition).

E. The SPD installation complies with NFPA 70.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than four days in advance of proposed electrical service interruptions.

2. Do not proceed with interruption of electrical service without Owner's written permission.

1.7 COORDINATION

A. Coordinate location of field-mounted SPD devices to allow adequate clearances for maintenance.

B. Coordinate SPD devices with Division 26 Section "Electrical Power Monitoring and Control."

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Where equipment design uses replaceable protection modules: One (1) of each size and type installed.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D.

2. GE.

3. Eaton/ Cutler-Hammer.

4. Liebert

5. Current Technology Inc.; Danaher Power Solutions.

6. Leviton

B. Surge Protection Devices:

1. Comply with UL 1449 (current edition).

2. Modular design.

3. Fuses, rated at 200-kA interrupting capacity.

4. Fabrication using bolted compression lugs for internal wiring.

5. Integral disconnect switch or circuit breaker.

6. Redundant suppression circuits.

7. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.

8. Arrangement with wire connections to phase buses, neutral bus, and ground bus.

9. LED indicator lights for power and protection status.

10. Audible alarm, with silencing switch, to indicate when protection has failed.

11. Form-C contacts rated at 1 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

12. Six-digit transient-event counter set to totalize transient surges.

C. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Switchgear, MCC, Main Entrance)	250 kA	125 kA
B	High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA
A	Branch Locations (Panelboards, MCCs, Busway)	120 kA	60 kA

D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V and 208Y/120 V, 3-phase, 4-wire circuits shall be as follows:

1. Line to Neutral:1200 V for 480Y/277 V, 700 V for 208Y/120 V.

2. Line to Ground: 2000 V for 480Y/277 V, 1200 V for 208Y/120 V.

3. Neutral to Ground: 1200 V for 480Y/277 V, 700 V for 208Y/120 V.

2.2 PANELBOARD SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Square D.

2. GE.

3. Eaton/ Cutler Hammer.

4. Advanced Protection Technologies Inc. (APT).

5. Current Technology Inc.

B. Surge Protection Devices:

1. Non-modular.

2. LED indicator lights for power and protection status.

3. Audible alarm, with silencing switch, to indicate when protection has failed.

4. Form-C contacts rated at 1 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

C. Surge Current Capacity – The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI / IEEE C62.41 location category			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Switchgear, MCC, Main Entrance)	250 kA	125 kA
B	High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA
A	Branch Locations (Panelboards, MCCs, Busway)	120 kA	60 kA

D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V, 208Y/120 V, 3-phase, 4-wire circuits shall be as follows:

1. Line to Neutral: 1200 V for 480Y/277 V, 700 V for 208Y/120 V.

2. Line to Ground: 2000 V for 480Y/277 V, 1200 V for 208Y/120 V.

3. Neutral to Ground: 1200 V for 480Y/277 V, 700 V for 208Y/120 V.

2.3 ENCLOSURES

A. Indoor Enclosures: NEMA 250 Type 1.

B. Outdoor Enclosures: NEMA 250 Type 3R.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install SPD devices at service entrance on load side, with ground lead bonded to service entrance ground.

B. Install SPD devices for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground at the SPD. Ground only at NEC required locations.

1. Provide manufacturer’s approved circuit breaker as applicable as a dedicated disconnecting means for SPD unless otherwise indicated.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.

2. After installing SPD devices but before electrical circuitry has been energized, test for compliance with requirements.

3. Complete startup checks according to manufacturer's written instructions.

C. SPD device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Do not energize or connect service entrance equipment, panelboards, control terminals or data terminals to their sources until SPD devices are installed and connected.

B. Do not perform insulation resistance tests of the distribution wiring equipment with the SPD installed. Disconnect before conducting insulation resistance tests and reconnect immediately after the testing is over.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train. Owner's maintenance personnel to maintain SPD devices.

END OF SECTION 264313

265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures and drivers.
2. Emergency lighting units.
3. Exit signs LED lighted
4. Lighting fixture supports.

B. Related Sections include the following:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multiple lighting relays and contactors.
2. Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.
3. Division 26 Section "Theatrical Lighting" for theatrical lighting fixtures and their controls.

C. Submittals:

1. Provide cut-sheets and summary all types of fixtures for review.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

F. RCR: Room cavity ratio.

G. LED Light Emitted Diode

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.

2. Emergency lighting units including battery and charger.

3. Ballast.

4. Energy-efficiency data.

5. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Submittals" Article in Division 23 Section "Diffusers, Registers, and Grilles."

6. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Division 23 Section "Diffusers, Registers, and Grilles."

7. Life, output, and energy-efficiency data for lamps.

8. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
   a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.
   b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

1. Wiring Diagrams: Power and control wiring.

C. Samples for Verification: Interior lighting fixtures designated for sample submission in Interior Lighting Fixture Schedule. Each sample shall include the following:

1. Lamps: Specified units installed.

2. Accessories: Cords and plugs.

D. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.

E. Qualification Data: For agencies providing photometric data for lighting fixtures.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

D. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

E. Mockups: Provide interior lighting fixtures for room or module mock-ups, complete with power and control connections.

1. Obtain Architect's approval of fixtures for mockups before starting installations.

2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.7 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 5 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

2. Warranty Period for Emergency Fluorescent Ballast Batteries: 5 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.

2. Warranty Period for Electromagnetic Ballasts: Three years from date of Substantial Completion.

C. Special Warranty for T5 and T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Two (2) year(s) from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.

2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

3. Battery and Charger Data: One for each emergency lighting unit.

4. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

5. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

C. Luminaires, Acceptable Manufacturers:

1.

2. Philips

3. Hubbell

4. Kenall

5. Lithonia

6. Cooper

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

A. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.

F. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

4. Laminated Silver Metalized Film: 90 percent.

G. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

H. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate lighting fixtures, indicated to require a filter, with one filter per ballast.

I. Air-Handling Fluorescent Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Division 23 Section "Diffusers, Registers, and Grilles."

1. Air Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.

2. Heat Removal Units: Air path leads through lamp cavity.

3. Combination Heat Removal and Air Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air supply units.

4. Dampers: Operable from outside fixture for control of return-air volume.

5. Static Fixture: Air supply slots are blanked off, and fixture appearance matches active units.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. Electronic Ballasts: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

1. Sound Rating: A.
2. Total Harmonic Distortion Rating: Less than 10 percent.
3. Transient Voltage Protection: IEEE C62.41, Category A or better.
4. Operating Frequency: 20 kHz or higher.
5. Lamp Current Crest Factor: 1.7 or less.
6. BF: 0.88 or higher.
7. Power Factor: 0.95 or higher.
8. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Electronic Programmed-Start Ballasts for T5 Lamps: Comply with ANSI C82.11 and the following:

1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher, unless otherwise indicated.
9. Power Factor: 0.95 or higher.

C. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.

1. Ballast Manufacturer Certification: Indicated by label.

D. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F and Higher: Electronic or electromagnetic type rated for 0 deg F starting and operating temperature with indicated lamp types.

E. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.

F. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.

2. Ballast Input Watts: Can be reduced to 20 percent of normal.

3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

G. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.

1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
   a. High-Level Operation: 100 percent of rated lamp lumens.
   b. Low-Level Operation: 30 percent of rated lamp lumens.

2. Ballast shall provide equal current to each lamp in each operating mode.

3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

1. Lamp end-of-life detection and shutdown circuit.

2. Automatic lamp starting after lamp replacement.

3. Sound Rating: A.

4. Total Harmonic Distortion Rating: Less than 20 percent.

5. Transient Voltage Protection: IEEE C62.41, Category A or better.

6. Operating Frequency: 20 kHz or higher.

7. Lamp Current Crest Factor: 1.7 or less.

8. BF: 0.95 or higher, unless otherwise indicated.

9. Power Factor: 0.95 or higher.

10. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

11. Ballast Case Temperature: 75 deg C, maximum.

B. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.

1. Dimming Range: 100 to 5 percent of rated lamp lumens.

2. Ballast Input Watts: Can be reduced to 20 percent of normal.

3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate 1 fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect un-switched circuit to battery-inverter unit and switched circuit to fixture ballast.

2. Night-Light Connection: Operate one fluorescent lamp continuously.

3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
   a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4. Battery: Sealed, maintenance-free, nickel-cadmium type.

5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

6. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.6 BALLASTS FOR HID LAMPS

A. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features, unless otherwise indicated:

1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.

2. Minimum Starting Temperature: Minus 22 deg F for single-lamp ballasts.

3. Normal Ambient Operating Temperature: 104 deg F.

4. Open-circuit operation that will not reduce average life.

5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

B. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Lamp end-of-life detection and shutdown circuit.

2. Sound Rating: A.

3. Total Harmonic Distortion Rating: Less than 15 percent.

4. Transient Voltage Protection: IEEE C62.41, Category A or better.

5. Lamp Current Crest Factor: 1.5 or less.

6. Power Factor: .90 or higher.

7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

8. Protection: Class P thermal cutout.

9. Retain subparagraph and associated subparagraphs below for bi-level ballasts.

10. Bi-Level Dimming Ballast: Ballast circuit and leads provide for remote control of the light output of the associated fixture between high- and low-level and off.
    a. High-Level Operation: 100 percent of rated lamp lumens.
    b. Low-Level Operation: 35 percent of rated lamp lumens.
    c. Compatibility: Certified by ballast manufacturer for use with specific bi-level control system and lamp type indicated. Certified by lamp manufacturer that

ballast operating modes are free from negative effect on lamp life and color-rendering capability.

11. Continuous Dimming Ballast: Dimming range shall be from 100 to 35 percent of rated lamp lumens without flicker.
    a. Ballast Input Watts: Reduced to a maximum of 50 percent of normal at lowest dimming setting.
    b. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated. Certified by lamp manufacturer that ballast operating modes are free from negative effect on lamp life and color-rendering capability.

C. Auxiliary Instant-On Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent light output.

D. High-Pressure Sodium Ballasts: Electromagnetic type, with solid-state igniter/starter. Igniter-starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.

1. Instant Re-strike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
    a. Re-strike Range: 105- to 130-V ac.
    b. Maximum Voltage: 250-V peak or 150-V ac RMS.

2. Minimum Starting Temperature: Minus 40 deg F.

3. Open-circuit operation shall not reduce average lamp life.

2.7 EXIT SIGNS LED LIGHTED

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: Fluorescent, 2 for each fixture, 20,000 hours of rated lamp life.

2. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.

3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored,

relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

4. Master/Remote Sign Configurations:

a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.

b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.8 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.

2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.

7. Integral Time-Delay Relay: Holds unit on for fixed interval of 5 minutes when power is restored after an outage.

8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.9 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

A. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

B. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.

2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.

3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.

4. Install at least four independent support rod or wire from BUILDING structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.

2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aim-able lighting fixtures to provide required light intensities.

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

A. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.3 CLEANING

A. Clean the diffuser or lenses before installing to the fixture.

END OF SECTION 265100

269020 - ELECTRICAL CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Requirements of Division 26 "COMMON WORK RESULTS FOR ELECTRICAL" apply to this Section.

1.2 SECTION INCLUDES

A. Cabinets.

B. Relays/Contactors.

C. Photo cells.

D. Time clocks.

E. Power supplies.

F. Terminal blocks.

G. Plastic wiring troughs.

H. Miscellaneous.

1.3 SUBMITTALS: SUBMIT THE FOLLOWING IN ACCORDANCE WITH SECTION 260500.

A. Shop Drawings: Provide complete point to point wiring diagrams inside low voltage panels and from panels to control/switching sources. Provide shop drawings indicating all conduit sizes and locations required for switching system.

B. Product Data: Provide for each device specified. Indicate coil and contact ratings, dimensions, cabinets and accessory items.

C. Provide category and UL file number for products.

D. Warranties.

E. Submittals for this section shall be signed by the subcontractor responsible for Division 13 controls, also.

PART 2 - PRODUCTS

2.1 CABINETS

A. Factory mount relays, time clocks, power supplies, terminal blocks, wiring troughs and accessories in a NEMA 1 cabinet conforming to Section 260533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS by a UL 508 listed manufacturer unless otherwise directed.

B. Contactors/relays shall be individually identified with name tags. All wiring within cabinets shall be pre wired through plastic wiring troughs and brought to terminal blocks for field connections. Wires at terminal blocks and contactors/relays shall be identified by contactor/relay and pole number.

C. Low voltage control wiring shall conform to Section 260519 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES 600V wires and cables.

D. Provide 1/4" minimum spacing between non-power limited wiring and power limited wiring.

E. Cabinet and components shall be suitable for installation and operation in an unconditioned space.

F. Relay cabinet power shall be 120 volts or as otherwise indicated.

G. Cabinets shall be lockable, keyed alike. Furnish two (2) keys for each cabinet.

H. Provide wire bending space, clearances, construction, etc. in accordance with NEC-312.

2.2 RELAYS/CONTACTORS

A. Provide mechanically held SPST Class A150 contacts of required number, voltage, and current rating conforming to NEMA ICS 2 and UL 508 "industrial control equipment." Contacts shall be fully field convertible from N.O. to N.C.

1. Magnetic Control Relay: Class A300.

2. Time Delay Relay: Class A600.

B. Control coil shall be Class 2 power limited with solid state control accessories as required.

C. Line and low voltage terminals shall be screw type.

D. Relays shall be ASCO 917 with 47, 48 or 49 Series control modules as required or equal by General Electric, Square D, Westinghouse/Cutler-Hammer, Siemens/ITE

2.3 PHOTO CELLS

A. Photocell switch manufactured to NEMA ICS 2 and UL 773A "Non-industrial Photoelectric Switches for Lighting Control."

B. Provide voltage, NEMA rating, contact rating and contact configuration as required.

C. Sensitivity two (2) footcandles to 50 footcandles, adjustable.

D. Provide photo cells manufactured by Intermatic, Dayton, Paragon or Tork.

2.4 TIME CLOCKS

A. Provide 24 hour clock timer manufactured to NEMA ICS 2 and UL 917 "Clock Operated Switches" with two (2) astronomic time setting and 12 hour spring wound reserve power carry over.

B. Manufacturers: Intermatic, Dayton, Paragon, Tork.

2.5 POWER SUPPLY

A. Provide low voltage power supply in conformance with NEC Article 725 Class 2 and UL 1585 "Class 2 and Class 3 Transformers."

B. Provide transformer size, primary, secondary fusing and accessories as required.

C. Manufacturers: General Electric, Square D, Westinghouse, Dormeyer, White Rodgers.

2.6 TERMINAL BLOCKS

A. Conform to NEMA ICS 4 and UL 486A "Wire Connectors and Soldering Lugs for use with Copper Conductors."

B. Provide phenolic, channel mount, screw type terminals.

C. Manufacturers: General Electric, Square D, Westinghouse, Cutler/Hammer, Buchanan, Allen-Bradley, Entrelec, Pass & Seymour/Legrand, Thomas and Betts, Marathon, Ilsco.

D. Provide UL listed copper ground terminal.

2.7 PLASTIC WIRING TROUGHS

A. Provide open slot vinyl wiring duct with snap on cover conforming to NEMA ICS 6 of width and height as required.

B. Manufacturers: Gould Shawmut, Panduit, Rob Roy, Tyton, Electrovert, Pass & Seymour/Legrand, Leviton.

2.8 MISCELLANEOUS

A. Provide miscellaneous items (diodes, solid state relays, logic chips, fuse holders, etc.) as required for a complete operating system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Furnish all labor, materials, tools, equipment, and services for interface with HVAC controls, lighting controls, and other control systems as indicated and required by contract documents. Relays, conduit, wiring and accessories required shall be provided and installed.

B. Completely coordinate with work of all other trades.

C. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

D. Mount control panels where indicated on drawings and provide proper NEC working clearance assuming panel will require examination while energized.

E. Use manufacturer's recommended cable size for length of run and relays served.

F. Provide conduit and wire between control panels, power panels, relays and low voltage switches as required to achieve the sequence of operation indicated.

G. Inside relay cabinets, provide 1/4" minimum spacing between non-power limited wiring and power limited wiring. Otherwise, power limited wiring shall be in separate enclosures from non-power limited wiring.

3.2 DEMONSTRATION

A. Provide system demonstration under provisions of contract closeout.

END OF SECTION 269020

269500 - FIELD ELECTRICAL TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Requirements of Division 26 "COMMON WORK RESULTS FOR ELECTRICAL" apply to this Section.

1.2 SECTION INCLUDES

A. Testing by Installing Contractor

B. Testing by Independent Certified Testing Contractor

C. All testing shall be witness with the Owner, Commissioning Agent, Engineer or Architect.

1.3 SUBMITTALS: SUBMIT THE FOLLOWING IN ACCORDANCE WITH SECTION 260500.

A. Contractor shall submit experience and certified of testing firm and individuals who will be performing and evaluating tests before any tests are done.

B. Contractor shall submit in writing at least 24 hours in advance notification of the occurrence of any test described in this section.

C. Contractor shall record all test data and submit three (3) copies for review. In addition to the test data, each record shall include; date of test, ambient temperature, climate conditions, instruments used, names of test personnel and witnesses and identification of items tested.

D. The testing firm shall maintain a written record of all tests and, upon completion of project, shall assemble and certify a final test report.

1.4 QUALITY ASSURANCE: COMPLY WITH THE FOLLOWING.

A. All tests shall be done in accordance with all applicable codes and standards.

B. Qualifications of Testing Firm:

1. The testing firm shall be an independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.

2. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.

3. The testing firm shall meet OSHA criteria for accreditation of testing laboratories, Title 29,

or be a Full Member company of the International Electrical Testing Association (IETA).

4. The testing firm shall utilize engineers and technicians who are regularly employed by the firm for testing services.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 DIVISION OF RESPONSIBILITY

A. All tests indicate in this specification section shall be done by the testing firm except the installing contractor shall be responsible for the following:

1. The contractor shall perform routine insulation-resistance, continuity, and rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by the testing firm specified herein.

2. 120 Volt General Purpose Receptacles: All 120 volt general purpose receptacles shall be tested for correct connection using a Hubbell Catalog #5200 or equal receptacle tester.

3. 120 Volt Ground Fault Circuit, Interrupter (GFCI) Receptacles: All 120 volt GFCI receptacles shall be tested for correct connection and rating using Hubbell Catalog #GFT-2G with a range of 2 to 7 milliamps.

4. Enclosed (Disconnect) Switches: Subsequently to completion of installation of electrical disconnect switches, energize circuits and demonstrate capability and compliance with requirements. Except as otherwise indicated, do not test switches by operating them under load. However, demonstrate switch operation through six opening/closing cycles with circuit unloaded. Open each switch enclosure for inspection of interior, mechanical and electrical connections, fuse installation, and for verification of type and rating of fuses installed. Correct deficiencies then retest to demonstrate compliance. Remove and replace defective units with new units and retest.

5. Light Switching: Verify proper connection and operation of switches for lighting fixtures.

6. Lighting Contactors: Demonstrate proper operation of lighting contactors for all items indicated in Division 16.

7. Balancing Loads: After Substantial Completion, but not more than two months after Final Acceptance, conduct load-balancing measurements on panelboards and circuit changes as follows:
   a. Perform measurements during period of normal working load as advised by the Owner.
   b. Perform load-balancing circuit changes outside the normal occupancy/working schedule of the facility. Make special arrangements with Owner to avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.

c. Recheck loads after circuit changes during normal load period. Record all load readings before and after changes and submit test records.

d. Tolerance: Difference between phase loads exceeding 20 percent at any one panelboard is not acceptable. Rebalance and recheck as required to meet this minimum requirement.

B. The Contractor shall supply a suitable and stable source of electrical power to each test site. The testing firm shall specify the specific power requirements.

C. The Contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.

D. Any system, material, or workmanship which is found defective on the basis of acceptance tests shall be reported to the Owner/Engineer's representative replaced or repaired by the Contractor at no cost to the Owner, and retested.

E. An electrical system will not be accepted until tested in its entirety and results reported to the Owner.

3.2 TESTING FIRM

A. The testing firm shall test the following equipment as indicated in each section:

1. 600V Wire and Cables
2. Grounding and Bonding.
3. Dry Type Transformers.
4. Enclosed Motor Controllers
5. Motor Control Center
6. Panelboards
7. Switchboards/Switchgear

3.3 INFRARED BASELINE SCANNING

A. Provide scanning for Switchboards, Transformers, MCC’s, Panelboards, Generator connection points, Copper Busses, Circuit Breakers, Terminations and Transfer Switches.

B. After Substantial Completion, but not more than two (2) months after Final Acceptance, perform an infrared IR scan in Section 26-95-00 Part 3, 3.2 of each panelboard, switchboard and pad mounted transformer. Remove fronts to make joints and connections accessible to a portable scanner.

C. Instrument: Use an approved infrared IR scanning device designed to measure temperature or detect significant deviations from normal values. Provide calibration record for device used.

D. Record of Infrared IR Scanning: Prepare a certified report identifying panelboards checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 269500

SECTION 270000 – GENERAL TECHNOLOGY REQUIREMENTS

PART 1 - GENERAL

1.01 PROJECT SUMMARY

A. Scope: Successful bidder shall provide, install, configure, and provide warranty service for technology systems described herein.

1.02 RELATED DOCUMENTS

A. Documents: Provisions of General Conditions, Supplementary Conditions, and the sections included under Procurement & Contract Requirements are included as part of this section as though bound herein.

1.03 RELATED WORK

A. Section 270500 – Communications General Requirements

B. Section 270526 – Grounding and Bonding for Technology Systems

C. Section 270528 – Pathways for Technology Systems

D. Section 270537 – Firestopping for Technology Systems

E. Section 271100 – Communications Equipment Rooms

F. Section 271300 – Communications Backbone Cabling

G. Section 271500 – Communications Horizontal Cabling

H. Section 271600 – Communications Connecting Cords

I. Section 271800 – Communications Labeling and Identification

J. Section 274000 – AV/Multimedia General Requirements

K. Section 274100 – Audio Visual Systems

1.04 DEFINITIONS

A. Approved or Approval: Where approval is called for, only persons with the authorized authority may grant approval. Owner reserves all rights to govern over and grant approval and will appoint authority of agents acting on their behalf.

B. As Required: Contractor shall provide the quantity of said item that is necessary. Owner and Consultant reserve the right to make the final determination of necessary quantities to provide for a complete system.

C. Basis of Design: The documentation of the concepts, calculations, decisions, and product selections used to meet the Owner's project requirements. These Consultant produced documents are not shop drawings. Product selections depict minimum functionality and overall quality and are open to substitution requests.

D. Consultant: True North Consulting Group.

E. Contractor: The qualified party responsible to provide all items and perform services as described within these documents. The Contractor referred to within a specific specification section shall be the successful qualified party contracted to perform and complete that work.

F. Documents: The complete package of Bid and Contract Requirements, General Technology Requirements, related Division 27 sections, drawings, schedules, and addenda that make up this Request for Bid.

G. End-User: Individual(s) who will ultimately operate the completed system.

H. ETR: Existing to Remain. Item is to remain in current location and maintain current functionality.

I. Furnish: To supply and deliver to project site, ready for installation.

J. Install: To place in a position of service or use.

K. NIC: Not in Contract. Item will be the responsibility of others.

L. Notice to Proceed: Formal communication from Owner to Contractor stating the date the Contractor can begin work subject to the conditions of the contract. The performance time of the contract starts from the Notice to Proceed date.

M. OFCI: Owner Furnished Contractor Installed. Item will be provided by Owner and shall be installed by Contractor.

N. OFE: Owner Furnished Equipment. Item will be provided and integrated by Owner.

O. OFOI: Owner Furnished Owner Installed. Item will be provided and installed by Owner.

P. Owner: The party named in the Procurement and Contract Requirements as the advertising party.

Q. Provide: To furnish and install, complete and ready for intended use.

R. Substantial Completion: The stage in the progress of installation when the systems described herein are sufficiently complete, in accordance with the Contract Documents, so that the Owner can utilize such systems for their complete intended use.

S. Turnkey: Of or involving the provision of a complete product or service that is ready for immediate use.

T. Work: The provision of products and/or services to meet the requirements specified in these documents.

1.05 REFERENCE STANDARDS AND CODES

A. Standards and other procedures referenced by this bid package are as follows:

1. ADA – Americans with Disabilities Act of 2010
   www.ada.gov/2010ADAstandards_index.htm
2. AIA – American Institute of Architects
   www.aia.org
3. ANSI – American National Standards Institute
   www.ansi.org
4. ASTM – American Society of Testing and Materials
   www.astm.org
5. BICSI – Building Industry Consulting Service International, Inc.
   (RCDD Standards)
   www.bicsi.org
6. CFR – Code of Federal Regulations
   www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
   (Available from the Government Printing Office)
   (Material is usually first published in the Federal Register)
7. U.S. Copyright Law, December 2011
   www.copyright.gov/title17
8. ECIA – Electronic Components Industry Association
   ESC – EIA Standards Council
   www.eciaonline.org
9. IACS – International Annealed Copper Standard
   www.ndt-ed.org/GeneralResources/IACS/IACS.htm
10. IEC – International Electrotechnical Commission
    www.iec.ch
11. IEEE – Institute of Electrical and Electronics Engineers
    standards.ieee.org
12. ISO – International Organization for Standardization
    www.iso.org
13. ITU-T – International Telecommunication Union – Telecommunication
    www.itu.int

14. NEC – National Electrical Code (NFPA 70)
    maintained by NFPA – National Fire Protection Association
    www.nfpa.org
15. NECA – National Electrical Contractors Association
    www.necanet.org
16. NEMA – National Electrical Manufactures' Association
    www.nema.org
17. OSHA – Occupational Safety and Health Administration
    (U.S. Department of Labor, OSHA)
    www.osha.gov
18. TIA – Telecommunications Industry Association
    www.tiaonline.org/standards
19. UL – Underwriters' Laboratories
    www.ul.com

B. Standards: Referenced standards and/or procedures shall be binding on the Contractor and work shall be judged against such standards and procedures unless otherwise stated in writing.

C. Local/State Codes: Contractor shall comply with all local and state code requirements as determined by the authority having jurisdiction (AHJ).

D. Owner Standards: Contractor shall obtain and abide by all published Owner standards as they pertain to the work described herein.

E. Contractor shall use the latest versions of all standards and codes unless otherwise directed by the authority having jurisdiction (AHJ) or expressly noted herein.

1.06 QUALIFICATIONS

A. Refer to related sections for specific requirements.

1.07 PERMITS AND INSPECTIONS

A. Responsibility: Obtain permits and inspections required for the work. Contractor is responsible for all permit and inspection costs.

B. Performance: Perform tests required herein, or as may be reasonably required to demonstrate conformance with the specifications or with the requirements of any legal authority having jurisdiction.

C. Review: Obtain approvals from authorities responsible for enforcement of applicable codes and regulations to establish that the work is in compliance with all requirements of reference codes indicated herein and required by the appropriate jurisdiction. Make corrections, changes or additions as required and deliver certificates of acceptance,

operation, and/or compliance with the Operation and Maintenance Manuals described herein.

1.08 DRAWINGS AND BASIS OF DESIGN

A. General: Work, equipment, or material delineated on any drawing in this package is expected to be provided by Contractor unless noted otherwise.

B. Interpretation: Work shall be installed in accordance with the basis of design diagrammatically expressed on the drawings and described in the written specifications and equipment schedule(s). Contractor shall not make limiting interpretation that provides for incomplete work or a non-functioning system.

1.09 PRODUCT SUBSTITUTION PROCEDURES

A. Requests for Substitutions: Should the Contractor request a change in the material that is to be supplied, from that which was specified in the contract, the Contractor shall provide the Owner and the Consultant with a written request for said change.

B. Substitutions for Non-specified Products: Where no product specification is provided, Contractor may use manufacturer's specification for the identified product as a guide for suggesting appropriate substitutions.

C. Requirements: The Request for Substitution shall include:

1. Reason for substitution.

2. Material data sheets for both the proposed item(s) and the item(s) to be replaced.

3. Any cost impact to the Owner.

D. Changes: Proposed changes to Contract Documents shall be clearly identified in the pre-construction submittals.

E. Approval: The Owner may approve or deny any Requests for Substitution. The Owner reserves the right to govern over and proclaim whether proposed products are equal to the specifications. The Contractor shall not procure any substitute materials until the Owner has approved and signed the Request for Substitution and passed copies to the Contractor and the Consultant. Any procurement or work performed prior to this approval is at the Contractor's own risk.

F. Deviation: Products provided or installed that deviate from the products specified in make, model, color, or other significant characteristic (i.e., non-approved substitutions) shall be removed and replaced with specified products at no additional expense to Owner.

1.10 SOFTWARE

A. Versions: Consultant used the following software versions for this project:

1. Autodesk Revit MEP 2020 (floor plans)

2. Autodesk AutoCAD MEP 2018 (detail sheets)

1.11 SUBMITTAL CONDITIONS

A. The Contractor shall not consider the Consultant or Owner's review of submittals to be exhaustive or complete in every detail. Approval of shop drawings or submittals including substitutions indicates only the acceptance of the Contractor's apparent intent to comply with general design or method of construction and quality as specified. The finished product shall meet functional requirements, operations, arrangements, and quantities and comply with the contract documents unless specifically approved otherwise.

B. The Contractor shall be held responsible for delivery of systems as specified. Any errors or omissions in the submittals shall not relieve Contractor of responsibility to deliver complete systems as specified.

1.12 PRE-CONSTRUCTION PROCEDURES

A. Pre-Construction Submittal Meeting: Contractor shall schedule web conference (WebEx or similar) with Consultant to review basis of design and submittal expectations.

B. Prior to Work: Pre-construction submittals shall be provided to Consultant with appropriate promptness as to cause no delay to the work.

C. Project Timeline: Project timeline will not be altered due to lateness of submittals. Contractor is bound to deliver a timely, complete, and finished project as stipulated in their contract and specified herein.

D. Format and Distribution: Contractor shall provide one (1) electronic copy in PDF format to Consultant of all pre-construction submittals. The Contractor shall provide hard copies sets as required up to five (5) sets.

E. Provision: Contractor shall submit pre-construction submittals including any corrections or additions to Consultant prior to the procurement of equipment or commencement of work.

F. Review: Pre-construction submittals shall be received and formally approved by Consultant prior to the procurement of material or the commencement of work. Any procurement or work performed prior to this approval is at Contractor's own risk.

G. Failure to Provide: The failure of Contractor to provide pre-construction submittals as required herein may result in the withholding of payment for work and/or the cancellation of the contract.

1.13 PRE-CONSTRUCTION SUBMITTALS

A. Pre-construction submittals are intended to document the details of installation. Exact copies of original drawings and specifications are not acceptable as pre-construction submittal drawings. Consultant schematic diagrams describe the basis of design as defined herein.

B. Contractor shall provide to Consultant the following pre-construction submittals for approval in addition to specific requirements identified in subsequent sections.

1. Qualifications: Shall include documentation of all required qualifications.

2. Shop Drawings:

a. Title: Each drawing shall have a descriptive title and all subparts of each drawing shall have unique identifiers.

b. Floor Plans: Shall include device locations, Contractor provided furniture and installation notes.

c. System Drawings: Shall include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal type, cable identification detail, connectors, adapters, intra/inter-rack power distribution, installation notes and any other information required to convey the complete turnkey system design.

d. Equipment Rack and Cabinet Elevations: Shall include placement of all mounted equipment.

e. Structurally Mounted Elements: Shall include both plan view of placement as well as a detail of structural mounting techniques to be used.

f. Furniture: Shall include all Contractor provided furniture showing dimensional drawings, cable management and finishes with samples for Owner approval.

3. Product Data:

a. Equipment Schedules: Shall include manufacturers, part numbers, quantities and unit pricing.

b. Product Cut Sheets: Shall identify (highlight, arrow, etc.) actual part numbers to be utilized including but not limited to equipment, mounting hardware, cabling, connectors, software and power distribution equipment.

4. Manufacturer’s Recommendations:

a. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, copies of these recommendations shall be provided prior to installation. Installation of the items will not be allowed to proceed until the recommendations are received and approved.

1.14 PRE-INSTALLATION PROCEDURES

A. Refer to individual sections for additional information.

1.15 CONSTRUCTION PROGRESS PROCEDURES

A. Meeting Attendance: Contractor is required to attend job progress meetings in accordance with requirements set by Owner or Consultant.

B. Additional Coordination: Contractor shall request additional job construction coordination meetings it deems to be necessary to ensure coordination of their responsibilities with other parties.

C. Progress Inspection: Consultant may perform periodic progress inspections. At Consultant's request, Contractor shall make Project Manager and/or Lead Technician available.

D. Test Plan: Ten (10) business days prior to the proposed Contractor test date, Contractor shall provide a test plan defining the tests required.

1. The test plan shall be approved by Consultant prior to any testing.

1.16 CONSTRUCTION PROGRESS SUBMITTALS

A. Completion: Contractor shall complete and submit via email all construction progress documentation in PDF format as requested by Owner and Consultant.

B. Contractor shall provide to Consultant the following construction progress submittals in addition to specific requirements identified in subsequent sections.

1. Weekly Report: Weekly written report to be submitted to Consultant through appropriate project channels in PDF format outlining progress from previous week, plans for progress in the current week, and any coordination issues that may require Consultant or Owner attention.

2. Test Plan: Shall ensure the system meets Owner operational and performance specifications and include the following:

a. Identification of the capabilities and functions to be tested.

b. Detailed instructions for the setup and execution of each test.

c. Procedures for evaluation and documentation of the results.

C. Failure to Complete: Failure to complete requested construction progress documentation may result in the withholding of payment by Owner.

1.17 CLOSEOUT PROCEDURES

A. Notification: Contractor shall provide written notification to Consultant and Owner when Contractor is satisfied that the work has reached Substantial Completion and is ready for inspection.

B. Pre-Inspection Submittals: Contractor shall submit an electronic copy of all closeout submittals to Consultant in accordance with the requirements found in these documents no less than ten (10) business days prior to the scheduled Final Inspection.

   1. Test Results
   2. As-built drawings (full-size sheets)
   3. Operation and Maintenance Manuals
   4. End User Software

C. Photos that demonstrate complete system installation.

D. Punch List: Work or materials found to be incomplete, of unsatisfactory quality, failing to meet the specifications in these documents, and/or unacceptable to Consultant or Owner shall be documented by Consultant and provided to Contractor to rectify at no additional cost. Contractor shall provide written notification to Consultant and Owner when all punch list items have been completed.

E. Final Inspection: At Consultant's request, Contractor shall make Project Manager and/or Lead Technician available.

F. Re-Inspection: If more than one (1) re-inspection is necessary, the costs of the additional travel, time, and expenses of Owner and Consultant may be deducted by Owner from the contract amount due to the Contractor.

G. Punch List Approval: Once all punch list items are complete, the Contractor shall return an initialed punch list to the Consultant and Owner for verification. Punch list shall be considered complete only after having been signed by Owner and Consultant.

H. Closeout Submittals: Upon approval of closeout submittals and prior to final acceptance, Contractor shall provide three (3) electronic copies to Owner and Consultant in format(s) noted below.

   1. Record Drawings – AutoCAD 2010 editable .dwg format AND PDF.
   2. Operation and Maintenance Manuals – CD OR DVD.
   3. End User Software – CD OR DVD.
   4. Documentation of testing and system certification.
   5. Completed Minnesota Department of Revenue IC-134 Form.

I. Closeout Submittal Format and Distribution: Upon approval of closeout submittals and prior to final acceptance, Contractor shall provide a total of three (3) bound hard copies and one (1) digital copy with labeled dividers of all record drawings (full-size sheets) and operation and maintenance manuals, three (3) copies to Owner and one (1) digital copy to Consultant. Title on front and spine of binder shall be "Operation and Maintenance Manual – [Project Name]". The following additional items shall be identified on the binder cover:

1. Client Name
2. Contractor Name and Contact Information
3. Consultant Name and Contact Information
4. Date

J. All documentation prepared by the Contractor, including hard copy and electronic forms, shall become the property of the Owner.

K. Payment Authorization: Final payment will be authorized only after all closeout procedures and requirements have been followed and fulfilled by Contractor and approved in writing by Owner and Consultant, including punch list(s) and/or re-inspection(s) and delivery of closeout deliverables.

1.18 CLOSEOUT SUBMITTALS

A. Closeout submittals are intended to document the details of the final installation that substantially conforms to the construction documents and functions as intended to meet the Owner's needs.

B. Contractor shall provide to Consultant the following closeout submittals for approval in addition to specific requirements identified in subsequent sections.

1. As-built drawings: As-built drawings are prepared by the Contractor. They show, in red ink, on-site changes to the Consultant-approved pre-construction submittal documents. As-built drawings shall be submitted to Consultant for approval prior to submitting record drawings and include:

    a. Changes made by Addenda, Change Orders, Requests for Information (RFIs), Architect's Supplemental Instruction (ASIs), or Requests for Proposal (RFPs) in addition to any other changes to the original documents.

    b. Actual device locations, conduit routing, wiring and relationships as they were constructed.

    c. Nomenclature showing as-built wire designations and colors.

    d. Room numbers coinciding with Owner space planning numbering.

2. Record drawings: Record drawings are the final drawings prepared by the Contractor and incorporate all as-built drawing changes previously approved by Consultant. Record drawings should be electronically produced without any handwritten, red ink, or clouded changes.

3. Operation and Maintenance Manuals: Notwithstanding requirements specified elsewhere, submit one (1) copy of each of the following per binder:

    a. A final Bill of Materials for each system.

b. A Microsoft Excel (.xlsx format) spreadsheet for each device that resides on the network, provide the following:

   i. IP Address

   ii. MAC Address

   iii. Serial Number

   iv. Manufacturer

   v. Model Number

   vi. Device Username

   vii. Device Password

   viii. Telecom Closet or Rack Location

   ix. Patch Panel Port Number

   x. Switch Port Number

   xi. Any other relevant information as requested by Owner

c. Manufacturers Instruction Manuals: Specification sheets, operation manuals and service sheets published by the manufacturers of the components, devices and equipment provided.

d. Information for testing, repair, troubleshooting, assembly, disassembly, and recommended maintenance intervals.

e. Replacement parts list with current prices. Include list of recommended spare parts, tools, and instruments for testing and maintenance purpose.

f. Performance, Test, and Adjustment Data: Comprehensive documentation of performance verification according to parameters specified herein.

g. Warranties: Provide an executed copy of the Warranty Agreement and copies of all manufacturers' Warranty Registration papers as described herein.

h. Sufficient information, (detailed schematics of subsystems, assemblies, and subassemblies to component level) clearly presented, shall be included to determine compliance with drawings and specifications.

i. Any other items defined herein.

4. Local Reference Diagrams: Within each equipment rack, enclosure, or cabinet, the Contractor shall place a functional diagram of the system(s) in a clear plastic sleeve secured to the equipment rack, cabinet, or enclosure.

5. Intellectual Property: Provide all required items and written release as described herein.

6. Training Program: Proposed training materials and program outline.

7. Spare Parts and Remote Controls: Contractor shall submit record of Owner sign-off of turnover of spare parts and remote controls.

1.19 PROJECT MANAGEMENT

A. Project Manager: Contractor shall appoint a Project Manager who will be the main point of contact for Owner and Consultant regarding the project.

B. Responsibility: Project Manager is responsible for the following:

1. Successfully completing the contract in a timely manner.

2. Overseeing work and performance of all employees and Subcontractors who have been hired by Contractor, and ensuring compliance with specification.

3. Completing and submitting required documentation.

4. Attending project coordination meetings as required by Owner, Consultant, and Contractor. Contractor is responsible for taking minutes of these meetings and distributing copies to all participants in a timely manner.

5. Coordinating with Owner, Consultant, Architect, General Contractor, and other Contractors involved in the project to ensure smooth flow of work and on-time project completion.

6. Providing a written weekly progress update to the Owner and Consultant in a PDF format emailed to the project team.

7. Reporting all unexpected conditions and problems that may result in delay or expense to Owner and Consultant immediately upon discovery.

C. Change of Project Manager: If Contractor seeks to change Project Manager during the course of the Project, such change is subject to prior written approval from Owner.

D. The Owner reserves the right to request a change of project manager at any time for any reason.

1.20 EXAMINATION OF EXISTING CONDITIONS

A. Examination: Contractor shall examine the facility and construction documents to the extent necessary to plan for efficient installation strategies prior to the delivery of materials to the site or the commencement of work. Other documents (Architectural Drawings, hardware schedules, etc.) may be made available upon request. Failure to adequately complete the examination shall not result in change order requests.

B. Acceptance of Conditions: Commencement of work by Contractor shall indicate acceptance of existing conditions, unless a written notice of exceptions has been provided to Owner prior to commencement.

C. Observation: If Contractor observes—during preliminary examinations or subsequent work—existing violations of fire stopping, electrical wiring, grounding, or other safety- or code-related issues, Contractor shall report these to Owner in a timely manner.

D. Pre-Existing Damage: If Contractor observes damage to finished surfaces before they begin installation in any area, Contractor shall document by taking digital photos of the damaged area(s) and immediately notify Construction Manager and Consultant via email with attached photos.

E. Damage during Installation: Any damage caused by, or reasonably believed by the Construction Manager to be caused by the Contractor shall result in back-charges for said damages. Repairs shall match preexisting color and finish of walls, floors, and ceilings. Any Contractor damaged ceiling tiles, floor, and carpet shall be replaced to match color, size, style, and texture.

1.21 CONTRACT MODIFICATION PROCEDURES

A. Changes: Changes to the contract may be initiated by Owner, Consultant or Contractor.

B. Request for Information (RFI): If a change originates with Contractor, the Contractor shall submit an RFI for Consultant review. If it is deemed a change is necessary, the Consultant shall issue a PR to address the change.

C. Proposal Request (PR): If a change originates with Owner or Consultant, Consultant shall issue a Proposal Request to Contractor.

D. Change Proposal (CP): If a change originates with Contractor, or if Contractor receives a Proposal Request from Consultant, Contractor shall submit a Change Proposal to Consultant to review.

1. References: A Change Proposal shall reference the work to be performed, and shall include the cost change to the Project (if any) and the time change to the scheduled completion (if any).

2. Additional Information: Consultant may request additional information to be supplied with the Change Proposal for consideration.

3. Acceptance: Owner reserves the right to accept or reject Change Proposals.

E. Change Order: A Change Order is a modification of the contract.

1. If a Change Proposal is approved, Owner will issue a Change Order that references PR and/or CP. Change Order is not valid until it has been signed by Owner.

2. Work performed or equipment supplied outside of contract without a valid Change Order is done at Contractor’s own risk.

1.22 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Storage: Contractor shall provide secure material storage. If Contractor chooses to store cabling or equipment at project site, that Contractor shall receive written approval from GC or Owner to identify acceptable location. All equipment provided by the Contractor remains the responsibility of that Contractor until Owner has beneficial use of the equipment.

B. Protection: Contractor shall take all necessary precautions to protect materials from the following:

1. Theft
2. Vandalism/Tampering
3. Dents
4. Scratches
5. Dust
6. Temperature
7. Weather
8. Cutting
9. Paint
10. Other hazardous conditions

C. Replacement: Contractor shall replace any damaged or lost material as required by Owner or Consultant.

D. Installed Materials: Installed materials remain the responsibility of the Contractor until Acceptance. Contractor shall take necessary precautions to ensure the safety and security of installed materials.

1.23 INTERFERENCE WITH THE FACILITY

A. Transportation and storage of materials at the facility, work involving the facility, and other matters affecting the habitual use by the Owner of the Owner's buildings, shall be conducted to minimize interference, and at times and in a manner acceptable to the Owner.

1.24 ON-SITE CONDUCT

A. Conduct: Any demonstration of rudeness, use of profanity, or lack of respect by Contractor Personnel to a building tenant will be cause for immediate removal from the premises, and such Personnel will not be allowed to return. Contractor and Contractor's Personnel are to remain in project area.

B. Vandalism: Graffiti or vandalism will not be tolerated. Any Contractor/Personnel caught in the act shall be immediately removed from the premises and will not be allowed to return.

C. Hazardous Conditions: No one shall be allowed to endanger the building, its premises, or its occupants in any manner whatsoever. In the event that a situation occurs which threatens the building or its occupants in any manner, Contractor, Contractor Personnel, Subcontractor, etc. shall take immediate steps to correct the hazardous condition. In the event that Contractor's Personnel fail to correct hazardous condition, Owner reserves the right to immediately take steps to correct the situation at Contractor's expense.

1.25 SAFEGUARDS AND PROTECTION

A. Barriers: Provide and maintain suitable barriers, guards, fences and signs where necessary to accommodate the safety of others relative to and/or for the protection of this work.

B. Regulations: Comply with OSHA, Federal, State, Local, and Owner regulations and standards pursuant to this work.

C. Protection: Protect all materials and equipment to prevent the entry or adhesion of any and all foreign material. If necessary, cover equipment with temporary protective material suitable for this purpose.

D. Finishing: Check, clean and remove defects, scratches, fingerprints and smudges if necessary from all equipment and devices immediately prior to Acceptance of the Installation.

E. Damage: Replace all damaged or defective material or work at no additional cost prior to Final Acceptance.

F. Documentation: Provide written description of accidents by workers, staff, and general public of any incident occurring on the project. Report incident in writing to Owner's representative immediately and to the Project Manager for follow up.

1.26 OWNER-FURNISHED PRODUCTS

A. Delivery: Owner is responsible for delivery of Owner-furnished products to the project site, unless otherwise specified in this document.

B. Placement: Contractor is responsible for locating, inspecting, and moving Owner-furnished products to their final installation position.

C. Inspection: Contractor shall report any damage, discrepancies in quantity, type, or function to Owner and Consultant immediately upon discovery.

D. Warranty: Contractor assumes no responsibility for any material warranty for Owner-furnished products. Contractor shall be responsible for integrating, cabling, and installing Owner-furnished products under the same warranty conditions as other products furnished by Contractor.

1.27 QUALITY ASSURANCE

A. Assurance: It is the intent of these specifications to describe and provide for a complete, professional, and reliable installation.

B. Qualifications: Contractor employees who are engaged in installation shall be adequately trained in the tasks they are expected to perform.

C. Acceptability: Owner shall determine the acceptability of work.

D. Regulatory Requirements: Contractor shall comply with code requirements that apply to the work being performed.

E. Certifications: Where manufacturer certifications are required for warranty or for authorized resale, installation personnel shall have received such certification prior to the start of installation of those manufacturers' materials.

1.28 QUALITY CONTROL

A. Installation: During installation period, when connections are made to the Owner's existing infrastructure, Contractor shall use care to ensure that such connections will not have a negative impact which could reduce or hamper existing systems.

1.29 OWNER'S RIGHT TO USE EQUIPMENT

A. The Owner reserves the right to use equipment, material and services provided as part of this work prior to Acceptance of the Work, without incurring additional charges and without commencement of the Warranty period.

1.30 INTELLECTUAL PROPERTY OWNERSHIP

A. All intellectual property shall remain in escrow for an unlimited period of time. All supporting documentation including but not limited to: software, firmware, programming, uncompiled source code, graphic files, diagrams, written and electronic files, including all latest versions of the documentation and software necessary to edit and adapt the system(s), shall be provided to the Owner on a CD or DVD for all spaces and all systems. The integrator and/or programmer shall also maintain a current live copy incorporating all system modifications to be provided at the Owner's request and for system restoration upon a failure.

B. A written release shall be given by the Contractor and all other required parties for all programming and configuration done by the Contractor and/or Subcontractors. This release will acknowledge the Owner's ownership and right to modify the intellectual property directly, or to have the intellectual property modified by any party of the Owner's choosing.

PART 2 - PRODUCTS

2.01 BASIC EQUIPMENT AND MATERIALS REQUIREMENTS

A. Standards: Equipment and materials used to accomplish the goals of this project shall meet standards for good engineering practice as defined within this document.

B. Quality: Products specified in these documents are intended to establish a baseline or operational, functional, and performance-based standards that all proposed products shall meet or exceed by functionality and quality.

2.02 FACTORY-ASSEMBLED PRODUCTS

A. Manufacturer: Reference to specific equipment manufacturers does not imply that all products produced by that manufacturer meet the specification requirements.

B. Age of Equipment: Equipment shall be new and unused with full manufacturer's warranties. Contractor shall supplement such warranties as required by the specification. Contractor shall immediately notify Consultant of any product that will be or is expected to be discontinued by the end of the project for resolution.

C. No Modification: Where a product is available from a factory/manufacturer to meet the needs as outlined, that product shall be used without modification to ensure the full factory warranty is maintained.

D. Like Materials: Like materials used shall be of the same manufacturer, model, and quality unless otherwise specified.

E. Software/Firmware: No software or firmware is to be used unless specifically authorized by Owner or its appointed representative.

2.03 RACKS, CABINETS, HARDWARE

A. Equipment Racks and Cabinets: Provide racks and cabinets as specified herein and/or described in accompanying documents, appendices, or drawings. Verify that any existing racks and/or cabinets provided by others are complete, bringing any discrepancies to the attention of Owner and Consultant prior to beginning the installation.

B. Shelves and Mounts: Contractor shall supply necessary mounting hardware to install rack-mounted equipment. Mounting hardware shall be a product of the manufacturer of the equipment to be mounted, or manufacturer of the rack system, or approved by either for use with their product. Provide supporting channels, shelves, rack mounts, and/or rack ears as recommended by equipment manufacturers.

C. Screws and Washers: Contractor shall provide screw head types appropriate to the level of security required for the equipment and racking. Screws shall include polyethylene or nylon washer.

1. Public Access Areas: Star post or square post security screws shall be used for hardware and equipment mounted in equipment racks and consoles in areas that are accessible to the public.

2. Restricted Access Areas: Philips head screws may be used where a secure room entrance or locked rack/console door prevents public access.

2.04 POWER DEVICES

A. Power Strips: Unless otherwise specified, power strips shall be UL listed, surface mounted, and rated for 20 amp continuous electronic loads. Outlets shall be 125 volt, 20 amp, three-wire, grounded, and NEMA 5-20R compliant. Cords shall be 12/3 SJT with molded plug.

B. Power Distribution Panels: Unless otherwise specified, power distribution panels shall be UL listed, rack mounted, rated for 20 amp continuous electronic loads, with switch and pilot light. Up to eight outlets shall be mounted to the back, each rated 125 volt, 20 amp, three-wire, grounded, and NEMA 5-20R compliant. Switch and pilot shall be mounted to the front. Cords shall be 12/3 SJT with molded plug.

C. Contractor shall provide acceptable power distribution units as required in order to provide sufficient outlet connectivity for Contractor-furnished and Owner-furnished equipment indicated on drawings and equipment schedules, plus up to 15% additional capacity for future growth. This may be in addition to any power distribution equipment indicated on equipment schedules.

2.05 CABLE AND CONNECTORS

A. Cable: Cable shall be selected and applied in a manner defined by signal type, consistent with best industry practices. Highest quality products shall be used with attention given to transmission characteristics, termination methods, resistive and complex impedance at operating frequencies, and insulating material characteristics. Where required by the NEC, substitutions of air handing plenum cable shall exactly match the normally applied product and shall meet the standards of UL Standard #900 and the NEC Articles 800 and 820.

B. Connectors: Highest quality products shall be used with attention given to transmission characteristics, termination methods, resistive and complex impedance at operating frequencies, and insulating material characteristics. Strain reliefs and cable clamps shall be sized for the connector and the cable.

C. Color: Cable and connector color shall be coordinated with Consultant to maintain consistency with cable and connector color schemes used by other trades.

2.06 CABLE MANAGEMENT

A. Plastic Cable Ties: Single use white nylon plastic cable ties, appropriate screw fittings, or mounting clips may be used for AC power cable management within racks and enclosures. Plastic/nylon cable ties shall not be used for signal and DC cables.

B. Velcro Cable Ties: Velcro straps shall be used for all signal and DC cables. Velcro straps shall be black, with no logo or decoration, except as authorized by Consultant.

2.07 ANCILLARY HARDWARE

A. General: Contractor shall provide ancillary and required accessory items necessary to provide a complete and fully functional system to Owner.

B. Interpretation: Exclusion of or limitation in the language used in the drawings or specifications shall not be interpreted as meaning that ancillary or accessory items ofwork or equipment necessary to complete or make the installed system fully functional can be omitted.

2.08 GROUNDING HARDWARE

A. Refer to Section 270526 for specific Grounding and Bonding requirements.

B. Provide data/telecommunication grounding systems indicated in the project drawings and specifications. Products shall include, but are not limited to, cables/wires, connectors, terminals, compression lugs, grounding rods/electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, ANSI/TIA and established industry standards for applications indicated.

2.09 COMPATIBILITY OF RELATED EQUIPMENT

A. Existing Equipment: Equipment and systems specified in these documents shall be assumed to be compatible with the systems already installed at Owner site(s) and as identified in this document as related to this project.

B. Installed Equipment: Specified equipment and systems shall be compatible with all other equipment and systems as offered by Contractor, thus placing the responsibility on Contractor to ensure proper interaction.

2.10 LICENSES

A. Any and all licenses required for system functionality shall be provided.

2.11 SPARE PARTS

A. Suggested List: Contractor is requested to submit a list of suggested spare parts with an offered price, allowing Owner to select appropriate parts.

B. Means of Obtainment: Contractor shall state where spare parts can be obtained after the installation.

2.12 MAINTENANCE MANUALS

A. Contractor shall produce a maintenance manual showing interconnection of equipment and any special procedures necessary for proper operation and maintenance of the systems.

PART 3 - EXECUTION

3.01 GENERAL

A. Contractor shall provide, furnish, deliver, transport, erect, install, connect and configure all of the material and equipment described herein or depicted on any bid package document or drawing, as required for a turnkey solution.

3.02 COORDINATION

A. General: Contractor shall cooperate with other Contractors for proper provisioning, anchorage, placement, and execution of all work. Interference between the work of various Contractors shall be resolved before installation. In the event of conflict on space requirements or location of devices, refer the matter to Owner and Consultant for decision.

B. Related Work: References to the following related work do not limit or release Contractor from the responsibility of coordination with other trades or from having the necessary knowledge of other non-referenced work.

1. Work by General Contractor.
2. Work by other Technology Contractors.
3. Work by Electrical Contractor, including electrical rough-ins and surface-mounted raceway.

C. Delays: Contractor shall coordinate with all other trades to avoid causing delays in the installation schedule.

D. AC Power: Contractor shall coordinate with General Contractor its requirements for proper AC power to service all equipment installed by Contractor.

E. Low Voltage Sleeving: Contractor shall provide openings through walls as necessary, with sleeving and fire-stopping materials installed in a professional manner to meet local and national codes.

F. Grounding and Bonding: Contractor shall coordinate with General Contractor its requirements for proper grounding and bonding to their equipment.

G. Surface-Mounted Raceway Coordination

1. General and Electrical Contractors: Contractor shall coordinate with General Contractor and Electrical Contractor the installation of surface-mounted-raceway where not provided but made necessary by non-penetrable wall.

2. Verification: Contractor shall field verify and coordinate the proposed use of surface-mounted raceway at any location with Consultant and Owner.

3.03 BASIC EXECUTION REQUIREMENTS

A. General: Contractor is responsible for following industry standards of good practice for telecommunications and networking equipment.

B. Aesthetic Factors: With the installation of equipment and cables, consideration shall be given not only to operational efficiency but also to overall aesthetic factors. Contractor shall redo, at no cost to Owner, any work deemed by Owner to appear sloppy, hastily done, or unprofessional. Owner shall make final decision over whether work shall be redone.

C. Manufacturers' Recommendations: Manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers or as indicated in their published literature unless otherwise noted herein.

D. Protection of Work Area: Work shall be properly protected during construction; including shielding soft or fragile materials, protecting against dust and dirt, protecting and supporting cable ends off of the floor and from other traffic, protecting floor box lids, and temporarily plugging open conduits during construction. Upon completion, installation shall be thoroughly cleaned and all tools, equipment, obstructions, or debris present as a result of work shall be removed from the premises.

E. Protection of Cable and Equipment: Contractor shall make appropriate preparations to protect all cabling and equipment from foreign material. Foreign material is defined as any substance or material that would void the manufacturer's performance warranty, impact ratings (UL, Plenum, etc.), or cover up markings needed for inspection. Foreign material includes, but is not limited to, paint overspray (intentional or not), fire-stopping material, drywall compound, or any other chemical, liquid, or compound that could come in contact with cables, cable jackets, cable termination points, or other equipment.

1. Cleaning of cables or equipment with harsh chemicals from a failure to comply with Protection of Cable and Equipment clause is unacceptable. Contractor shall replace any affected cable, cable components, or equipment in their entirety at Contractor's sole cost.

F. Waste Materials: Contractor shall keep work area neat, orderly, and free from accumulation of waste materials. Remove trash and debris from the building and job site as required to maintain a clean work environment at all times. Rubbish shall be moved to a common trash point or receptacle on the job site as determined and directed by General Contractor or Owner.

G. Dumpsters: No construction debris shall be placed in building's dumpsters. Contractor shall provide a dumpster for construction waste and debris at own expense. Said dumpster shall be emptied on a regular schedule. Location of dumpster shall be arranged through Building Management. Appropriate measures shall be taken to protect asphalt or other ground surfaces.

H. Ceiling Grid: Contractor shall not hang cable supports from ceiling grid wire.

I. Roof Deck: Contractor shall not shoot into the roof deck for mounting cable hangers.

J. Mounting: Equipment and enclosures shall be mounted plumb and square in relation to the structure.

K. Raised Floor: All cabling installed below the raised floor shall be placed in the provided cable trays with appropriate means to hold cable in place. If no cable tray exists, Contractor shall provide J-hooks to hold cables in place. Sleeves shall be utilized for cable egress.

L. Motorized Furniture: Care shall be taken to properly dress all cables placed within motorized furniture and provide sufficient cable length and strain relief to allow motorized elements to operate within their full range of travel.

M. Flexible Furniture: Care shall be taken to properly dress all cables placed within flexible or re-configurable furniture to provide sufficient cable length and strain relief to allow full range of travel for flexible furniture configurations.

3.04 PREPARATION

A. Existing Equipment: Prior to any installation, the Contractor shall prepare the site by removing any remaining debris, leveling equipment racks (where appropriate), and verifying information and systems stated to be in-place are ready for use.

B. Equipment for Installation: Prior to installation, Contractor shall ensure that required major equipment has been secured and is ready for installation.

3.05 CLEANING

A. Tool Clean-up: Contractor is not permitted to use restrooms for tool clean-up. A slop-sink may be provided in janitorial closet on each floor for cleaning of tools and equipment and as a source of water. Janitorial closet or maintenance area or shop shall be kept clean at all times. Contractor or Contractor's Personnel found using restrooms for clean-up or other similar purposes shall be subject to removal from building.

B. Daily: At the end of each work period or day, Contractor shall remove excess packing, drilling remnants, and other non-equipment related parts, materials, or debris to ensure a clean, safe, and professional working environment.

C. Carpet: Contractor shall ensure that no damage to carpeting occurs as a result of their work. Contractor shall cover carpets in areas of work to prevent wire and other debris from entering the carpet.

3.06 FIRE STOPPING

A. Contractor is responsible for applying fire-stopping material in and around all openings that it creates or are created for it, whether or not specifically indicated in specifications or project drawings, where code requires the use of fire stopping material.

B. Contractor shall ensure that all fire-stopping materials meet appropriate codes and are installed in a neat and workman like manner.

3.07 WATERPROOFING

A. Contractor is responsible for creating a waterproof seal in and around any openings to the outside environment that are created by Contractor or for systems being installed.

B. Contractor shall ensure that all waterproof materials meet appropriate codes and are applied according to good engineering practice.

3.08 RACKS, CABINETS, AND HARDWARE

A. Racks and Cabinets: Contractor shall assemble and install racks and cabinets.

B. Installation Hardware: Install hardware in a secure manner. Screws shall be tightened to a torque just sufficient to secure equipment without deforming washers beyond their original diameter.

C. Considerations: Rack mount equipment shall be secured as recommended by the manufacturer with consideration to airflow, power, and in/out connections.

D. Cross Connections: Where cross connections are required between equipment, interconnections shall be installed using cable management devices to secure cables in a neat and workmanlike manner, applying best industry practices.

3.09 INSTALLATION REQUIREMENTS

A. Cable pulling shall be done in accordance with cable manufacturer's recommendations and ANSI/IEEE C2 standards. Recommended pulling tensions and pulling bending radius shall not be exceeded. Any cable bent or kinked to radius less than recommended dimension shall not be installed.

B. All cable shall be pulled by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to ensure that the maximum tensile load for the cable as defined by the manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of a "break-away", or other approved method.

C. Qualified personnel utilizing state-of-the-art equipment and techniques shall complete all installation work. During pulling operation, an adequate number of workers shall be present to allow cable observation at all points of pathway entry and exit.

D. All cable shall be free of tension at both ends.

E. PLENUM rated cable shall be used in areas used for air handling or where required by code.

F. Contractor shall replace any cables that have been damaged or abraded during installation.

G. Pulling lubricant may be used to ease pulling tensions. Lubricant shall be of a type that is non-injurious to the cable jacket and other materials used and will not harden or become adhesive with age.

H. A pull cord (nylon; 1/8” minimum) shall be co-installed with all cable installed in any conduit or surface mount raceway.

3.10 CABLE

A. Cable treatment: Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the rating of the manufacturer.

B. Splicing

1. Voice, data, and other twisted pair cables: No splices shall be installed in any voice, data or twisted pair cables.

2. Technology systems: No splices shall be installed in any cable less than five hundred (500) feet in length.

3. Digital multimedia/video cables: No splices are allowed in any digital multimedia/video cable.

4. Overhead paging systems: Cable splices for constant voltage overhead paging system shall occur only at speaker, amplifier or volume control knob locations.

C. Lengths

1. Variations: Where cables are to be of the same length, variations in the length shall be less than plus or minus ½ inch. Lengths of cables are based on the length of the unterminated signal conductors.

2. Labeling: Cables, regardless of length, shall be marked with a labeling scheme approved by Consultant.

3. Service Loops: A surplus of cable, located at or near the point of termination to facilitate potential future changes, shall be provided where appropriate. Cables shall have a minimum cable slack of 10ft (3m) at the telecommunication room(s) and 3.28ft (1m) at each telecommunications outlet in the suspended ceiling unless noted otherwise. Service loops shall be stored in an extended loop or in a figure-eight configuration, not in bundled loops.

D. Grouping

1. Cables shall be separated into like groups according to signal or power levels.

2. Power Cable Group: Power cables shall be secured to one side of the rack separate from any low-energy signal cable groups. Separation shall be a minimum of 4” in all directions.

3. Signal Cable Group: Signal cables shall be grouped according to signal type and secured to one side of the rack separate from any power cable groups. Separation shall be a minimum of 4” in all directions.

E. In Equipment Racks

1. Equipment rack wiring and cabling shall be neatly dressed.

2. Fastening: Rack cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame.

F. Support for Cables Outside of Equipment Racks

1. External wire and cables shall be supported at least every 5 feet (1.5m) from the structure and as required to maintain less than 12 inches of cable sag between supports without over-tensioning the cables. Contractor shall vary the precise distance between cable supports on long runs to avoid harmonics issues.

2. Hardware: Cables shall be supported by J-hooks, cable tray, or ladder rack. Hardware shall be secured to building structure using 3/8” threaded rod supports.

a. Right Angles: Cables are to run at right angles to the structure, placed above ceiling in halls or corridors.

b. Height: Cables shall not run above red iron joist.

G. Concealment: Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests. Cabling systems installed in public areas shall be installed within walls, ceiling, or floors or within surface wiring pathways, as dictated by codes and good engineering practice.

H. Velcro Straps for Horizontal Cabling: Straps shall be installed snugly without deforming cable insulation. Straps shall be spaced at uneven intervals not to exceed 4 feet.

I. Cable Ties and Velcro Straps within Equipment Racks and Cabinets: Ties and straps shall be installed snugly, without deforming cable insulation, at uneven intervals not to exceed 8 inches. Cable ties shall only be used for non-signal carrying cables. No sharp burrs shall remain where excess length of the cable tie has been cut.

J. Obstruction: Contractor shall notify Owner immediately if any obstruction or hazard is discovered in a pathway provided by others.

3.11 CONNECTORS

A. Preparation: Cables shall be carefully prepared and connectors installed as directed by the manufacturer. Proper stripping devices and crimping tools shall be used.

B. Terminations: Connectors shall be carefully fitted to mating devices on equipment to avoid damage to mating contacts, inserts, or bodies. Specialized terminations shall be made in a neat and secure manner suited to the service of the wire and as directed by the manufacturer. Contractor shall use manufacturer specified terminations when those specifications exist.

C. Soldering: A person skilled in that practice shall execute soldered terminations. Any excessive insulation displacement resulting from soldering shall be grounds to require the Contractor to re-terminate the connector.

D. Adapters: Adapters shall be used only where the identity of the necessary type of connector is unknown at the time of installation, such as for Owner-provided equipment or in anticipation of future equipment upgrades, with Consultant's approval.

3.12 SPARE PARTS AND REMOTE CONTROLS

A. Keys: Contractor shall turnover all keys, tagged and organized by type on individual key rings, to Owner upon project completion.

B. Refer to individual sections for spare parts and remote control requirements.

3.13 EQUIPMENT INSTALLATION

A. General: Contractor shall make system properly operational and physically secure by mounting equipment and related accessories into furniture, consoles, and racks as required. Manufacturer's guidelines for installation shall be followed. Discrepancies in installation procedure or inability to complete a given task due to a shortage of materials or malfunctioning equipment shall be reported to Consultant immediately upon discovery.

B. Equipment Placement: Contractor shall locate equipment as indicated on drawings and as specified herein. Where such information is not provided, Contractor shall follow industry best practices and locate operable devices at convenient positions; heat generating devices at the top and seldom-accessed equipment below.

1. Unless otherwise specified, end user-operable devices shall be positioned within the range of front wheelchair access per ADA standards.

C. Equipment Installation: Equipment shall be installed as directed by the manufacturer using equipment manufacturer's desktop mounting frames, equipment tubs, installation hardware, and techniques. Contractor shall be responsible for moving equipment from storage and for providing necessary personnel or devices to carry and lift equipment around obstacles and into operating position.

3.14 SOFTWARE AND FIRMWARE

A. At the completion of the project the Owner shall have the option to receive final software updates and firmware updates to the latest versions before the project is paid in full at no cost to the Owner.

3.15 ROUGH-IN

A. Scheduling: Contractor shall make every effort to install systems per this specification in a timely manner including rough-in of cabling and other apparatus where appropriate to stay on schedule.

B. Protection of Environment: Where cabling and/or equipment is installed prior to other trades completing their work in an area, Contractor shall take necessary precautions to cover, wrap, or otherwise protect to reduce possible damage which may result from plastering, painting, cleaning, or other such work completed after installation and before substantial completion of the project.

3.16 CUTTING, DRILLING, PATCHING, AND PAINTING

A. Coordination: Contractor is responsible for coordinating with the General Contractor and other trades when any cutting or drilling is required for the installation or proper performance of the specified systems.

B. Restoration: Contractor is responsible for returning all surfaces (including walls, floors, and ceilings) to their previous condition after any cutting including painting.

C. Painting: Contractor is responsible to paint all new work including exposed pathway to match the conditions.

3.17 LABELING

A. General: Rack-mounted equipment and hardware shall be labeled as required herein. Connectors, jacks, receptacles, outlets, cables, cable terminations, terminal blocks, rack mounted equipment, active slots of card frame systems, etc. shall be clearly, logically, and permanently labeled in a manner acceptable to Consultant.

B. Approval: Proposed wording and/or numbering schemes for labeling shall be provided to Consultant for review and written approval prior to procurement or installation.

C. Labels used shall be permanent and secure. Provide labeling as follows unless otherwise noted in a specific section:

1. Like Size: All labels, including engraved labels, shall be sized to match other labels used for same purpose.

2. Equipment Racks: For enclosed racks containing equipment, provide labels on each equipment rack rear door or console rear panel reading “No user serviceable parts. Refer service to qualified technician.”

3. Installer and Consultant Identification: Position at the front top center section of each equipment rack a label that states the names of system Installer and Consultant.

4. Custom Panels: Custom panel nomenclature shall be engraved, etched, or screened. Markings are to be designed to ensure consistency and clarity within and without of

system. Verify markings and placements by submitting label sample layouts to Consultant for approval prior to procurement.

5. Documentation: Labeling information shall appear on the as-built drawings.

3.18 FIRE-STOPPING

A. If Contractor removes anything from an opening in a fire-rated wall, Contractor shall restore the fire-rating condition of the wall to the same condition as before Contractor started its work. Depending on the size of the opening, this may involve sheetrock patching, in addition to use of other appropriate fire-stopping materials

3.19 ADDITIONAL ENGINEERING SERVICES

A. General: Contractor is responsible for securing necessary engineering services were needed to meet the needs of the installation.

B. Change Orders: Only when Contractor can show that additional engineering services are needed as a result of changes to the scope of the services being requested in the contract documents will Owner entertain a Change Order Request for these services.

3.20 TESTING

A. Procedure: Contractor shall develop a rigorous testing procedure to ensure full functionality and durability of installed systems under heavy-use conditions.

B. Supplies: Contractor shall supply testing equipment needed to verify compliance with specifications found in these documents.

C. Schedule: Contractor shall complete required testing prior to the substantial completion inspection by Owner and Consultant.

D. Data: Test data shall be properly documented and recorded so that it is available for final inspection.

E. Quality Control: Testing may be repeated during the inspection process at the request of Owner or Consultant.

F. Prior to energizing or testing the system, Contractor shall ensure the following:

1. Installation: Products are installed in a proper and safe manner per the manufacturer's instructions.

2. Cleanliness: Products are neat, clean, and unmarred, and parts securely attached. Dust, debris, solder, splatter, etc., is removed.

3. Cables and Connections: Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

4. Grounding: Electronic devices are properly grounded.

5. AC Power: Each AC power receptacle is tested with a circuit checker for proper hot, neutral, and ground connections prior to connecting equipment.

3.21 GROUNDING

A. Refer to Section 270526 for specific Grounding and Bonding installation requirements.

3.22 TRAINING PROGRAM

A. Contractor shall provide training in the manner delineated below in addition to specific requirements identified in subsequent sections.

B. Contractor shall provide audio-video recording of each training session to Owner.

C. Prior to scheduling or delivering End User training, Contractor shall confirm that:

1. Closeout submittals have been accepted by Owner and Consultant.

2. Final closeout inspection has been completed and punch list items rectified.

3. Training schedule dates have been coordinated with and approved by Owner and Consultant.

D. Training shall include:

1. Approved handouts.

2. Practical and comprehensive operation of systems.

3. Basic system troubleshooting techniques.

4. Basic system maintenance.

E. Training Blocks

1. Training time is defined as those hours specifically set aside for the sole purpose of training end users. Credited time will not be given for any time spent providing instructions to the Owner's staff for a system not completed or that has not passed final acceptance by the Owner and Consultant, or training performed outside of the approved training program.

2. This training will be divided into training session "Blocks" as coordinated with the Owner.

a. The first training session block shall consist of training intended for the common system operators. Such training, at a minimum, shall include the day to day use of the system.

b. The second training session block shall consist of training administrators of the day to day administration of the system. Such training, at a minimum, shall include use of the administration control functions of the systems, user setup, and filtering and pulling reports.

c. The third training session block shall consist of training administrators on system troubleshooting, maintenance, and updates. Such training, at a minimum, shall include using the system tools to diagnose issues, diagnosing common physical equipment issues, performing simple maintenance, and performing system updates.

d. The forth training session block shall consist of a training session structured for high-level users, for example staff trainers who will provide instruction to other users and will include advance system configuration and operational knowledge needed to maintain and manage all specified technology systems. The Contractor may elect to engage the Manufacturer(s) in certifying the high-level end users in the systems at no cost to the Owner.

F. The Contractor shall issue a certificate of training completion to the trainees upon completion of their training. Such certificates must be signed by both the trainer and trainee(s) for the Contractor to receive training credit.

3.23 WARRANTY AND MAINTENANCE PROGRAM

A. Contractor shall provide a warranty conforming to the stipulations below in addition to specific requirements identified in subsequent sections.

B. As part of the base proposal cost, the Contractor shall include a 1-year turnkey warranty period with full support costs.

C. The Warranty period shall begin after all punch list items have been rectified. The Contractor shall receive a letter of completion from the Consultant and Owner indicating project completion and starting the warranty period.

D. The warranty and support work included in this contract shall cover the following materials, software, and services, without additional cost to the Owner:

1. Inspections, preventative maintenance, and testing of equipment and components. The Contractor shall schedule a 10-month on-site preventative system review 10-months into each year of warranty and support including system inspections, preventive maintenance, software upgrades/patches, and testing of equipment and components.

2. Regular Service, Emergency Service, and Normal Service.

3. Labor, travel, equipment, materials, and transportation cost for all services covered by this warranty.

E. Response Time: Contractor shall respond to calls for warranty services in a timely manner as delineated below.

1. The Owner reserves the right to make the final determination of emergency or normal service calls and the right to coordinate the best times for service of any system failure.

2. Emergency service calls are defined as failures which prohibit the use of a typical system function(s) and pose a life safety concern, or such failures which cause a major impact to the Owner's daily operations.

    a. The Contractor shall provide remote service diagnosing the impact within two (2) hours after notification by the Owner.

    b. If remote service does not correct the reported issue, the Contractor shall provide on-site service correcting the impact within four (4) hours after notification by the Owner.

3. Normal service calls are defined as failures which prohibit the use of typical system function(s) but which do not inhibit critical system usage, do not pose life safety concerns, and do not create a major impact to Owner's daily operations.

    a. The Contractor shall provide remote service correcting the impact within twenty-four (24) hours after notification by the Owner.

    b. If remote service does not correct the reported issue, the Contractor shall provide on-site service correcting the impact within forty-eight (48) hours after notification by the Owner.

4. The Contractor shall supply Service Request forms and or proper contact procedure to the Owner with instructions for proper notification of the Contractor for warranty service. By following said instructions, the Owner shall constitute proper notification for any needed warranty service

F. Repair Time: Contractor shall locally stock critical parts in sufficient quantities such that emergency repair or replacement shall be guaranteed within twelve (12) hours. Temporary replacements within this time period shall be acceptable, provided temporary replacements do not compromise system functionality and provided permanent replacement is achieved within ninety-six (96) hours. Contractor may contact the Owner for use of Owner supplied spare parts where delay of system repair will have negative impact on system performance.

G. Transmittal: A copy of this Warranty shall be delivered to and signed for by the Owner's representative whose primary responsibility is the operation and care of these systems. A copy of the signed Warranty document shall be delivered for review as part of the Final Submittals.

H. Registration: Contractor shall register Warranty papers for all equipment and software in the name of the Owner and furnish reproductions of all equipment Warranty papers to the Owner with the Final Submittals.

I. Subcontracting: Warranty service work may not be subcontracted except with specific permission and approval by the Owner.

1. Service/Warranty Procedures: Contractor shall submit a warranty service plan containing all contact information and Owner service call directions for Owner review with project close-out submittals.

J. Resolution of Conflicts:

1. The Owner retains the right to resolve unsatisfactory warranty service performance at any time by declaring the work unsatisfactory and stating specific areas of dissatisfaction in writing.

2. If the Contractor or his approved Subcontractor does not resolve such stated areas of dissatisfaction within ninety-six (96) hours, the Owner may appoint an alternative service agency or person to fulfill the terms of the Warranty at the expense of the Contractor. This action may be taken repeatedly until the Owner is satisfied that Warranty service performance is satisfactory. Satisfactory resolution of a malfunction shall be considered adequate when the device, equipment, system or component which is chronically malfunctioning is brought into compliance with the standards of performance as contained herein and published by the manufacturers of the equipment installed.

END OF SECTION

SECTION 270500 – COMMUNICATIONS GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 270000 for additional project scope information.

B. This section describes the products and execution requirements related to furnishing and installing Category 5e/6/6a Cabling and Termination Components and related subsystems as part of a Structured Cabling System.

C. Others will provide the network electronics for the LAN within the Telecom Rooms (TRs) and will be responsible for connecting the new cabling infrastructure to the LAN. The Contractor, however, shall supply the patch cords. The Contractor shall be available on site during the crossover to assist with any cabling issues that may occur during the connection.

D. The Telecommunication Contractor shall provide and install all sleeves through the wall penetrations as required whether or not specifically marked on Project Drawings, unless otherwise noted.

E. All cables and related terminations support, and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Contractor, as detailed in the following section(s).

F. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association and present manufacturing standards.

G. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

1.02 RELATED WORK

A. Section 270000 – General Technology Requirements

B. Section 270526 – Grounding and Bonding for Technology Systems

C. Section 270528 – Pathways for Technology Systems

D. Section 270537 – Firestopping for Technology Systems

E. Section 271100 – Communications Equipment Rooms

F. Section 271300 – Communications Backbone Cabling

G. Section 271500 – Communications Horizontal Cabling

H. Section 271600 – Communications Connecting Cords

I. Section 271800 – Communications Labeling and Identification

J. Section 274000 – AV/Multimedia General Requirements

K. Section 274100 – Audio Visual Systems

1.03 DEFINITIONS

A. Refer to Section 270000 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. Refer to Section 270000 for additional requirements.

B. All references relate to the current version adopted by the city/county according to the authority having jurisdiction (AHJ). If the city/county has not adopted a version the latest version shall be utilized.

C. ASTM B633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel

D. ASTM A653: Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process

E. ASTM A123: Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel

F. ASTM A510: Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

G. ANSI/TIA 569-C: Telecommunications Pathways and Spaces

H. ANSI/TIA 568-C.0, 1, 2, 3, 4: Commercial Building Telecommunications Standard

I. ANSI/TIA-598-C-2005 – Optical Fiber Cable Color Coding

J. ANSI/TIA 606-B: Administration Standard for Telecommunications Infrastructure

K. ANSI/TIA 942-A: Telecommunications Infrastructure Standard for Data Centers

L. ANSI/TIA 607-B: Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises

M. IEEE: National Electrical Safety Code® (NESC®)
standards.ieee.org/about/nesc

1.05 QUALIFICATIONS

A. Refer to Section 270000 for additional requirements.

B. Premises Distribution System: Written certification that the premises distribution system complies with the EIA ANSI/TIA/EIA-568-C.0,1, 2, 3, EIA ANSI/TIA/EIA-569-B, and ANSI/TIA/EIA-606-A.

C. Materials and Equipment: Where materials or equipment are specified to conform, be constructed, or be tested to meet specific requirements, Contractor shall supply, upon request by Consultant or Owner, certification that the items provided conforms to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements, or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

D. Certifications

1. The Contractor shall have an RCDD (Registered Communication Distribution Designer) on staff assigned to manage this Project; documented proof shall accompany the proposal response.

2. All installing personnel shall have completed and be certified in manufacturer training or BICSI (Building Industry Consulting Service International) installation training for UTP infrastructure systems, or the Contractor shall contract with manufacturer for installation of all proposed components. Company Certifications shall accompany the proposal response.

3. The Contractor's technicians shall be certified and trained in the connectivity hardware which is being installed.

4. The Contractor shall submit certification that installers are factory certified to install and test the provided products. No less than half of the crew to be used for the telecommunications installation shall be trained by that manufacturer for the work.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Shop Drawings in addition to requirements in Section 270000:

1. Equipment rack elevation details

2. Elevations of telecommunication room walls with planned mounted equipment

3. Outlet faceplate details for all outlet configurations, sizes, and cable types

4. Overhead telecommunication room enlargements, providing dimensions of room and clearance for maintenance and operation

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 270000 for requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 270000 for requirements.

1. Data cable test results
2. CD containing:
    a. As-built drawings (CAD format)
    b. As-built drawings (PDF format)
    c. Detailed test results in original tester format (e.g. Fluke Linkware)
    d. Detailed cable test results in PDF format
3. Warranty certification from connectivity manufacturer

1.09 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall be responsible for all materials until completion of Project.

B. Cable shall be stored according to manufacturer's recommendations at minimum. In addition, cable shall be stored in a location protected from vandalism and weather.

C. If cable is stored outside, it shall be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees Fahrenheit, the cable shall be moved to a heated (minimum 50 degrees Fahrenheit) location. If necessary, cable shall be stored off site at the Contractor's expense.

D. If the Contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.

E. Commercial off-the-shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 270000.

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 270000 for additional requirements.

3.02 TRAINING

A. Refer to Section 270000 for additional requirements.

3.03 WARRANTY

A. Refer to Section 270000 for additional requirements.

B. The Contractor shall provide to the Owner a manufacturer's 15-year minimum warranty certificate for all materials, equipment, etc. Upon successful completion of the installation and subsequent inspection, the Owner shall receive the numbered certificate from the manufacturing connectivity hardware (patch panels, jacks, parch cords 110 blocks, etc.) company registering the installation. This warranty shall include all labor, materials, and travel time.

C. The warranty shall ensure against product defects and guarantee that all approved cabling components exceed the specifications of TIA/EIA-568-C and ISO/IEC IS 11801 for cabling links/channels, and that the installation will exceed the loss and bandwidth requirements of TIA/EIA 568-C ISO/IEC IS 11801 for fiber links/channels for a fifteen (15) year period. The warranty shall apply to all passive structured cabling system components.

D. The warranty shall cover the failure of the wiring system to support the application that it was designed to support, as well as additional application(s) introduced in the future by recognized standards or user forums that use the TIA/EIA 568-C or ISO/IEC IS 11801 component and link/channel specifications for cabling. Such warranty shall apply for a minimum of a fifteen (15) year period.

E. The warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective products(s), labeling of the new components, and testing of the circuit(s) at no cost to the Owner.

3.04 EXAMINATION

A. Verification of Conditions: Contractor shall examine areas and conditions under which work is to be performed and identify conditions detrimental to proper and timely completion.

B. Contractor shall verify that cable lengths comply with published standards.

C. Contractor shall notify Owner of any proposed installation which is expected to exceed maximum lengths prior to installation of cable.

D. Contactor shall consult with Owner regarding alternative routing or location of cable.

E. Contractor shall not proceed until unsatisfactory conditions have been corrected.

3.05 INSTALLATION REQUIREMENTS

A. Refer to Section 270000 for additional requirements.

3.06 COOPERATION

A. The Contractor shall cooperate with other trades and General Contractor's personnel in locating work in a proper manner.

B. Should it be necessary to raise, lower, or move longitudinally any part of the work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

3.07 TESTING AND ACCEPTANCE

A. The Contractor shall perform acceptance tests as indicated below for each subsystem (backbone, station, etc.) as it is completed.

B. The Contractor shall supply all equipment and personnel necessary to conduct the acceptance tests. Prior to testing, the Contractor shall provide a summary of the proposed test plan for each cable type, including equipment to use, setup, test frequencies or wavelengths, results format, etc. The Consultant will approve the method of testing.

C. The Contractor shall visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. The Contractor shall provide the Consultant with a written certification that this inspection has been made.

D. The Contractor shall conduct acceptance testing according to a schedule coordinated with the Consultant. Representatives of the Owner may be in attendance to witness the test procedures. The Contractor shall provide a minimum of one (1) week advance notice to the Consultant and Owner to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.

E. Tests related to connected equipment of others shall be done only with the permission and presence of Contractor involved. The Contractor shall ascertain that testing only as required to prove the wiring connections are correct.

F. The Contractor shall provide Consultant with test results and descriptions of the testing methodology, including the date of the tests, the equipment used, and the procedures followed. At the request of the Consultant, the Contractor shall provide copies of the original test results.

G. All cabling shall be 100% fault free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the Contractor's expense. The applicable tests shall then be repeated.

H. Backbone voice cables shall be free of shorts within the pairs and be verified for continuity, pair validity and polarity, and conductor position on the termination blocks (e.g., 110). Any mispositioned pairs shall be identified and corrected. The percentage of "bad" pairs shall

not exceed 1% in any backbone (riser or tie) cable based on total pair count. All bad pairs shall be identified and documented.

I. The Consultant or Owner may request that a 10% random field re-test be conducted on the cable system to verify documented findings.

1. If requested, the Contractor shall test up to 10% of cable links at no cost to the Owner.

2. Tests shall be a repeat of those defined above and under Testing and Acceptance. If findings contradict the documentation submitted by the Contractor, additional testing shall be performed to the extent determined necessary by the Consultant, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.08 FIRE STOPPING

A. Contractor shall seal any openings created for cable pass-through between floors or through fire rated walls. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Creation of such openings as are necessary for cable passage between locations as shown on the Drawings shall be the responsibility of the Contractor. Any openings created by or for the Contractor and left unused shall also be sealed as part of this work.

END OF SECTION

SECTION 270526 – GROUNDING AND BONDING FOR TECHNOLOGY SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 270000 for additional project scope information.

1.02 RELATED WORK

A. Section 270000 – General Technology Requirements

B. Section 270500 – Communications General Requirements

C. Section 270526 – Grounding and Bonding for Technology Systems

D. Section 270528 – Pathways for Technology Systems

E. Section 270537 – Firestopping for Technology Systems

F. Section 271100 – Communications Equipment Rooms

G. Section 271300 – Communications Backbone Cabling

H. Section 271500 – Communications Horizontal Cabling

I. Section 271600 – Communications Connecting Cords

J. Section 271800 – Communications Labeling and Identification

K. Section 274000 – AV/Multimedia General Requirements

L. Section 274100 – Audio Visual Systems

1.03 DEFINITIONS

A. Refer to Section 270000 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. IEEE C2 - National Electrical Safely Code

B. IEEE Std. 837-2002, or latest version – Standard for Qualifying Permanent Connections Used in Substation Grounding

C. ANSI/TIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications

D. NFPA 70E - Standard for Electrical Safely in the Workplace

E. ANSI/NECA/BICSI-607 - Telecommunications Bonding and Grounding Planning and Installation methods for Commercial Buildings

F. UL 467 - Standard for Grounding and Bonding Equipment

G. Refer to Section 270000 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 270000 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 270000 for additional requirements.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 270000.

2.02 GROUNDING AND BONDING CABLE

A. The grounding and bonding cable shall be stranded copper conductors.

B. The grounding and bonding cables shall have a green jacket color and riser or plenum rated as required.

C. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications, or as required by NFPA 70, whichever is larger. Differentiate between normal ground and isolated ground when both are used within the same facility.

2.03 GROUNDING AND BONDING BUSBARS

A. Telecommunications Main Grounding Busbar (TMGB)

1. Factory-drilled solid copper with holes to accommodate lugs. Field manufactured busbars are not acceptable.

2. 0.25” thick x 4” wide

3. Sized for current applications and future growth, no less than 18”

4. Insulated from its support
5. Shall be an electro-tin plated busbar
6. Maintain a minimum of 2” of clearance from wall
7. UL listed and BICSI certified

B. Telecommunications Grounding Busbar (TGB)

1. Factory-drilled solid copper with holes to accommodate lugs. Field manufactured busbars are not acceptable.
2. 0.25” thick x 4” wide
3. Sized for current applications and future growth, no less than 12”
4. Insulated from its support
5. Shall be an electro-tin plated busbar
6. Maintain a minimum of 2” of clearance from wall
7. UL listed and BICSI certified

C. Horizontal Equipment Rack or Cabinet Busbar

1. Mounts to standard 19” Rack or Frame
2. Capacity: 6 Double hole lugs
3. Shall be an electro-tin plated busbar
4. UL listed and BICSI certified

D. Vertical Equipment Rack or Cabinet Busbar

1. Mounts to vertical rail or inside of cabinet in 19” or 23” equipment rack or frame.
2. Capacity: 9 Double hole lugs
3. Shall be an electro-tin plated busbar
4. UL listed and BICSI certified

2.04 MECHANICAL CONNECTORS

A. Mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers, and lock washers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.

B. Split bolt connector types are not allowed.

C. Connectors shall meet or exceed UL 467.

2.05 COMPRESSION LUGS

A. Shall be UL & CSA listed

B. Shall meet or exceed the performance requirements of IEEE 837, latest revision

C. Compression type

D. Shall be manufactured from pure wrought copper. Conductivity of this material shall be no less than 99% by IACS standards.

E. Shall be electro-tin plated

F. Lugs shall be 2-hole. Single hole lugs are not allowed

G. Long barrel that will allow a minimum of two crimps with standard industry colors

H. Each connector shall be filled with an oxide-inhibiting compound

I. Crimped with a compression, tool and die system, according to manufacturer's recommendation

2.06 TAPS

A. Connections to the Conductor shall be made with irreversible compression connectors

B. Shall be UL & CSA listed

C. Requires a minimum of (2) crimps for C Tap or H Tap, 1 crimp for I-Beam and busbar Tap

D. Crimp according to manufacturer's recommendation

PART 3 - EXECUTION

3.01 GENERAL

A. Install products in accordance with manufacturer's recommendations.

B. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

C. Mechanical connections shall be accessible for inspection and maintenance.

D. No insulation shall be installed over mechanical ground connections.

E. Ground connection surfaces shall be cleaned and all connections shall be made so that disconnection or removal is impossible.

3.02 RESISTANCE MEASUREMENT

A. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 2 ohms.

3.03 TELECOMMUNICATIONS BONDING BACKBONE (TBB)

A. The intended function of a TBB is to reduce or equalize potential differences between telecommunications systems. While the TBB will carry some current under ac power ground fault conditions, it is not intended to provide the only ground fault return path.

B. The TBB shall:

1. Be connected to the TMGB & TGB.

2. Be a continuous copper conductor that shall be sized no less than 6 AWG to a maximum of 3/0 AWG. The TBB shall be sized in accordance to the following table:

Linear Length – ft.	Size (AWG)
Less than 13	6
14 - 20	4
21 - 26	3
27 - 33	2
34 - 41	1
42 - 52	1/0
53 - 66	2/0
Greater than 67’	3/0

3. The TBB conductors shall be installed and protected from physical and mechanical damage.

4. The TBB conductors should be installed without splices.

a. Where splices are necessary, the number of splices should be kept to a minimum and they shall be accessible and located within telecommunications spaces or j-box labeled as a telecommunications bonding backbone splice.

b. Joined segments of a TBB shall be connected using exothermic welding, irreversible compression-type connectors or equal.

C. A metallic cable shield shall not be used as a TBB.

3.04 GROUNDING EQUALIZER (GE)

A. The GE shall be a continuous copper conductor that shall be sized no less than 6 AWG to a maximum of 3/0 AWG. The GE shall match the size of the TBB.

B. The GE shall connect to the telecommunications grounding busbar(s) in the same-floor telecommunications rooms on the first, top, and every third floor in a building greater than 4 floors.

C. A metallic cable shield shall not be used as a GE.

3.05 TELECOMMUNICATIONS EQUIPMENT BONDING CONDUCTOR (TEBC)

A. Connects the TMGB/TGB to equipment racks and cabinets.

B. Shall be a continuous copper conductor that shall be sized per the length of cable.

C. Shall be separated from ferrous materials by 2” or be bonded to the ferrous metal.

D. May be routed within cable trays or suspended 2” under or off the side of the cable tray or ladder rack.

E. Shall be supported every 3ft.

F. 8” minimum bend radius.

G. May come cross other cable groups at a 90 degree angle only.

H. A metallic cable shield shall not be used as a TEBC.

3.06 RACK OR CABINET BONDING CONDUCTOR

A. A bonding conductor shall be used to connect the equipment racks and cabinets directly to the TMGB, TGB or underfloor ground mesh network.

B. All metallic enclosures, including remote mounted equipment cabinets and racks for telecommunications, security or audio/visual shall be bonded to the nearest TMGB or TGB using a minimum sized conductor of 6 AWG. Remote bonds shall be labeled on both ends stating the destination of the bond.

3.07 ELECTRICAL DISTRIBUTION PANEL (EDP)

A. The AC EDP serving the Telecommunications Room shall be bonded to the TMGB or TGB using a minimum of a 6 AWG cable.

B. A qualified electrician shall make all connections within an AC electrical distribution panel.

3.08 OPTICAL FIBER CONDUCTIVE CABLES

A. Conductive fiber-optic cables should be bonded and grounded as specified in the NEC.

3.09 CONDUIT AND SLEEVE BONDING

A. All conduits and sleeves entering a telecommunications room shall be grounded.

3.10 LADDER RACK AND/OR CABLE TRAY

A. All low voltage cable runway sections shall be bonded together and bonded back to the nearest Telecommunications Room the runway is serving as close TMGB or TGB as practical.

B. Maintain an 8” minimum bend radius on the TEBC.

C. Keep a 2” separation from other cables both power and telecommunications.

D. Remove any paint, oxidation, etc. from the runway surfaces that are being bonded.

E. Drill two holes as required to accommodate the 2-hole compression lug.

F. Apply a thin coat of antioxidant around the holes and on the surface where the lug will be in contact.

G. Attach straps to the runway using stainless steel hardware sized for the lug holes.

H. Wipe off any excess antioxidant after installation of the lug.

3.11 BUILDING STEEL

A. Each ground bus bar shall be bonded to building steel.

B. Remove any paint or fire stopping spray from the building steel.

C. Provide the appropriate bonding connector to connect to beams, trusses or other types of structure.

3.12 LABELING

A. Each grounding/bonding cable shall be labeled at the TMGB or TGB.

B. All taps to the TBB shall be within an enclosure and labeled as to its purpose.

C. Mechanical connectors shall be clearly marked with the catalog number, conductor size, and manufacturer.

D. Compression lugs shall be clearly marked with manufacturer, catalog number, conductor size, and required compression tool settings.

3.13 TESTING

A. Refer to Section 270000 for additional requirements.

B. Perform testing in accordance with test instrument manufacturer’s recommendations using the fall-of-potential method.

3.14 TRAINING

A. Refer to Section 270000 for additional requirements.

3.15 WARRANTY

A. Refer to Section 270000 for additional requirements.

END OF SECTION

SECTION 270528 – PATHWAYS FOR TECHNOLOGY SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 270000 for additional project scope information.

1.02 RELATED WORK

A. Section 270000 – General Technology Requirements

B. Section 270500 – Communications General Requirements

C. Section 270526 – Grounding and Bonding for Technology Systems

D. Section 270528 – Pathways for Technology Systems

E. Section 270537 – Firestopping for Technology Systems

F. Section 271100 – Communications Equipment Rooms

G. Section 271300 – Communications Backbone Cabling

H. Section 271500 – Communications Horizontal Cabling

I. Section 271600 – Communications Connecting Cords

J. Section 271800 – Communications Labeling and Identification

K. Section 274000 – AV/Multimedia General Requirements

L. Section 274100 – Audio Visual Systems

1.03 DEFINITIONS

A. Refer to Section 270000 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. Refer to Section 270000 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 270000 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 270000 for additional requirements.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 270000.

2.02 WIRE BASKET TRAY RUNWAY

A. As shown on the Project Drawings, the Contractor shall provide and install sufficient wire basket tray runway systems to support horizontal cable bundles.

B. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install complete wire basket tray runway systems.

C. Wire basket runway systems shall include, but are not limited to, straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports, and accessories.

D. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.

E. Contractor shall ensure that all straight section longitudinal wires are installed with no bends, kinks, or twisting.

F. Wire basket runway shall be made of high strength steel wires and formed into a standard 2-inch by 4-inch wire mesh pattern with intersecting wires welded together. All wire ends along runway sides (flanges) shall be rounded during manufacturing to prevent damage to cables and injury to installers.

G. All fittings shall be field formed as needed.

H. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel. Splicing assemblies shall provide a continuous ground connection.

I. Wire Basket Tray shall be grounded only at the Telecommunications Room ground bus bar.

J. Cable Drop Out/Waterfall

1. Where cables bundles transition from tray to tray or tray to conduit or sleeve of varying elevations the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 20% future growth.

K. T-sections of tray shall be made using T-section fittings.

L. Straight section splices shall be made using splice plates.

M. Wire basket runway supports shall be of the trapeze hanger type.

N. Trapeze hangers shall be supported by 3/8 inch diameter rods.

O. Tray shall have an electro zinc finish or a flat Black finish wherever finished installation will be visible to end users.

P. Accessories (connectors, splice plates…) shall be painted to match tray finish.

Q. Contractor shall refer to project drawings for cable tray sizing.

R. Manufacturer: Cable trays and accessories shall be of one of the following manufacturers

1. Cooper B-Line
2. Legrand Cablofil
3. Pentair Hoffman
4. Or approved equal

2.03 CABLE HOOK SYSTEMS

A. In the areas where the cables are required to be run in a “free-air” plenum, a cable hook system shall be used.

B. Cable hooks shall be capable of supporting a minimum of 30 lbs. with a safety factor of 3.

C. Spring steel cable hooks shall be capable of supporting a minimum of 100 lbs. with a safety factor of 3 where extra strength is required.

D. Cable hooks shall be Category 6a or better rated.

E. Follow manufacturer’s recommendations for allowable fill capacity for each size of cable hook.

F. Installation and configuration shall conform to the requirements of the ANSI/ EIA/TIA Standards 568A & 569, NFPA 70 (National Electrical Code), and applicable local codes.

G. Cable hooks shall:

1. Have a flat bottom and provide a minimum of 1 5/8" cable bearing surface.

2. Have 90-degree radiused edges to prevent damage while installing cables.
3. Be designed so the mounting hardware is recessed to prevent cable damage.
4. Have a steel cable latch retainer to provide containment of cables within the hook.
5. Have a retainer that shall be removable and reusable.
6. Be factory assembled for direct attachment to walls, hanger rods, beam flanges, purlins, strut, and floor posts, to meet job conditions.

H. Factory assembled multi-tiered cable hooks shall be used where required to provide separate cabling compartments, or where additional capacity is needed.

I. Cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653 G90. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3.

J. Cable hooks for corrosive areas shall be stainless steel, AISI type 304.

K. Cable hooks shall be B-Line series BCH21, BCH32 or other manufacturer that meets these specifications

2.04 CABLE PATHWAY SLEEVES

A. The Contractor shall only provide when re-enterable sleeves are not possible.

B. The Contractor shall provide all necessary wall penetration for cable pathways whether or not specifically shown on Project Drawings.

C. All wall penetrations shall have a metallic sleeve(s) as required to maintain a maximum 40% fill ration.

D. All sleeves shall be properly firestopped by this Contractor.

E. Contractor shall provide all core holes, pathways and sleeves (minimum 1.25" c).

F. Contractor shall install non-metallic threadless insulating bushings on end of all conduits.

G. Conduit Core Holes and Sleeves thru Floor: For all floor penetrations, Contractor shall provide IMC conduits with threaded steel couplings set flush with finish floor. Extend 6” above finish floor with IMC before any termination.

2.05 RE-ENTERABLE FIRESTOP SLEEVES

A. Device modules comprised of steel pathway with self-adjusting intumescent foam pads/membrane allowing 0 to 100 percent visual cable fill.

B. Refer to the drawings for required sizes. If not specifically identified, utilize 2” or greater as required for cabling counts with 20% additional capacity for future growth.

C. Manufacturer:

1. STI EZ Path
2. Hilti Speedsleeve
3. Or approved equal

2.06 METAL CONDUITS AND FITTINGS

A. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. EMT: Comply with ANSI C80.3 and UL 797.
5. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
    a. Fittings for EMT:
        i. Material: Steel
        ii. Type: Setscrew
6. Expansion Fittings: Steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.07 OUTLET BOXES

A. General Requirements for Outlet Boxes

1. Comply with TIA-569-B.

B. Metallic outlet boxes and device covers shall be galvanized steel not less than 1/16'' thick.

C. The dimensions of the metallic outlet box shall be 2''x4'', 4''x4'' and 6''x4'' with a minimum depth of 2.5''. See drawings for details.

D. Metallic outlet boxes shall be equipped with single device cover (or two-device cover where needed).

E. Where installed in plaster, gypsum board, etc., covers shall be raised to compensate the thickness of the wall.

F. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

G. Where metallic outlet boxes are to be empty for future use, blank covers shall be used.

H. Gangable boxes are not allowed.

2.08 PAINTING

A. The Contractor is responsible for painting all exposed pathway, boxes, fittings, etc. The paint shall match the surrounding conditions and may change mid-run.

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 270000 for additional requirements.

3.02 TRAINING

A. Refer to Section 270000 for additional requirements.

3.03 WARRANTY

A. Refer to Section 270000 for additional requirements.

3.04 WIRE BASKET TRAY RUNWAY

A. Basket tray shall be installed in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of NEC, applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.

B. Coordinate installation of wire basket runway with other electrical work as necessary to properly interface installation of wire basket runway with other work.

C. Provide sufficient space encompassing wire basket runways to permit access for installing and maintaining cables.

D. Test wire basket runways to ensure electrical continuity of bonding and grounding connections and to demonstrate compliance with specified maximum grounding resistance.

3.05 CABLE HOOK SYSTEM

A. J-hooks fabricated to contain data/voice and video cables may be used to support 25 or fewer cables in each hook. J-hooks are to be fastened to building steel with beam clamps, suspended from ceiling slab with threaded rod, or anchored to the wall. All J-hooks shall be hung straight and level. No other installation technique will be authorized unless pre-approved.

B. Three tiered double-sided J-hook configurations shall contain a maximum of 25 cables per hook or 150 cables. Smaller configurations may be used as bundles decrease in size, maintaining no more than 25 cables per hook.

C. Bundles surpassing 150 cables shall be supported by hangers, fabricated of 3/8" threaded rod and 24" Unistrut. Hangers shall also be installed where the installation of a three-tiered J-hook system is not appropriate for the ceiling space, or where blocked by other trades' work.

D. Cable bundles consisting of fewer than 10 cables may be supported by single J hooks.

E. All cable support in the main cable path shall be installed every four feet. Small cable bundles (under 25) not in the main path may be supported every five feet.

F. A sag shall be maintained between supports of 6", to reduce cable strain. Velcro is an appropriate method of securing cables, when properly used and not over tightened.

G. Proper cable support is extremely important to the Owner, and care shall be taken by the Contractor to provide and install the appropriate supports. Supports found to be inadequate will be replaced.

H. Cable bundles including voice/data cabling shall not have plastic cable ties.

I. All cable trunks shall have radius controlled cable waterfalls where trunk drops from conduit, sleeve or tray from horizontal path to vertical path.

3.06 SURFACE RACEWAY SYSTEM

A. In areas where surface raceway will be used as a cable path, no exposed cable shall be permitted.

B. With the agreement of the Consultant and Owner, if a telecommunications outlet is required in an area where the walls cannot be fished, the station cable serving these outlets shall be covered with raceway. No exposed cable shall be permitted within offices, laboratories, and conference rooms, or like facilities. Contractor shall attempt to fish hollow walls, use existing conduit, or exhaust all other options to conceal cabling prior to installing surface raceway.

C. The raceway shall originate from a surface mounted box located off the floor and be attached to the wall and terminate above the ceiling. The outlet box height shall match existing electrical receptacle height. Raceway for a wall-mounted location shall originate from a surface mounted box with the top of the box located 48" off the floor.

D. Minimum bend radius shall be adhered to for UTP and fiber optic cable.

E. Where raceway is to be installed on painted, smooth, finished surfaces, the Contractor shall clean surface prior to installing raceway.

F. Where non-metallic raceway is to be installed on non-smooth surfaces such as wallpaper, unpainted brick, concrete, etc., the Contractor shall use flat-head screws in addition to the adhesive backing to fasten channel to surfaces.

G. Where Contractor is required to install metallic raceway, the raceway base shall be installed using flat-head screws and following all manufacturer's recommendations.

H. Where new outlet locations are indicated on Project Drawings as having existing Wiremold™ type raceway, the Contractor shall remove existing raceway from wall and install new specified raceway to cover any damage or markings caused from removing existing raceway product.

I. All surface raceway shall be mounted level and plumb. Where the Owner considers raceway channels to be installed unsatisfactorily, the Contractor shall remove and replace necessary channels at no additional cost to the Owner.

J. Suitable insulating bushings and inserts shall be used at connections to outlets and corner fittings. Dropped ceiling end fittings shall be utilized where raceway channel connects to dropped accessible ceiling tile. In rooms with drywall ceilings, open ceilings, or non-accessible ceilings, the Contractor shall extend raceway to the nearest location, hallway, or corridor that has accessible ceiling cavity. All cables shall be concealed.

3.07 PATHWAY APPLICATIONS

A. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT

2. Concealed in Ceilings and Interior Walls and Partitions: EMT

B. Minimum Pathway Size for Data: 1-inch trade size. Cable fill shall not exceed a 40% fill ratio.

C. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

2. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.

3.08 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support conduit within 12 inches of enclosures to which attached.

H. All conduit penetrations shall comply with all applicable fire codes. All conduit penetrations in fire-rated walls or floors shall be sealed and fire proofed to at least the rating of the penetration area.

I. Conduits shall be routed in the most direct route, with the fewest number of bends.

J. There shall be no continuous conduit sections longer than 100 feet. For runs that total more than 100 feet, insert junction or pull boxes (or gutters if appropriate) so that no continuous run between pull boxes is greater than 100 feet.

K. There shall be no more than two 90-degree bends (180 degrees total) between conduit pull boxes.

L. Changes in direction shall be accomplished with sweeping bends observing minimum bend radius requirements above. Do not use pull boxes for direction changes unless specifically designated otherwise in the Drawings.

M. Stub-ups to Above Recessed Ceilings:

    1. Use EMT for pathways.

    2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

O. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

R. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb. tensile strength. Leave at least 12 inches of slack at each end of pull

wire. Cap underground pathways designated as spare above grade alongside pathways in use.

3.09 OUTLET BOXES

A. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

B. Exact locations of the outlet boxes shall be coordinated with the electrical contractor and other trades.

C. The approximate locations of the outlets are indicated on the drawings. The exact locations shall be determined at the building. The right is reserved to change without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.

D. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a rain tight connection between box and cover plate or supported equipment and box.

E. Horizontally separate boxes by a minimum of 12'' mounted on opposite sides of walls so they are not in the same vertical channel.

F. Outlet boxes installed back to back in fire-rated walls shall be separated horizontally by a minimum of 24''.

G. Install all outlet boxes in finished areas flush with the wall. Maintain ¼'' or less space between outlet box front and finished wall surface.

H. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

I. Outlet boxes shall be firmly anchored in place and shall not depend on the cover plate to hold it secure to the wall.

J. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

K. Any surface boxes shall have rounded corners and edges. Surface boxes must be approved by Owner prior to installation.

3.10 RISER CONDUITS

A. Conduits entering equipment rooms shall be reamed or bushed and terminated not more than 4" from a wall and within 12” of room corners.

B. Conduits entering equipment rooms from below floor shall be terminated not more than 4" above finished floor.

C. Conduits shall not be less than 4" trade size and be equipped with a measured pull line at 12” increments rated at a minimum 1200 pound test.

D. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction.

E. Provide an insulating press fit bushing on all telecommunications riser conduits. Bushings must be rated to be used in an environmental air handling space (Plenum).

3.11 SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.12 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

END OF SECTION

SECTION 270537 – FIRESTOPPING FOR TECHNOLOGY SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. All penetrations of walls shall be approved by the General Contractor before any penetrations are made. Should the Contractor find it necessary to penetrate any walls extending to the slab, it will be the responsibility of that Contractor to provide satisfactory sleeving and fire caulking both inside and outside of that sleeving. If existing sleeving is to be utilized, it will be the responsibility of the Contractor to fire caulk inside the sleeving.

B. Refer to Section 270000 for additional project scope information.

1.02 RELATED WORK

A. Division 7 - Firestopping

B. Section 270000 – General Technology Requirements

C. Section 270500 – Communications General Requirements

D. Section 270526 – Grounding and Bonding for Technology Systems

E. Section 270528 – Pathways for Technology Systems

F. Section 270537 – Firestopping for Technology Systems

G. Section 271100 – Communications Equipment Rooms

H. Section 271300 – Communications Backbone Cabling

I. Section 271500 – Communications Horizontal Cabling

J. Section 271600 – Communications Connecting Cords

K. Section 271800 – Communications Labeling and Identification

L. Section 274000 – AV/Multimedia General Requirements

M. Section 274100 – Audio Visual Systems

1.03 DEFINITIONS

A. Refer to Section 270000 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. ANSI/TIA-EIA-569-D “Telecommunications Pathways and Spaces”

B. ASTM E90, “Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements”.

C. ASTM E814, “Fire Tests of Through Penetration Firestops”.

D. ASTM E1725, “Standard Test Methods for Fire Tests of Fire-Resistive Barrier Systems for Electrical System Components”.

E. CAN/ULC S115, "Standard Method of Fire Tests of Firestops Systems."

F. UL 1479, “Fire Tests of Through Penetration Firestops”.

G. National Fire Protection Association (NFPA) – NFPA 101: Life Safety Code.

H. National Fire Protection Association (NFPA) – NFPA 70: National Electrical Code.

I. Underwriters Laboratories Inc. (UL) – Fire Resistance Directory

J. Refer to Section 270000 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 270000 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 270000 for additional requirements.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 270000.

2.02 GENERAL PERFORMANCE REQUIREMENTS

A. Fire rated cable pathway devices shall be used in fire-rated construction for all low-voltage or optical fiber raceways. Such devices shall:

1. Meet the hourly fire-rating of fire rated wall and or floor penetrated.

2. Be tested for the surrounding construction and cable types involved.

3. Re-enterable firestop pathway shall have UL Systems permitting cable loads from zero to 100% visual fill.
4. Re-enterable firestop pathway shall be maintenance-free as defined by not requiring the removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
5. Pathways shall be engineered such that two or more devices may be ganged together for additional cable capacities.
6. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.
7. Size as shown on the drawings or as required when not specifically identified.

B. Non-rated cable pathway devices shall be used in non-fire-rated construction such as smoke partitions for all low-voltage and fiber optic cabling where frequent cable moves, adds and changes may occur. Such devices shall:

1. Limit the movement of smoke and sound of wall and or floor penetrated.
2. Restore the STC Rating of the penetrated assembly.
3. Provide L Ratings of greater than 1 CFM when empty and greater than 2.5 CFM at all other loading up to 100 percent.
4. Accommodate cable loads from zero to 100% visual fill.
5. Be maintenance-free as defined by not requiring the removal and or replacement of any material such as, but not limited to, firestop caulk, putty, pillows, bags, foam muffins, foam, foam plugs, foam blocks, or foam closures of any sort.
6. Pathways shall be engineered such that two or more devices may be ganged together for larger cable capacities.
7. Pathways shall be engineered to be re-enterable so they can be retrofitted and removed from around existing cables without cutting and re-splicing them.
8. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

C. Where non-mechanical pathways must be utilized, such as sealing (caulking) around single or grouped conduits, provide products that upon curing do no re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during or after construction.

D. Cable tray shall terminate at each barrier and resume on the other side such that cables pass independently through devices. Cable tray shall be properly supported on each side of the barrier.

E. Single Source: Obtain firestop systems for each type of penetration and construction condition indicated only from a single manufacturer.

2.03 MATERIALS

A. General: Use only products that have been tested for specific fire resistance rated construction conditions or acoustical and smoke related requirements conforming to construction assembly type, penetrating item type, annular space requirements, and rating involved for each separate instance.

B. Firestop Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture, the following products are acceptable:

1. Specified Technologies Inc. (STI) SpecSeal Series SSS or LCI Sealant.

2. Hilti

C. Firestop Putty: Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds, the following products are acceptable:

1. Specified Technologies Inc. (STI) SpecSeal Series SSP Putty.

2. Hilti

D. Firestop Pillows: Re-enterable, non-curing, mineral fiber core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag, the following products are acceptable:

1. Specified Technologies Inc. (STI) SpecSeal Series SSB Pillows.

2. Hilti

E. Fire-Rated Cable Grommet: Molded, two-piece grommet with an integral fire and smoke sealing foam membrane for sealing individual cable penetrations through framed wall assemblies.

1. Specified Technologies Inc. (STI) EZ-Firestop Grommets.

2. Hilti

F. Fire-Rated Cable Re-Enterable Pathways: Device modules comprised of steel pathway with self-adjusting intumescent foam pads or fabric ring allowing 0 to 100 percent cable fill, the following products are acceptable:

1. Specified Technologies Inc. (STI) EZ-PATH Fire Rated Pathway.

2. Hilti Speed Sleeve

G. Smoke and Acoustical Pathways: Device module comprised of a nonmetallic pathway with integral self-adjusting smoke and sound sealing system for cable penetrations through non-fire-resistance rated wall or floor assemblies, the following products are acceptable:

1. Specified Technologies Inc. (STI) EZ-PATH Smoke & Acoustical Pathway.
2. Hilti

H. Protective Wrap: Endothermic Wrap incorporating foil scrim for protection of cable pathways, through-penetration and membrane-penetration firestopping, Electrical Metallic Tubing (EMT), Rigid Metallic Conduit (RMC), or Cable Trays. The following products are acceptable:

1. Specified Technologies, Inc. (STI) E-Wrap™ Endothermic Wrap
2. Hilti

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 270000 for additional requirements.

3.02 TRAINING

A. Refer to Section 270000 for additional requirements.

3.03 WARRANTY

A. Refer to Section 270000 for additional requirements.

3.04 INSTALLATION

A. Install systems in accordance with Performance Criteria and in accordance with the conditions of testing and classification as specified or required.

B. Comply with manufacturer’s instructions for installation of products.

C. Place system stickers on each side of wall penetrations.

D. Place a reproduction (photo copy) of the UL System description in a document protector and mount to the wall next to the wall penetration. Highlight the section of the system description that list the allowed cable types.

E. Do not install products when ambient or substrate temperatures are outside limitations recommended by manufacturer.

F. Do not install products when substrates are wet due to rain, frost, condensation, or other causes.

G. Do not use materials that contain flammable solvents.

H. Coordinate construction of openings and penetrating items to ensure that through- penetration firestop systems are installed according to requirements.

I. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

3.05 SCHEDULES

Penetrant Type	Concrete Floor	Concrete Wall	Gypsum Board Wall
Blank Opening	C-AJ-0100, C-AJ-0101, C-AJ-0113, C-AJ-0116	C-AJ-0100, C-AJ-0101, C-AJ-0113, C-AJ-0116	W-L-0020, W-L-0034
Metal Conduits	C-AJ-1080, C-AJ-1240, C-AJ-1353	C-AJ-1080, W-J-1098, W-J-1100	W-L-1049, W-L-1222, W-L-1168
Plastic Conduits and Raceways	C-AJ-2140, C-AJ-2292, F-A-2186, F-A-2210, F-A-2225	C-AJ-2038, C-AJ-2108, C-AJ-2578, C-AJ-2586, W-J-2018, W-J-2076	W-L-2059, W-L-2074, W-L-2093, W-L-2241
Cables	C-AJ-3214, C-AJ-3231, F-A-3015, F-A-3021, F-A-3054	C-AJ-3214, C-AJ-3231, W-J-3098, W-J-3099,W-J-3124, W-J-3150, W-J-3180	W-L-3219, W-L-3248, W-L-3287, W-L-3356, W-L-3377, W-L-3378, W-L-3379, W-L-3390
Cable Trays	C-AJ-3317, C-AJ-8181, C-AJ-4029, F-A-3015, F-A-3037	C-AJ-8181, W-J-4021, W-J-4022, W-J-4033, W-J-3098, W-J-3145, W-J-3158	W-L-3218, W-L-3271, W-L-3286, W-L-3306, W-L-4008, W-L-4029, W-L-4043, W-L-8073

END OF SECTION

SECTION 271100 – COMMUNICATIONS EQUIPMENT ROOMS

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 270000 for additional project scope information.

B. This section describes the products and execution requirements relating to telecommunications cabling, termination components, racks, pathways, telecommunication rooms and related subsystems. Covered systems include the following:

1. Equipment room cable management system and equipment racks
2. Horizontal and backbone cable terminating equipment
3. Telecommunications grounds and related components

1.02 RELATED WORK

A. Section 270000 – General Technology Requirements

B. Section 270500 – Communications General Requirements

C. Section 270526 – Grounding and Bonding for Technology Systems

D. Section 270528 – Pathways for Technology Systems

E. Section 270537 – Firestopping for Technology Systems

F. Section 271100 – Communications Equipment Rooms

G. Section 271300 – Communications Backbone Cabling

H. Section 271500 – Communications Horizontal Cabling

I. Section 271600 – Communications Connecting Cords

J. Section 271800 – Communications Labeling and Identification

K. Section 274000 – AV/Multimedia General Requirements

L. Section 274100 – Audio Visual Systems

1.03 DEFINITIONS

A. Refer to Section 270000 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. Refer to Section 270000 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 270000 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 270000 for additional requirements.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 270000.

2.02 CATEGORY 6 PATCH PANELS

A. Cables shall be terminated at the telecommunication closets on high-density integrated patch panels incorporating Category 6 jacks (non-keyed 8-pin), meeting the specifications for the telecommunications outlet detailed in the section above.

B. Patch panel configuration shall be 48 ports.

C. The patch panel shall exceed ANSI/TIA/EIA 568-C.2-1 Category 6 component compliance standard. All pair combinations shall be considered, with the worst-case measurement being the basis for compliance.

D. The patch panels shall be interoperable and backwards compatible to lower performing cabling systems.

E. Panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers' minimum bend radius specifications are adhered to.

F. The patch panel shall have color-coded designation strips to identify cable count.

G. Manufacturers:

1. Belden

2. Panduit

2.03 VOICE BACKBONE TERMINATION FIELD

A. Wall Mounted 110 Blocks

1. At the MDF room or the primary distribution point for voice backbone cables shall be terminated on high-density wall mounted 110 blocks.

2. The panels shall incorporate the openings between rows to allow cables to be routed from behind the panel directly to the point of termination.

3. The panels shall be with cable managers and covers. Termination strips on the base shall be notched and divided into 5-pair increments and accommodate C5 clips.

4. The mechanical termination shall:

a. Have the ability of terminating 22-26 AWG plastic insulated, solid, and stranded copper conductors.

b. Provide a direct connection between the cable and jumper wires.

c. Have less than 0.2-dB of attenuation from 1 - 100 MHz.

d. Have less than 100 mw of DC resistance.

e. Have less than 5 mw of resistance imbalance.

f. Have minimal signal impairments at all frequencies up to 100 MHz.

5. Blocks shall identify pair position by a color designation: blue, orange, green, brown, and slate (backbone only).

2.04 FIBER OPTIC PATCH PANELS

A. The Contractor shall provide a fiber optic patch panel at each location where a fiber optic cable terminates.

B. All terminated fibers shall be mated to duplex LC couplings mounted on enclosed patch panels. Couplers shall be mounted on a panel that, in turn, snaps into the enclosure. The proposed enclosure shall be designed to accommodate a changing variety of connector types, including SC, ST, Fixed Shroud Duplex (e.g., “FDDI Connector”), Biconic, and FC by changing panels on which connector couplings are mounted.

C. The patch panel enclosure shall be sized to accommodate the total fiber count to be installed at each location as defined in the specifications and Drawings, including those not terminated (if applicable), PLUS 50% future growth.

D. The Contractor shall provide all required connector panels and connector couplings (sleeves, bulkheads, etc.) adequate to accommodate the number of fibers to be terminated.

E. Patch panels shall be designed for easy installation, front removal, and expansion of snap-in adapter panels.

F. Patch panels shall be enclosed assemblies affording protection to the cable subassemblies and to the terminated ends. The enclosures shall incorporate a hinged or retractable front cover designed to protect the connector couplings and fiber optic jumpers.

G. The patch panel's enclosure shall provide for strain relief of incoming cables and shall incorporate radius control mechanisms to limit bending of the fiber to the manufacturer's recommended minimums or 1.2", whichever is larger.

H. Access to the inside of the patch panel enclosure during installation shall be from the front and rear. Panels that require any disassembly of the cabinet to gain entry will not be accepted.

I. All patch panels shall provide protection to both the "facilities" and "user" side of the coupling. The patch panel enclosure shall be configured to require front access only when patching. The incoming cables (backbone, riser, etc.) shall not be accessible from the patching area of the panel. The enclosure shall provide a physical barrier to access of such cables.

J. Where singlemode fibers are installed, the fibers contained in these cables may be terminated either by (1) splicing of factory-terminated cable assemblies ("pigtails") or (2) use of a "fan-out" kit. In the latter approach, individual fibers are to be secured in a protective covering (such as an Aramid reinforced tube, for example) with connectors mated to the resulting assembly. In both instances, the proposed termination hardware shall incorporate a mechanism by which cable and subassemblies are secured to prevent damage. Splicing shall be by the "fusion" method. Individual splice loss shall not exceed 0.2 dB.

K. Fiber optic patch panels shall be Corning PCH-02 in TR/IDF and PCH-4U in MDF or Server Rooms or approved equal.

L. 50-micron LC adaptor panels shall be Corning CCH-CP12-E4 or approved equal.

2.05 CABLE MANAGEMENT SYSTEM

A. The cable management system shall be used to provide a neat and efficient means for routing and protecting fiber and copper cables and patch cords on telecommunication racks and enclosures. The system shall be a complete cable management system comprising 4-post and 2-post floor mount racks, wall mount racks, equipment cabinets and vertical and horizontal cable managers to manage cables on both the front and rear of the rack. The system shall protect network investment by maintaining system performance, controlling cable bend radius, and providing cable strain relief.

1. 2-Post Equipment Racks

a. The Contractor shall provide and install 2-post adjustable equipment racks to house cable termination components (e.g., copper data and fiber optic) and network electronics (by others) as shown on the drawings. Prior to installation, the Contractor shall coordinate exact placement with Owner.

b. Rack shall be 84" in height and shall be self-supporting.

c. Channel uprights shall be spaced to accommodate industry standard 19" mounting and have pass-through holes with smooth edges to protect cables.

d. Rack shall be constructed of aluminum.

e. Able to support up to 1,500 pounds.

f. Rack shall be double side drilled and tapped to accept 12-24 screws. Uprights shall also be drilled on back to accept cable brackets, clamps, power strip(s), etc. Hole pattern on rack front shall be per EIA/TIA specifications (5/8"-5/8"-1/2"). Hole pattern on the rear shall be at 3" intervals to accept cable brackets.

g. Rack shall be supplied with at least 24 spare screws.

h. Rack shall be supplied with a vertical ground bar and #6 AWG ground lug.

i. Manufacturers:

i. Chatsworth #55053-703

ii. Pentair Hoffman

iii. Or approved equal.

B. Vertical Cable Management

1. At the telecommunication rooms, vertical cable management shall be furnished and installed to adjacent racks to organize cables on front and rear of telecommunication racks.

2. Vertical cable managers shall include components that aid in routing, managing, and organizing cable to and from equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" or 23" racks.

3. Vertical cable management system shall feature the following:

a. Open cabling section on the rear that provides easy access and routes cable bundles feeding into the back of patch panels and 1 RMU cable guide on the front designed for fanning and managing patch cords.

b. Edge-protected pass-through ports designed for easy routing of cable from front channel to back.

c. Vertical slots along the center separator to allow securing cable bundles neatly with management straps.

d. Door/cover (front only) that is easily opened from the right or left and still easily removed to allow for quick moves, adds, and changes.

e. Movable wire retainers to retain the cables during cover removal.

4. Vertical cable management at the end of rack rows shall be 6”.
5. Vertical cable management between racks shall be 10”

2.06 POWER DEVICES

A. Refer to Section 270000 for additional requirements.

B. Horizontal PDU, Single Circuit for Network Racks

1. Power strip shall provide 3,840 joules of surge protection.
2. 40-80db of EMI/RFI power conditioning
3. 2 isolated and filtered power banks
4. Contractor shall provide one (1) power strip per rack/cabinet.
5. Power strip shall be rated for 20 amps.
6. Manufacturer:
    a. Tripp-Lite IBAR12-20ULTRA
    b. CyberPower
    c. Or approved equal

2.07 HORIZONTAL CABLE MANAGEMENT

A. Horizontal cable managers shall include components that aid in routing, managing, and organizing cable to and from equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" racks and constructed of steel bases with PVC duct attached. The duct fingers shall include retaining tabs to retain the cables in place during cover removal. The covers shall be able to hinge from either side yet still be easily removed to allow for quick moves, adds, and changes.

B. The cable managers shall be provided with movable wire retainers to retain the cables during cover removal and #12-24 mounting screws. An integral strain relief bracket shall be provided on either end of the duct to allow for easy cover placement.

C. Double-Sided horizontal cable managers shall be placed above and below each patch panel.

D. The Contractor shall also supply (1) per 48-port patch panel additional managers for network electronics.

E. Manufacturers:

1. Chatsworth #30530-719
2. Pentair Hoffman

2.08 TELECOMMUNICATION GROUND

A. The Telecommunication Contractor is responsible for providing an appropriate ground for all racks, trays, and telecommunications equipment installed by this Contractor. Refer to the Grounding and Bonding for Technology Systems specification section.

2.09 WIRE BASKET RUNWAY TRAY

A. Within each Telecommunications Room, the Contractor shall provide and install sufficient wire basket tray to support cable bundles from corridor to equipment racks or as shown on the Project Drawings, this Contractor shall provide and install sufficient basket tray to support cable bundles from corridor to equipment racks or cabinets.

B. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install complete wire basket runway systems in the telecommunication closet.

C. Wire basket runway systems shall include, but are not limited to, straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports, and accessories.

D. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.

E. All straight section longitudinal wires shall be straight (with no bends).

F. Wire basket runway shall be made of high strength steel wires and formed into a standard 2-inch by 4-inch wire mesh pattern with intersecting wires welded together. All wire ends along runway sides (flanges) shall be rounded during manufacturing for safety of cables and installers.

G. All fittings shall be field formed as needed.

H. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel. Splicing assemblies shall provide a continuous ground connection.

I. Wire Basket Tray shall be grounded to a Telecommunications Room ground bus bar.

J. Cable Drop Out/Waterfall

1. Where cables bundles transition from tray and drop to the rack, cabinets or ladder rack, the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 20% future growth.

K. T-sections of tray shall be made using T-section fittings.

L. Straight section splices shall be made using splice plates.

M. Wire basket runway supports shall be wall mounted brackets and trapeze hangers when spanning the room.

N. Trapeze hangers shall be supported by 3/8 inch diameter rods.

O. Provide size as indicated on the drawings.

P. Tray shall have flat Black finish.

Q. Accessories (connectors, splice plates…) shall be painted to match tray finish.

R. Manufacturer:

1. Cooper B-Line
2. Legrand Cablofil
3. Pentair Hoffman
4. Or approved equal

2.10 LADDER RACK

A. Within each Telecommunications Room, the Contractor shall provide and install ladder rack as shown on the Project Drawings.

B. Within each Telecommunications Room with a vertical conduit riser the Contractor shall provide and install vertical ladder rack connecting the ground conduit sleeve penetrations with the ceiling conduit sleeve penetrations.

C. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install a complete ladder rack system in the telecommunications room as shown on the Drawings.

D. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.

E. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel.

F. Cable Drop Out/Waterfall

1. Where cables bundles transition from tray and drop into the racks/cabinets, the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 20% future growth.

G. Size ladder rack as indicated on the Contract Documents.

H. Accessories (connectors, splice plates…) shall be painted to match tray finish.

I. Manufacturers:

1. Chatsworth
2. Cooper
3. Legrand
4. Pentair Hoffman
5. Or approved equal

2.11 PLYWOOD

A. The Contractor shall provide plywood. Plywood shall be installed on all walls within a telecommunications room and other locations as noted.

B. Provide void-free, interior grade, fire rated A-C grade plywood, 3/4" by 48" by 96", or as indicated.

C. When plywood is required to be painted, the paint shall be UL 723 rated white or gray fire retardant. The plywood's rating stamp shall be exposed (not painted over) on each sheet. Plywood shall have fire calk around all edges. Provide label including paint manufacturer, date painted, UL listing and name of Installer

D. Plywood shall be mounted vertically starting at 22" AFF to 118" AFF and anchored to all studs.

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 270000 for additional requirements.

3.02 TRAINING

A. Refer to Section 270000 for additional requirements.

3.03 WARRANTY

A. Refer to Section 270000 for additional requirements.

3.04 EQUIPMENT RACK AND CABINETS

A. Prior to permanently securing racks or cabinets, the Contractor shall coordinate a walk through with the Owner to determine exact placement of racks.

B. The Contractor shall bolt the rack to the floor as recommended by the manufacturer. Multiple racks shall be joined and the ground made common on each. Rack shall also be stabilized by extending a brace extending to the wall. Alternately, overhead cable tray over which the cabling accesses the equipment rack(s) shall provide this function.

C. A space between the rack upright and the wall (~6") shall be planned to allow for cabling in that area. The rear of the rack shall be ~40" from the wall to allow for access by maintenance personnel. In all cases, a minimum of 40" workspace in front of the rack is also required. Locations where these guidelines cannot be followed shall be brought to the attention of the Consultant for resolution prior to installation.

D. All hardware and equipment is to be mounted at least 18" above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware shall be reviewed and approved by the Consultant and Site Coordinator(s) prior to installation.

E. Equipment rack shall be equipped with cable management hardware to allow an orderly and secure routing of twisted pair cabling to the data patch panels. At minimum, one such horizontal jumper management panel shall be placed below each fiber optic patch panel installed by the Contractor. Additional jumper management panels may be required pending installation of other cable types on the rack. The rack shall be grounded to the telecommunications grounding backbone (TGB) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket).

3.05 WIRE BASKET TRAY AND LADDER RACK RUNWAY

A. Runway shall be installed in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of NEC, applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.

B. Coordinate installation of runway with other electrical work as necessary to properly interface installation of wire basket runway with other work.

C. Provide sufficient space encompassing runways to permit access for installing and maintaining cables.

D. Test runways to ensure electrical continuity of bonding and grounding connections and to demonstrate compliance with specified maximum grounding resistance.

END OF SECTION

SECTION 271300 – COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 270000 for additional project scope information.

B. This section describes the products and execution requirements relating to telecommunications voice, data and video backbone cabling and termination components.

C. Backbone Cabling is the cable and hardware interconnecting telecommunication rooms (TRs), building demarcation rooms, equipment rooms and server rooms. The backbone cabling shall consist of the following cable types:

1. 50-micron Multimode Fiber Optic Cable

1.02 RELATED WORK

A. Section 270000 – General Technology Requirements

B. Section 270500 – Communications General Requirements

C. Section 270526 – Grounding and Bonding for Technology Systems

D. Section 270528 – Pathways for Technology Systems

E. Section 270537 – Firestopping for Technology Systems

F. Section 271100 – Communications Equipment Rooms

G. Section 271500 – Communications Horizontal Cabling

H. Section 271600 – Communications Connecting Cords

I. Section 271800 – Communications Labeling and Identification

1.03 DEFINITIONS

A. Refer to Section 270000 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. Refer to Section 270000 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 270000 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.09 TEST DATA – FIBER OPTIC MEDIA

A. The test result information for each link shall be recorded in the memory of the field tester upon completion of the test.

B. The test result records saved by the tester shall be transferred into a Windows-based database utility that allows for the maintenance, inspection, and archiving of these test records. A guarantee shall be made that these results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test.

C. The database for the completed job shall be stored and delivered on CD-ROM. This CD-ROM shall include the software tools required to view, inspect, and print any selection of test reports.

D. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:

1. The identification of the link in accordance with the naming convention defined in the overall system documentation.

2. The overall Pass/Fail evaluation of the link-under-test including the Attenuation worst-case margin (margin is defined as the difference between the measured value and the test limit value as defined in this document).

3. The date and time the test results were saved in the memory of the tester.

E. The following general information is to be provided in the electronic database containing the test result information for each link:

1. The identification of the customer site as specified by the end user.

2. The overall Pass/Fail evaluation of the link-under-test.

3. The name of the standard selected to execute the stored test results.

4. The cable type and the value of the ‘index of refraction’ used for length calculations.

5. The date and time the test results were saved in the memory of the tester.

6. The brand name, model, and serial number of the tester.
7. The revision of the tester software and the revision of the test standards database in the tester.

F. The detailed test results data to be provided in the electronic database for each tested optical fiber shall contain the following information:

1. The identification of the link/fiber in accordance with the naming convention defined in the overall system documentation.
2. The insertion loss (attenuation) measured at each wavelength, the test limit calculated for the corresponding wavelength, and the margin (difference between the measured attenuation and the test limit value).

G. The link length shall be reported for each optical fiber for which the test limit was calculated.

H. Contractor shall provide accurate as-built Construction Drawings at the site during construction.

I. The Drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (".dwg", AutoCAD rel. 2004 and ".dxf") formats on which as-built construction information can be added. These documents will be modified accordingly by the Contractor to denote as-built information as defined above and returned to the Owner.

J. The Contractors shall annotate the base Drawings and return to the Consultant in hard copy (same plot size as originals) and electronic (AutoCAD rel. 2004 and ".dxf") form.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 270000.

2.02 TIGHT-BUFFERED OPTICAL FIBER CABLES FOR INDOOR DISTRIBUTION APPLICATIONS

A. General Considerations

1. The cable shall meet the requirements of the National Electrical Code (NEC) Section 770.
2. For plenum applications, the cable shall meet applicable flame tests: ANSI/UL 910 (NFPA 262-1994).

3. Finished cables shall conform to the applicable performance requirements of Tables 8-6 and 8-7 of the Insulated Cable Consultants Association, Inc. (ICEA) *Standard for Fiber Optic Premises Distribution Cable* (ICEA S-83-596).

B. Cable Construction

1. The coated fiber shall have a layer of Teflon placed between the acrylate coating of the optical fiber and the thermoplastic buffer. The diameter of the thermoplastic buffer coating shall be 900 ±50µm. The fiber coating and buffer shall be removable with commercially available stripping tools in a single pass for connectorization or splicing.
2. Cables with 2 to 24 fibers layered aramid yarns shall serve as the tensile strength member of the cable.
3. A ripcord shall be applied between the aramid yarns and the outer jacket to facilitate jacket removal.
4. The outer jacket shall be extruded over the aramid yarns for physical and environmental protection. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness. The jacket shall be smooth, as is consistent with the best commercial practice.
5. The fibers shall be stranded around a dielectric central member.
6. For cables containing 12-24 fibers, the fibers shall be arranged in two layers.
7. The central member shall be over coated with a thermoplastic, when required, to achieve dimensional sizing to accommodate and support the 900 µm buffered fibers.
8. Cables with 24 to 60 fibers shall have unitized riser and plenum constructions.
9. The buffered fibers shall be grouped in six-fiber subunits.
10. The fibers shall be stranded around a dielectric central member in the subunit.
11. Layered aramid yarns shall serve as the tensile strength member of the subunit.
12. A ripcord may be applied between the aramid yarns and the subunit jacket to facilitate jacket removal.
13. The subunit jacket shall be extruded over the aramid yarns for physical and environmental protection. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness. The jacket shall be smooth, as is consistent with the best commercial practice.
14. The subunits shall be stranded around a dielectric central member. A ripcord shall be inserted beneath the outer jacket to facilitate jacket removal. The outer jacket shall be extruded around the subunits. The strength members shall be of a high modulus aramid yarn. The aramid yarns shall be helically stranded around the buffered fibers. Non-toxic, non-irritant talc shall be applied to the yarns to allow them to be easily separated from the fibers and the subunit jacket.

C. Outer Cable Jacket

1. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness; jackets extruded under high pressure are not acceptable. The jacket shall be smooth, as is consistent with the best commercial practice. The jacket shall provide the cable with a tough, flexible, protective coating, able to withstand stresses. The nominal thickness of the cable outer jacket shall be sufficient to provide adequate cable protection while meeting the mechanical, flammability, and environmental test requirements of this document over the life of the cable.

2. The color of the jacket shall match the jacket color of the optical fiber cable located inside of the cable.

D. Fiber Identification

1. The individual fibers shall be color-coded for identification. The optical fiber color-coding shall be in accordance with ANSITIA/EIA-598-B “Optical Fiber Cable Color Coding.” The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color-coded buffered fibers shall not adhere to one another.

2. When buffered fibers are grouped into individual subunits, each subunit jacket shall be numbered for identification, with the exception of filler subunits where used. The number shall be repeated at regular intervals. The subunit jacket color shall be aqua for subunits containing OM3/4 multimode fibers, yellow for subunits containing singlemode fibers, and white for filler subunits.

3. The outer jacket for all dielectric cable shall be marked with the manufacturer name or UL file number, date of manufacture, fiber type, flame rating, listing symbol, and sequential length markings every two feet. The marking shall be in contrasting color to the cable jacket. The cable jacket color shall be Aqua for cables containing OM3/4 multimode fibers and yellow for cables containing singlemode fibers.

4. Cables shall be marked with the manufacturer name, date of manufacture, fiber type, flame rating, listing symbol, and sequential length markings every two feet. The marking shall be in contrasting color to the cable jacket. The cable jacket color shall match the color of the core optical fiber cable.

E. Cable Specifications

1. Temperature Range

a. Non-Plenum Applications: The storage temperature range for the cable on the original shipping reel shall be -40 to +70ºC. The installation/operating temperature range for riser cables shall be -20 to +70 ºC. Testing shall be in accordance with FOTP-3.

b. Plenum Applications: The storage temperature range for the cable on the original shipping reel shall be -40 to +70ºC.The installation/operating temperature range for plenum cables shall be 0 to +70ºC.Testing shall be in accordance with FOTP-3.

2. Compressive Load Resistance

   a. When tested in accordance with FOTP-41, Compressive Loading Resistance of Fiber Optic Cables, the cable shall withstand a minimum compressive load of 89 N/cm (50 lbf/in) applied uniformly over the length of the compression plate. While under compressive load, the fiber shall not experience an attenuation change greater than 0.4 dB at 1550 nm (singlemode) or greater than 0.6 dB at 1300 nm (multimode). After the compressive load is removed, the fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.4 dB at 1300 nm (multimode).

3. Cyclic Flexing

   a. When tested in accordance with FOTP-104, Fiber Optic Cable Cyclic Flexing Test, the cable shall withstand 25 mechanical flexing cycles at a rate of 30 ± 1 cycle per minute. The fiber shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.4 dB at 1300 nm (multimode).

4. High and Low Temperature Bend

   a. When tested in accordance with FOTP-37, Fiber Optic Cable Bend Test, Low and High Temperature, the cable shall withstand four full turns around a mandrel at test temperatures of 0 ºC and +50 ºC. The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.5 dB at 1300 nm (multimode).

5. Impact Resistance

   a. When tested in accordance with FOTP-25, Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies, the cable shall withstand a minimum of 20 impact cycles for riser cables and 10 impact cycles for plenum cables. The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.4 dB at 1300 nm (multimode).

6. Temperature Cycling

   a. When tested in accordance with FOTP-3, Procedure to Measure Temperature Cycling Effects on Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components, the change in attenuation at extreme operational temperatures (0 to +50 ºC) shall not exceed 0.3 dB/km at 1550 nm (singlemode) or 0.6 dB/km at 1300 nm (multimode). The change in attenuation is measured with respect to the baseline values measured at room temperature before temperature cycling.

7. Twist-Bend

a. When tested in accordance with FOTP-91, Fiber Optic Cable Twist-Bend Test, a length of cable no greater than 2 meters shall withstand 10 cycles of mechanical twisting and bending around a mandrel 20 times the cable outer diameter. The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or 0.4 dB at 1300 nm (multimode).

F. Multimode OM4 (50/125 µm)

1. The multimode fiber utilized in the optical fiber cable shall meet EIA/TIA-492AAAA-A-1997, Detail Specification for 50µm Core Diameter/125µm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers, unless noted otherwise. Cable shall have the following specifications:

a. Core Diameter: 50 ± 3 µm

b. Core Non-Circularity: ≤5%

c. Cladding Diameter: 125± 2 µm

d. Cladding Non-Circularity: <2.0%

e. Core-to-Cladding Concentricity: ≤ 3 µm

f. Coating Diameter: 245 ± 2 mm

g. Refractive Index Profile: Graded index

h. Numerical Aperture: 0.275 ± 0.015

i. Maximum Attenuation: less than 3.0 dB/km at 850 nm and 1.0 dB/km at 1300 nm.

2. IEEE 802.3ae Performance: The fiber shall support laser-based 10 Gigabit Ethernet (10GbE) operation for up to 550 meters.

3. Attenuation at the Water Peak: The attenuation coefficient at 1380 nm shall not exceed the attenuation coefficient at 1300 nm by more than 1.0 dB/km.

4. Macrobend Attenuation: The attenuation due to 100 turns of fiber around a 75-± 2 mm diameter mandrel shall not exceed 0.5 dB at 850 nm or 1300 nm.

G. Manufacturer:

a. Belden

b. Panduit

2.03 FIBER OPTIC CONNECTORS

A. The MM optical connector shall be LC UPC type.

B. The SM optical connector shall be LC UPC type.

C. The connector ferrule shall be ceramic or glass-in-ceramic. The optical fiber within the connector ferrule shall be secured with an adhesive.

D. The attenuation per mated pair shall not exceed 0.35 dB (individual) and 0.2 dB (average). Connectors shall sustain a minimum of 200 mating cycles per EIA/TIA-455-21 without violating specifications.

E. The connector shall meet the following performance criteria:

1. Cable Retention (FOTP-6) 0.2 dB
2. Durability (FOTP-21) 0.2 dB
3. Impact (FOTP-2) 0.2 dB
4. Thermal Shock (FOTP-3) 0.2 dB
5. Humidity (FOTP-5) 0.2 dB

F. Connectors shall be field terminated and polished or fusion spliced. Mechanical, quick connect or index-gel based connectors are not allowed.

G. Manufacturer:

a. Belden
b. Panduit

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 270000 for additional requirements.

B. Field Test Requirements for Fiber Optic Cabling System

1. The fibers utilized in the installed cable shall be traceable to the manufacturer. Upon request by the Owner, the Contractor shall provide cable manufacturer's test report for each reel of cable provided. These test reports shall include the manufacturers on reel attenuation test results at 850-nm and 1300-nm for each optical fiber of each reel prior to shipment from the manufacturer.
2. Factory data shall be provided upon request, showing on-the-reel bandwidth performance results as tested at the factory.
3. Every fiber optic backbone link in the installation shall be tested in accordance with the field test specifications defined by the Telecommunications Industry Association (TIA) standard ANSI/TIA/EIA-568-C or by the appropriate network application standard(s), whichever is more demanding.

4. The test shall include the representative connector performance at the connecting hardware associated with the mating of patch cords. The test does not, however, include the performance of the connector at the interface with the test equipment.
5. 100% of the installed cabling links shall be tested and shall pass the requirements of the standards mentioned above and as further detailed in this document. Any failing link shall be diagnosed and corrected at no additional cost to the Owner. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with RFP.
6. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:
    a. The manufacturer of the fiber optic cable and/or the fiber optic connectors
    b. The manufacturer of the test equipment used for the field certification
    c. Training organizations authorized by BICSI
7. Field test instruments for multimode fiber cabling shall meet the requirements of ANSI/TIA/EIA-526-14-A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA/EIA-568-C.1) with a Category 1 light source.
8. Field test instruments for singlemode fiber cabling shall meet the requirements of ANSI/EIA/TIA-526-7.
9. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.
10. The fiber optic launch cables and adapters shall be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters.
11. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests.
12. Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.
13. A representative of the Owner shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase five business days before testing begins.
14. A representative of the Owner will select a random sample of 5% of the installed links. The results obtained shall be compared to the data provided by the installation

Contractor. If more than 2% of the sample results differ in terms of the Pass/Fail determination, the installation Contractor, under supervision of the Owner representative, shall repeat 100% of the testing. The cost of retesting shall be borne by the installation Contractor.

C. Fiber Performance Test Parameters

1. The link attenuation shall be calculated by the following formulas specified in ANSI/TIA/EIA standard 568-B.

   a. Link Attenuation = Cable_Attn + Connector_Attn + Splice_Attn

   b. Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)

   c. The values for the Attenuation_Coefficient are listed in the table below:

Type of Optical Fiber	Wavelength (nm)	Attenuation_Coefficient (dB/km)
Multimode 62.5/125 µm	850	3.5
	1300	1.5
Multimode OM3 50/125 µm	850	3.5
	1300	1.5
Multimode OM4 50/125 µm	850	3.0
	1300	1.5
Singlemode (Inside plant)	1310	0.5
	1550	0.4
Singlemode (Outside plant)	1310	0.4
	1550	0.5

   d. Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)

   e. Maximum allowable mated connectors_loss = 0.50 dB

   f. Splice_Attn (dB) = number of splices (S) * splice_loss (dB)

   g. Maximum allowable splice_loss = 0.1 dB (when tested bidirectionally)

2. Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices—i.e., it does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

3. Test equipment that measures the link length and automatically calculates the link loss based on the above formulas is preferred.

4. The above link test limits attenuation are based on the use of the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1. The user shall follow the procedures established by these standards or application notes to accurately conduct performance testing.

5. The backbone link (multimode/singlemode) shall be tested in two directions at both operating wavelengths to account for attenuation deltas associated with wavelength.

6. Multimode backbone links shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A.

7. Because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation shall be used to determine limit (acceptance) values.

8. Multimode backbone links are designed to be used with network applications that use laser light sources (underfilled launch conditions). However, the link attenuation equation has been based upon the use of a light source categorized as Category 1, Overfilled.

9. Singlemode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1. All singlemode links shall be certified with test tools using laser light sources at 1310 nm and 1550 nm.

3.02 TRAINING

A. Refer to Section 270000 for additional requirements.

3.03 WARRANTY

A. Refer to Section 270000 for additional requirements.

3.04 FIBER OPTIC CABLE INSTALLATION REQUIREMENTS

A. Cable slack shall be provided in each backbone fiber optic cable. This slack is exclusive of the length of fiber that is required to accommodate termination requirements and is intended to provide for cable repair and/or equipment relocation. The cable slack shall be stored in a fashion as to protect it from damage and be secured in the termination enclosure or a separate enclosure designed for this purpose. Multiple cables may share a common enclosure.

B. A minimum of 15 feet of slack cable (each cable) shall be coiled and secured at each end.

END OF SECTION

SECTION 271500 – COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.01 SCOPE

A. This section describes the products and execution requirements relating to telecommunications voice, data and video horizontal (station) cabling and termination components.

B. Horizontal cabling is the cabling between the work area telecommunications outlet and the telecommunications room (TR). Horizontal cabling is often referred to as “station cabling”.

C. The horizontal cabling system will consist of the following:

1. Unshielded Twisted Pair (UTP) Cable
2. Outlet Termination Modules (jacks)
3. Outlet Termination Plates
4. Above Ceiling Cable Support Systems
5. Horizontal Cable Testing Requirements
6. Cable Pathway/Sleeve Requirements

1.02 RELATED WORK

A. Section 270000 – General Technology Requirements

B. Section 270500 – Communications General Requirements

C. Section 270526 – Grounding and Bonding for Technology Systems

D. Section 270528 – Pathways for Technology Systems

E. Section 270537 – Firestopping for Technology Systems

F. Section 271100 – Communications Equipment Rooms

G. Section 271300 – Communications Backbone Cabling

H. Section 271600 – Communications Connecting Cords

I. Section 271800 – Communications Labeling and Identification

J. Section 274000 – AV/Multimedia General Requirements

K. Section 274100 – Audio Visual Systems

1.03 DEFINITIONS

A. Refer to Section 270000 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. Refer to Section 270000 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 270000 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 270000 for additional requirements.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 270000.

2.02 CATEGORY 6 HORIZONTAL COPPER CABLES

A. All cables and equipment shall be furnished, tested, installed and wired by the Contractor.

B. All horizontal data cables shall terminate on modular patch panels in the telecommunications closet as specified on the Drawings.

C. This specification defines the requirements for commercially available high performance Category 6 cable.

D. This cable shall be suitable for installation free-air, in building risers, in conduit, and/or in cable tray and shall carry CMP rating.

E. The cable design described herein shall exceed transmission performance of Category 6 cables.

F. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the National Electrical Code, and meet the specifications of

NEMA (low loss), UL 444, and ICEA. Conductor shall also conform to the requirements for solid annealed copper wire in accordance with ASTM B 3.

G. All cables, termination components, and support hardware shall be furnished, tested, installed, and wired by the Contractor.

H. The jacket color for data cables shall be Jacks shall be BLUE in color for standard data, GREEN in color for wireless, PURPLE in color for AV and YELLOW in color for Security.

I. IMPORTANT: Cable and termination components (jack, patch panel, wiring blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer.

J. Manufacturers:

1. General Cable Genspeed 6000
2. Commscope Uniprise Ultramedia 6

2.03 INFORMATION OUTLET

A. General

1. Station cables shall each be terminated at their designated workstation location in the connector types described in the subsections below. Included are modular jacks, faceplates, and surface mount raceway. The combined assembly is referred to as the Standard Information Outlet (SIO). These connector assemblies shall snap into a mounting frame.
2. SIOs shall be mounted in new outlet boxes, where existing boxes are in place, on surface mount raceway typically in surface raceway with barrier, in floor mount interface boxes, or on power poles either currently owned or new.
3. The telecommunications outlet frame shall accommodate or incorporate the following:
    a. A minimum of four (4) modular jacks, when installed on a wall-mounted assembly.
    b. A mechanism for adjusting the surface plate to a plumb position.
4. When multiple jacks are identified in close proximity on the Drawings. The Contractor shall determine the optimum compliant configuration based on the products proposed.
5. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each SIO type for review by the Consultant.

B. Modular Jack

1. Data jacks shall be non-keyed 8-pin modular jacks.

2. Termination components shall be designed to maintain the cable's pair twists as closely as possible to the point of mechanical termination.
3. Jacks shall utilize a four-layer printed circuit board to control NEXT.
4. Jack housings shall fully encase and protect printed circuit boards and IDC fields.
5. Modular jack contacts shall accept 2500 plug insertions.
6. Modular jack contacts shall be formed flat for increased surface contact with mated plugs. These contacts shall be arranged on the PC board in two staggered arrays of four to maximize contact spacing and minimize crosstalk.
7. Modular jack contacts shall be constructed of Beryllium copper for maximum spring force and resilience.
8. Contact Plating shall be a minimum of 50 micro inches of gold in the contact area over 50 micro-inch of nickel, compliant with FCC part 68.5.
9. Jack termination shall be 110 IDC, integral to the jack housing, laid out in two arrays of four contacts.
10. Jacks shall utilize a paired punch down sequence. Cable pairs shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
11. Jacks shall utilize tin lead plated (60% tin/40%lead) phosphor bronze 110 insulation displacement contacts.
12. Jacks shall terminate 22-26 AWG stranded or solid conductors.
13. Jacks shall terminate insulated conductors with outside diameters up to .050".
14. Jacks shall be compatible with single conductor 110 impact termination tools.
15. Jacks shall be compatible with EIA/TIA 606 color code labeling and accept snap on icons for identification or designation of applications.
16. Jacks shall be WHITE in color for standard data, GREEN in color for wireless, PURPLE in color for AV, YELLOW in color for security and RED in color for fire alarm/life safety.
17. Jacks shall be marked as either T568A or T568B wiring.
18. Category 6 jacks shall be manufactured by:
    a. Panduit
    b. Uniprise

C. Outlet Faceplates

1. Faceplates shall match the electrical outlets for material type and color.

2. Faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.

3. Any unused jack positions shall be fitted with a removable blank inserted into the opening.

4. Modular jacks shall have capability to incorporate a dust cover that fits over and/or into the jack opening. The dust cover shall be designed to remain with the jack assembly when the jack is in use. No damage to the jack pinning shall result from insertion or removal of these covers. Dust covers that result in deformation of the jack pinning shall not be accepted.

5. Wall-mounted “voice only” outlets shall be installed where identified on the floor plan Drawings to accommodate wall-mounted telephone sets. The wall plate shall be of stainless steel construction, accommodate one RJ-45 jack, mount on a standard single gang outlet box or bracket, and include mating lugs for wall phone mounting.

6. All standard information outlets and the associated jacks shall be of the same manufacturer throughout each/the building. An allowable exception, however, is the wall-mounted “voice only” outlet described above.

7. Faceplates shall be manufactured by modular jack manufacturer.

D. Surface Mount Interface Box

1. Low profile, surface mount boxes shall incorporate recessed designation strips at the top for identifying labels. Designation strips shall be fitted with clear plastic covers.

2. The box shall feature built-in cable management for both fiber and copper applications.

3. Any unused jack positions shall be fitted with a removable blank inserted into the opening.

4. Modular jacks shall have capability to incorporate spring-loaded shutter door for added protection from dust and other airborne contaminants. The dust cover shall be designed to remain with the jack assembly when the jack is in use.

5. The box shall have the capability to incorporate optional magnets that can be internally mounted.

6. Surface mount box shall be manufactured by modular jack manufacturer.

2.04 HORIZONTAL COMPOSITE MM FIBER OPTIC/COPPER CABLING FOR EXTENDED ETHERNET WITH POE

A. For devices that are beyond the distance limitation of UTP cabling and require PoE to operate such as IP surveillance cameras and wireless access points the Contractor, as noted on the drawings, shall provide a composite 2-strand OM3 MM fiber optic cable with an 18 awg 2-conductor stranded copper cable for power within a single jacket. The Contractor shall provide 12 awg when required based on distances and voltage drop.

B. Provide SC, ST or LC connectors has required for the application and devices the fiber will be connecting to.

C. All pre-terminated and field terminated fiber shall be tested and certified with an OTDR and meet OM3 standards.

D. Provide plenum, riser or OSP rated cable as required for the application.

E. Manufacturer:

1. Berk-Tek OneReach
2. CommScope Powered Fiber
3. Corning ActiFi Composite Fiber
4. Or approved equal

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 270000 for additional requirements.

3.02 TWISTED PAIR TEST EQUIPMENT

A. Test equipment used under this contract shall be from a manufacturer who has a minimum of five years' experience in producing field test equipment. Manufacturers shall be ISO 9001 certified.

B. All test tools of a given type shall be from the same manufacturer and have compatible electronic results output. Test adapter cable shall be approved by the manufacturer of the test equipment. Baseline accuracy of the test equipment shall exceed TIA Level III, as indicated by independent laboratory testing.

C. Test equipment shall:

1. Be capable of certifying Category 5E, 6 and 6A permanent links.
2. Have a dynamic range of at least 100dB to minimized measurement uncertainty.
3. Be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.
4. Include S-band time domain diagnostics for NEXT and return loss.
5. Be capable of running individual NEXT, return loss, etc., measurements in addition to AutoText.
6. Include a library of cable types, stored by major manufacturer.

7. Store at least 1000 Category 6 autotests in internal memory.

D. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurements.

E. The approved manufacturer of the test equipment is Fluke and JDSU/Viavi.

3.03 TRAINING

A. Refer to Section 270000 for additional requirements.

3.04 WARRANTY

A. Refer to Section 270000 for additional requirements.

3.05 STATION CABLING

A. Information outlet cables with copper media (voice & data UTP and “TV” coax) shall be located as detailed on the Project Drawings.

B. The Contractor shall utilize these documents in determining materials quantities and routing.

C. Station cables shall be run to the information outlet from the telecommunications room serving each area in conduit, free-air above drop ceiling, in cable tray, and/or in modular furniture.

D. The maximum station cable drop length for UTP cables shall not exceed 295 feet (90 meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and shall include any slack required for the installation and termination. The Contractor shall install station cabling in a fashion to avoid unnecessarily long runs.

E. Contractor shall verify cable lengths comply with published standards; prior to installation of any horizontal cabling, this Contractor shall verify cable paths and confirm no horizontal cable will exceed 295 total feet. If it is determined that the cable will exceed 295’, this Contractor shall route the cabling to another telecommunications room or determine shorter path so cables are under 295’. If this is not possible, the Contractor shall notify the Consultant prior to installation. Failure to do this step will not result in a change order from the Contractor.

F. All cables shall be installed splice-free unless otherwise specified.

G. During pulling operation, an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as the feed cable and operate pulling machinery.

H. Avoid abrasion and other damage to cables during installation.

I. All cable shall be free of tension at both ends. In cases where the cable shall bear some stress, Kellom grips may be used to spread the strain over a longer length of cable.

J. Where installed free-air, installation shall consider the following:

1. Cable shall run at right angles and be kept clear of other trades' work.
2. Cables shall be supported according to code, using "J-hooks" anchored to ceiling concrete, walls, piping supports, or structural steel beams.
3. Hooks shall be designed to maintain cable bend to larger than the minimum bend radius (typically 4x the cable diameter).
4. Supports shall be spaced at a maximum 4-foot interval unless limited by building construction. If cable "sag" at mid-span exceeds 6 inches, another support shall be used.

K. Cable shall never be laid directly on the ceiling grid.

L. Cables shall not be attached to existing cabling, plumbing, or steam piping, ductwork, ceiling supports, or electrical or communications conduit.

M. Manufacturers' minimum bend radius specifications shall be observed in all instances. Use of plastic cable ties is not acceptable. Cable bundles shall be neatly dressed with use of Velcro type straps.

N. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.

O. A coil of one foot in each cable shall be placed in the ceiling at the last support (e.g., J-hook) before the cables enter a fishable wall, conduit, surface raceway, or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15 feet of slack shall be left in each station cable under 250 feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.

P. To reduce or eliminate EMI, the following minimum separation distances from $\leq$480V power lines shall be adhered to:

1. Twelve (12) inches from power lines of $<$5-kVa
2. Eighteen (18) inches from high voltage lighting (including fluorescent)
3. Thirty-nine (39) inches from power lines of 5-kVa or greater
4. Thirty-nine (39) inches from transformers and motors

Q. All openings shall be sleeved and firestopped per prevailing code requirements upon completion of cable installation.

3.06 INFORMATION OUTLET

A. Information outlets shall be flush mounted on wall-mounted boxes, in floor-mounted boxes, on surface raceway, or on modular furniture.

B. Any outlets to be added where these conditions are not met shall be positioned at a height matching that of existing services or as directed otherwise by the Site Coordinator and the Consultant. Nominal height (from finished floor to center line of outlet) in new installation shall be as follows:

1. Standard Voice & Data Outlet (SIO) shall match adjacent electrical outlets.

2. Wall-Mounted Telephone Outlet (Standard Voice only) shall meet ADA requirements for both front and side reach access.

C. The Contractor shall coordinate the style of the telecommunication outlets to be installed in the floor mount boxes and surface mount raceways with the Owner.

3.07 ELEVATOR INTERFACE

A. The Contractor shall furnish and install an elevator interface box outside of the elevator equipment room.

1. The Contractor shall provide an elevator telecommunications junction box located outside of the Elevator Machine Room, for interface of telecommunication cable to the elevator cab(s). This requirement complies with ANSI A17.1 code which prevents work within the Elevator Machine Room, other than specific elevator work.

2. Telecommunications J-box shall include a keyed lockable door. Additionally, the J-box shall have proper punch down blocks and data jacks suitable for terminating all cables within the J-box.

3. The Contractor shall provide any voice/data cables to this enclosure as required.

4. Electronics or cable for other systems such as security shall not be placed within this enclosure.

5. Coordinate exact location of elevator security junction box with the Elevator Contractor, Architect, and Consultant, prior to installation.

6. Cables entering the elevator telecommunications J-box and elevator equipment room shall be appropriately labeled by the Contractor, so that the Elevator Contractor can connect the appropriate wires to the elevator controllers. Wires should be individually labeled to separate them from other elevator functions and to assist the Elevator Contractor in making proper connection points.

3.08 CABLE TERMINATION

A. At the telecommunication closet, all data and voice cables shall be positioned on termination hardware in sequence of the outlet ID, starting with the lowest number.

B. Termination hardware (blocks and patch panels) positioning and layout will be reviewed and approved by the Consultant prior to construction. The review does not exempt the Contractor from meeting any of the requirements stated in this document.

C. Cable Termination – Data/Voice UTP

1. Data/voice patch panels shall be designed and installed in a fashion as to allow future station cabling to be terminated on the panel without disruption to existing connections.

2. Data patch panels shall be sized to accommodate a minimum of 20% growth in the quantity of stations relative to the initial installation.

3. At information outlets and data/voice patch panels, the installer shall ensure that the twists in each cable pair are preserved to within 0.5 inch of the termination for data/voice cables. The cable jacket shall be removed only to the extent required to make the termination.

D. Cable Termination – Fiber Optic

1. All fibers shall be terminated using the specified connector type.

2. All terminated fibers at the telecommunications closets shall be mated to couplings mounted on patch panels. Couplings shall be mounted on a panel that, in turn, snaps into the housing assembly. Any unused panel positions shall be fitted with a blank panel inhibiting access to the fiber optic cable from the front of the housing.

3. All couplings shall be fitted with a dust cap.

4. Fibers from multiple locations may share a common enclosure, but they shall be segregated on the connector panels and clearly identified. Fibers from multiple destinations may be secured in a common enclosure, provided they are clearly identified as such. Fibers from different locations shall not share a common connector panel (e.g., “insert”).

5. Slack in each fiber shall be provided as to allow for future re-termination in the event of connector or fiber end-face damage. Adequate slack shall be retained to allow termination at a 30” high workbench positioned adjacent to the termination enclosure(s). A minimum of one meter (~39”) of slack shall be retained regardless of panel position relative to the potential work area.

6. If the cable is armored the Contractor shall install a plastic twist-on bushing on each end of interlocking armored fiber to protect cable from sharp edges of the armor.

3.09 TEST DATA – COPPER MEDIA

A. The test result records saved by the tester shall be transferred into a Windows-based database utility that allows for the maintenance, inspection, and archiving of these test records. A guarantee shall be made that these results are transferred to the PC unaltered,

i.e., “as saved in the tester” at the end of each test. Comma separated value (CSV) format is not acceptable.

B. The database for the completed job – including twisted-pair copper cabling links, if applicable –shall be stored and delivered on CD-ROM. This CD-ROM shall include the software tools required to view, inspect, and print any selection of test reports.

C. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:

1. The identification of the link in accordance with the naming convention defined in the overall system documentation.

2. The overall Pass/Fail evaluation of the copper channel-under-test, including the NEXT worst-case margin (margin is defined as the difference between the measured value and the test limit value).

3. The overall Pass/Fail evaluation of the fiber link-under-test, including the Attenuation worst-case margin (margin is defined as the difference between the measured value and the test limit value).

4. The date and time the test results were saved in the memory of the tester.

3.10 COPPER STATION CABLES

A. Station cabling testing shall be from the jack at the outlet in the work area to the patch panel on which the cables are terminated.

B. Testing shall be of the permanent link. Contractor shall warrant performance, however, based on channel performance and provide patch cords that meet channel performance criteria. All cabling not tested strictly in accordance with these procedures shall be retested at no cost to the Owner.

C. Testing shall be from the jack at the SIO to the patch panel on which the cables are terminated at the wiring hub.

D. Horizontal “station” cables shall be free of shorts within the pairs and shall be verified for continuity, pair validity and polarity, and wire map (conductor position on the modular jack). Any defective, split, or mispositioned pairs shall be identified and corrected.

E. Testing of the cabling systems rated at TIA Category 5e/6/6a and above shall be performed to confirm proper functioning and performance.

F. Testing of the transmission performance of station cables (Category 5e/6/6a) shall include the following:

1. Length

2. Attenuation

3. Pair to Pair NEXT
4. ACR
5. PSNEXT Loss
6. Return Loss
7. Pair to Pair ELFEXT Loss or ACRF
8. PSEFEXT Loss or PS-ACRF
9. Propagation Delay
10. Delay Skew
11. Return Loss

G. The maximum length of station cable shall not exceed 90 meters, which allows 10 meters for equipment and patch cables.

H. Worst case performance at 20°C, based on a horizontal cable length of 90 meters and equipment cord length of 4 meters, shall be as follows:

1. CATEGORY 6 (Permanent LINK)

Frequency (MHz)	Insertion Loss (Maximum dB)	NEXT Loss Pair to Pair (dB)	PS-NEXT Loss (dB; Worst Case)	ELFEXT Loss Pair to Pair (dB)	PSELFEXT loss (dB)
1.0	1.9	65.0	62.0	64.2	61.2
4.0	3.5	64.1	61.8	52.1	49.1
8.0	5.0	59.4	57.0	46.1	43.1
10.0	5.5	57.8	55.5	44.2	41.2
16.0	7.0	54.6	52.2	40.1	37.1
20.0	7.8	53.1	50.7	38.2	35.2
25.0	8.8	51.5	49.1	36.2	33.2
31.25	9.8	50.0	47.5	34.3	31.3
62.5	14.1	45.1	42.7	28.3	25.3
100.0	18.0	41.8	39.3	24.2	21.2
200.0	26.1	36.9	34.3	18.2	15.2
250.0	29.5	35.3	32.7	16.2	13.2

I. In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation method. The Contractor shall make additional tests as the Consultant deems necessary at no additional expense to the Owner or Consultant.

J. All data shall indicate the worst-case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combination and in both directions when required by the appropriate standards.

K. Cables shall be tested to the maximum frequency defined by the standards covering that performance category. Transmission Performance Testing shall be performed using a test instrument designed for testing to the specified frequencies. Test records shall verify “PASS” on each cable and display the specified parameters—comparing test values with standards-based “templates” integral to the unit.

END OF SECTION

SECTION 271600 – COMMUNICATIONS CONNECTING CORDS

PART 1 - GENERAL

1.01 SCOPE

A. This section describes the products relating to high quality Category 6 voice and data patch cords.

B. In this section the term patch cords refers to the cords that connect Owner provided data network electronics to the horizontal cable infrastructure.

C. It is important that the horizontal cable system and the provided patch cords work as one complete system for guaranteed channel performance. Patch cords shall be manufactured by the same manufacturer as the jack and patch panels.

D. The Contractor shall provide and deliver all cords as listed in this section. The Owner will be responsible for installation of cords.

1.02 RELATED WORK

A. Section 270000 – General Technology Requirements

B. Section 270500 – Communications General Requirements

C. Section 270526 – Grounding and Bonding for Technology Systems

D. Section 270528 – Pathways for Technology Systems

E. Section 270537 – Firestopping for Technology Systems

F. Section 271100 – Communications Equipment Rooms

G. Section 271300 – Communications Backbone Cabling

H. Section 271500 – Communications Horizontal Cabling

I. Section 271800 – Communications Labeling and Identification

J. Section 274000 – AV/Multimedia General Requirements

K. Section 274100 – Audio Visual Systems

1.03 DEFINITIONS

A. Refer to Section 270000 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. Refer to Section 270000 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 270000 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 270000 for additional requirements.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 270000.

2.02 CATEGORY 6 PATCH CORDS

A. The Owner has the right to determine the final length of the patch cords after the contract is awarded.

B. All patch cords shall be round and consist of eight insulated 23 AWG (24 AWG for Cat 5e), stranded copper conductors, arranged in four color-coded twisted pairs within a flame retardant jacket and be backwards compatible with lower performing categories. Modular patch cords shall utilize ISO termination method that is designed to reduce and control near-end cross talk (NEXT) and far end cross talk (FEXT) without compromising signal impedance.

C. Both ends of the cord shall be equipped with modular 8-position (RJ45 style) plugs wired straight through with standards compliant wiring. All modular plugs shall exceed FCC CFR 47 part 68 subpart F and IEC 603.7 specifications, and have 50 micro inches of gold plating over nickel contacts. Cable shall be label-verifiable. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Patch cords shall have color-coded insert molded strain relief boot with a latch guard to protect against snagging. Additional color-coding shall be available by the use of snap-in icons.

D. Patch cords shall be wired straight through. Pin numbers shall be identical at each end and shall be paired to match T568B patch panel jack wiring per ANSI/TIA/EIA-568-B. Patch cords shall be unkeyed.

E. The manufacturer of the cords shall be the same as the manufacturer for UTP termination hardware (jacks & patch panels). Cords shall be highest quality patch cords available by connectivity manufacturer.

F. The patch cords shall match the Category rating of the jack and cable it will be connecting to.

G. This Contractor shall provide the following patch cords:

Qty	Length	Notes
1	7 feet	Non-Plenum for each Category 6 cable on the MDF and IDF
1	10 feet	Non-Plenum on each device that connects to the category cable

2.03 FIBER OPTIC PATCH CORDS

A. The Owner has the right to determine the final length of the patch cords after the contract is awarded.

B. All MM fiber optic patch cords shall:

1. Be duplex 2-3mm tight buffer design with Aqua jacket.
2. Have LC-LC connectors with straight thru connectors (A-A Polarity).
3. Have 50-micron OM4 core.

C. This Contractor shall provide the following patch cords:

Qty	Length	Notes
1	3 meter	MM Non-Plenum for each pair in both sides The MDF and IDFs including the devices

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 270000 for additional requirements.

3.02 TRAINING

A. Refer to Section 270000 for additional requirements.

3.03 WARRANTY

A. Refer to Section 270000 for additional requirements.

3.04 ORDERING AND DELIVERY

A. Prior to ordering patch cords the Contractor shall schedule meeting with Owner and Consultant to verify patch cord lengths, colors and quantities.

B. Contractor shall coordinate delivery of patch cords with Owner. Contractor shall have list of delivered cords and shall have Owner sign delivery sheet at time of delivery.

END OF SECTION

SECTION 271800 – COMMUNICATIONS LABELING AND IDENTIFICATION

PART 1 - GENERAL

1.01 SCOPE

A. This section describes the products and execution requirements relating to labeling of telecommunications cabling, termination components, and related subsystems. Covered systems include the following:

1. Equipment room backboards and equipment racks
2. Station cable and terminating equipment
3. Telecommunications grounds and related components

1.02 RELATED WORK

A. Section 270000 – General Technology Requirements

B. Section 270500 – Communications General Requirements

C. Section 270526 – Grounding and Bonding for Technology Systems

D. Section 270528 – Pathways for Technology Systems

E. Section 270537 – Firestopping for Technology Systems

F. Section 271100 – Communications Equipment Rooms

G. Section 271300 – Communications Backbone Cabling

H. Section 271500 – Communications Horizontal Cabling

I. Section 271600 – Communications Connecting Cords

J. Section 274000 – AV/Multimedia General Requirements

K. Section 274100 – Audio Visual Systems

1.03 DEFINITIONS

A. Refer to Section 270000 for additional definitions.

1.04 REFERENCE STANDARDS AND CODES

A. Refer to Section 270000 for additional requirements.

1.05 QUALIFICATIONS

A. Refer to Section 270000 for additional requirements.

1.06 PRE-CONSTRUCTION SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.07 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.08 CLOSEOUT SUBMITTALS

A. Refer to Section 270000 for additional requirements.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 270000.

2.02 LABELS

A. All labels shall be permanent and be machine generated (e.g., Brady or Panduit). No handwritten or non-permanent labels shall be allowed. Labels shall be Brady “I.D. Pro” or XC-Plus or equivalent. Labeling on backboards and/or equipment racks may be pre-cut adhesive type.

B. Characters on all labels shall be black printed on a white background.

C. Label size shall be appropriate to the cable size(s), outlet faceplate layout, patch panel design, or other related equipment sizes and layouts.

D. All labels to be used on cables shall be self-laminating, white/transparent vinyl, and be wrapped around the cable sheath. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminated over the full extent of the printed area of the label.

E. Labels used to identify innerduct carrying fiber optic cable shall be labeled with a durable yellow polyethylene tag that reads “CAUTION Fiber Optic Cable” and includes blank spaces for adding (1) fiber count and (2) destination information. An example of a compliant product is VIP Products’ “Caution Write-On Coverall Tag.”

F. Contractor to label the ceiling tile out side each location with the outlet information with permanent label’s

G. Everything cables device or components must be label with a nomenclature that is approved by the costumers with permanent labels that matches the as-builts.

PART 3 - EXECUTION

3.01 TESTING

A. Refer to Section 270000 for additional requirements.

3.02 TRAINING

A. Refer to Section 270000 for additional requirements.

3.03 WARRANTY

A. Refer to Section 270000 for additional requirements.

3.04 GENERAL

A. The Contractor shall match the Owner's standard labeling scheme.

B. Clean surfaces before attaching labels.

C. Install all labels firmly. Labels attached to terminating equipment such as backboards, faceplates, 110 blocks, and patch panels shall be installed plumb and neatly on all equipment.

3.05 LABELING OF CABLING AND TERMINATION COMPONENTS

A. Backboard and Equipment Racks

1. Backboards and equipment racks shall be labeled by the Contractor identifying the telecommunication room. Additionally, equipment racks shall have an alpha character after the room number unique to that particular communications closet. For example, TR1-A would be the first rack in TR1.

2. Character height shall be 1-inch (minimum).

B. Cabling

1. Horizontal cables shall have a machine generated wrap around cable label within 4" of each end of the cable. Label shall be clearly legible and meet TIA-EIA 606 standards. Character height shall be .25" (minimum).

2. Voice/data/video backbone cables shall have a machine generated wrap around cable label within 12" of each end of the cable. Label shall be clearly legible and meet TIA-EIA 606 standard. Character height shall be .5" (minimum).

3.06 FIBER OPTIC BACKBONE, RISER CABLES, AND TERMINATION COMPONENTS

A. All fiber optic backbone and copper (inter-building, riser, and tie) cables shall be identified AT BOTH ENDS with a designation that identifies where the opposite end of the same cable

terminates (e.g., equipment room or telecommunications room I.D.). In addition, labeling of all fiber optic cables shall include the number of fibers in the cable.

B. Each fiber optic termination panel shall be clearly labeled indicating the destination of the cable(s) and the fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.

3.07 STANDARD INFORMATION OUTLET (SIO) FACEPLATES

A. All faceplates shall be clearly labeled indicating the destination of the cable(s) (telecommunication room number), the data patch panel(s) letter designation, the data port number(s) on the data patch panel(s), and the voice cable number(s).

B. Telecommunications outlets are to be labeled (1) on the cover of the assembly and (2) on each cable terminated at that location.

C. Station cables shall be labeled within two inches of the cable end.

3.08 DATA PATCH PANELS

A. All data patch panels shall be clearly labeled indicating the telecommunication room number, the data patch panel letter designation, and the data port number on the data patch panel (ports 1 through 48). Each telecommunication room shall start with data patch panel ‘A’ and continue through the alphabet.

B. A data port schedule for each telecommunication room shall be created in spreadsheet format (Excel) with the telecommunication room number, data patch panel letter designations, data port numbers, and room numbers identified in the spreadsheet. In addition, for each data patch panel port, a field shall be provided in the spreadsheet for the Owner to manage the cabling infrastructure by recording the device and any special notes pertaining to the room utilizing the data cable terminated to the port.

C. Refer to Telecommunication “T” Series Project Drawings for standard information outlet faceplate and data & voice patch panel labeling scheme requirements. A sample of the data and voice port schedules is to be provided to the Owner, in the cable record book and in electronic format (Excel spreadsheet), with final documents provided on the Project Drawings.

3.09 FIBER OPTIC CABLES AND TERMINATION COMPONENTS

A. All fiber optic cables, termination enclosures and connector panels, and splice closures shall be clearly labeled.

B. In addition, labeling of all fiber optic cables shall include the number of fibers in the cable.

C. Each fiber optic termination panel shall be clearly labeled indicating (1) the destination(s) of the cable(s) and (2) fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.

3.10 GROUND SYSTEM LABELING

A. All grounds shall be labeled as close as practical to the point of termination (for ease of access to read the label). Labels shall be nonmetallic and include the following statement: “WARNING: If this connector or cable is loose or must be removed, please call the building telecommunications manger.” Refer to ANSI/TIA/EIA 606 for additional labeling requirements.

END OF SECTION

SECTION 274000 – AV/MULTIMEDIA GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 270000 for additional project scope information.

B. Successful bidder shall provide, install, configure, and provide warranty service for audiovisual systems, including displays, audio/video/graphics switching and distribution systems, integrated control systems, and other equipment as described herein.

1.02 RELATED WORK

A. Section 270000 – General Technology Requirements

B. Section 270500 – Communications General Requirements

C. Section 270526 – Grounding and Bonding for Technology Systems

D. Section 270528 – Pathways for Technology Systems

E. Section 270537 – Firestopping for Technology Systems

F. Section 271500 – Communications Horizontal Cabling

G. Section 271600 – Communications Connecting Cords

H. Section 271800 – Communications Labeling and Identification

I. Section 274100 – Audio Visual Systems

1.03 REFERENCE

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 270000 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

3. Execution: Coordination, testing, training, warranty, and cable management.

1.04 DEFINITIONS

A. HDCP: High-bandwidth Digital Content Protection or a security protocol designed to limit unauthorized use of protected content. Where applicable, HDCP compliant devices shall be utilized per design specifications. Use of HDCP compliant systems designed herein is the responsibility of the end user and compliance with Owner's Fair Use policies.

B. EDID, E-EDID: Extended Display Information Data, Enhanced-Extended Display Information Data or a remotely readable (read by a source) data file that resides in a display or specialized audiovisual device – commonly referred to as a "sink" – describing the capabilities of the sink to a connected source.

C. Configuration: the software and firmware programming that defines and creates the functionality, levels, presets, and settings of devices.

D. Configure: To define functionality, levels, presets, and settings of device(s) using software and/or firmware.

E. Programmer: Contractor personnel engaged in developing the configuration of systems.

F. DSP: Digital Signal Processing, or Digital Signal Processor.

G. AEC: Acoustic Echo Cancellation.

H. Fixed Architecture: Referring to software providing fixed processing paths with adjustable processing objects in a predetermined sequence.

I. Open Architecture: Referring to software providing infinitely variable Programmer selected processing paths with adjustable processing objects arranged in any sequence deemed appropriate by Programmer.

1.05 REFERENCE STANDARDS AND CODES

A. Giddings, G. H. Philip. *Audio Systems – Design and Installation*.
Focal Press, 1990.
Focal Press, Elsevier Inc.
30 Corporate Drive, Suite 400
Burlington, MA 01803

B. AV Installation Handbook, Second Edition.
InfoComm International, 2009.
11242 Waples Mill Road, Ste. 200
Fairfax, VA 22030

C. Audiovisual Systems Performance Verification (ANSI/Infocomm 10:2013)
InfoComm International, 2013.
11242 Waples Mill Road, Ste. 200
Fairfax, VA 22030
http://www.infocomm.org/cps/rde/xchg/infocomm/hs.xsl/35975.htm

D. *Dashboard for Controls Template, Design Reference, and Integrators Guide.*
InfoComm International.
www.infocomm.org/cps/rde/xchg/infocomm/hs.xsl/35324.htm

E. Copyright Act of 1976
U.S. Copyright Office
101 Independence Ave. S.E.
Washington, DC 20559
Phone: (202) 707-3000

1.06 QUALIFICATIONS

A. Primary AV Contractor shall have at least one (1) employee assigned to the project in a design or management role, and at least one (1) employee assigned to the project in an installing technician role, holding at least one of the follow certifications:

1. CTS (InfoComm International)
2. CTS-I (InfoComm International
3. CTS-D (InfoComm International)
4. EST-L2 (National Systems Contractor Association)

B. DSP & Automation/Control Systems Programmer

1. Training: Programmer shall have received manufacturer-provided and/or manufacturer-approved training in the configuration of the DSP & Automation/ Control systems being provided and or interfaced.
2. Certification: Programmer shall hold the highest applicable manufacturer programming certification(s) offered by the manufacturer(s) of the DSP & Automation/ Control systems hardware being provided and or programmed.
3. At minimum, the awarded Contractor shall possess:
    a. For QSC: QSYS Level 2, QSYS Control 201, and QSYS Quantum certified.
    b. Audinate: Dante Level 3 CertifiedTraining: Programmer shall have received manufacturer-provided and/or manufacturer approved training in the configuration of the DSP systems being provided.
4. Certification: Programmer shall hold the highest applicable manufacturer programming certification(s) offered by the manufacturer(s) of the DSP hardware.

C. Control System Programmer

1. Training: Programmer shall have received manufacturer-provided and/or manufacturer approved training in the configuration of the integrated control systems being provided.
2. Certification: Programmer shall hold the applicable manufacturer programming certification(s) or be an authorized independent programmer of the integrated control systems.
    a. For QSC: QSYS Level 2, QSYS Control 201, and QSYS Quantum certified

b. For AMX: AMX Certified Expert (ACE Programming Expert)

c. For Crestron: Crestron Certified Programmer

d. For Extron: Extron Control Professional

e. Or approved equal

D. Refer to subsequent sections for section specific qualification requirements.

1.07 PRE-CONSTRUCTION SUBMITTALS

A. Refer to Section 270000 for additional requirements.Structurally Mounted Elements: Including but not limited to monitors, projectors, projection screens, and loudspeakers.

C. Frequency Assignment Plans: Provide for all wireless microphones.

D. Custom Engraving: Layout and labeling/engraving of custom products including wall plates and interconnection panels. Provide engraving detail with material and finish detail.

E. Power Distribution: Plan for distribution and switching of AC and DC power to all audiovisual devices, including sequencing order of outlets and banks. Time delay to be field configured as necessary for proper system power up and down.

F. Colors: Confirm color option selections with Architect per location for items such as speakers, projectors, plates, etc.

G. Layouts of physical and virtual user controls in graphical format. This shall include:

1. Engraved buttons and overlays

2. Machine-printed adhesive labels

3. Graphical user interfaces for touch panels or web interfaces

4. Descriptive write-up of function(s) of each button for each page.

H. Copy of manufacturer configuration software, or link to manufacturer website download page for accessing configuration software.

1. Version: Submitted software shall be identical version used to create Audio DSP configuration.

I. Integrated control system review shall be done via web conference with Consultant.

J. Contractor shall make changes as requested by Consultant in pre-construction submittal review.

1.08 CONSTRUCTION PROGRESS SUBMITTALS

A. Refer to Section 270000 for additional requirements.

1.09 CLOSEOUT SUBMITTALS

A. Refer to Section 270000 for additional requirements.

B. Quick-Reference Guides: Contractor shall create a concise quick-reference guide covering normal system operation and basic troubleshooting procedures for each room/system type. Length of each quick-reference guide shall be commensurate with the information needed for successful operation, subject to Owner approval.

1. Upon Owner approval, Contractor shall provide two (2) laminated copies and one (1) digital copy for each room/system type.

C. Serial Numbers: Contractor shall provide a list of serial numbers for all supplied components with serial numbers and with a unit price greater than $99. Organize list by room/system type.

1.10 CORRECTION PERIOD

A. Length of Period: Contractor shall offer a one year correction period to Owner for this system. Contractor shall repair all equipment and cabling problems at no additional cost to Owner during the correction period.

B. Commencement: Correction period shall begin at date of Final Acceptance.

C. Final Acceptance: shall be defined as the date at which all contract work (save for a correction period) is complete, including punch list completion & verification, closeout submittals, and written verification by the Owner is obtained by the Contractor that the systems have been accepted.

D. Response: Contractor shall respond by phone within two (2) hours to calls for service or assistance from Owner during normal business hours for the duration of the correction period.

E. On-site Response: Contractor shall respond on-site within eight (8) business hours from the time of the initial phone contact in the event that the issue cannot be resolved over the phone.

F. Equipment on Loan: Contractor shall loan equipment for any broken, defective, or non-functional equipment that cannot be repaired and returned within one week. Contractor shall provide shipping, delivery, and integration at no additional cost to Owner. Equipment shall be comparable in size, speed, brightness, and relevant performance specifications, as determined by Owner.

G. Projection Lamps: Projection lamps are to be warranted by Contractor for a minimum of 90 days, or the rated life expectancy of the lamp, whichever comes first.

H. Damaged Equipment: Equipment that is damaged due to intentional misuse, abuse or negligence is not covered under this warranty; however, Contractor shall assist Owner in

putting the system back in working order in the shortest possible timeframe while charging normal service rates for labor and equipment.

1.11 OWNERSHIP

A. Property Rights: Contractor assigns to Owner any and all intellectual property rights and applications made by Contractor, or its agents or employees in connection with the performance of this contract. Contractor also acknowledges and agrees that services rendered in connection with the performance of this contract shall be a “work made for hire” within the meaning of Section 201 inventions of the Copyright Law of 1976.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 270000.

2.02 PRODUCT SPECIFICATIONS

A. Provisions: Product specifications are provided in subsequent sections to Contractor for the appropriate configuration and/or provision of accessories as well as for a guide to indicate key features for possible substitutions.

B. Where wireless microphone systems are specified, Contractor shall determine optimal frequency range for final product selection and submit Manufacturer’s recommended frequency band for Owner and Consultant approval prior to ordering equipment. Contractor shall provide congruent frequency band products where like systems are specified for interoperability of components. Where three (3) or more wireless microphones are specified within the same system, Contractor shall provide and install necessary antennae distribution for optimal performance, to be submitted for Owner and Consultant approval during pre-construction phase.

C. Interconnections: Contractor shall be responsible for providing populated, grommeted, or blank cover plates for all wall and floor box openings intended for audiovisual systems.

D. Twisted Pair (TP) Category Cabling: Contractor shall use twisted pair Category cable as recommended by manufacturer of transmission equipment for optimal bandwidth and signal timing. Where cable type is not specified by manufacturer, Contractor shall use shielded twisted pair Category 6 cabling. Cable type shall be detailed in pre-construction submittals with any deviations from manufacturer recommendations expressly noted.

E. Mounts: Contractor shall fabricate mounts for projectors, monitors, loudspeakers, cameras, etc. as necessary, and shall modify standard mounts as required for optimal mounting configurations. Intended hardware shall be detailed in shop drawing submittals.

1. Custom mounting configurations shallbe submitted in shop drawings for review.

2. Contractor shall provide all hardware as necessary, including flanges, Unistrut, threaded pipe, column extensions, yokes, clamps, threaded rod, aircraft cable, and any other hardware required to securely mount equipment.

3. All ceiling tile penetrations shall be neatly finished with a plate, grommet and/or escutcheon ring.

2.03 MISCELLANEOUS MATERIAL

A. Required Equipment: Contractor shall provide additional system components typically and reasonably required to make system operational even though not specifically indicated in Drawings, Appendices or Specifications including, but not limited to, cable, connectors, connecting accessories, adaptors, power supplies, power strips, rack mounting adapters and shelves, cover plates and closure panels, relays and switches, remote antenna mounts, terminal blocks, and related connector and termination hardware required by but not supplied with the equipment.

B. Blank Fill Panels: Contractor shall provide blank fill panels to cover any openings in equipment racks provided under this contract whether specified in the equipment schedules or not. Fill panels shall match finish of specified rack hardware.

C. Power Distribution Strips: Contractor shall provide power distribution strips as necessary for distributing power within equipment racks and consoles. Strips shall be UL listed, be securely mountable, and appropriate for professional installation.

D. Wall Openings: Contractor shall provide blank faceplates to cover any unused openings within the project area. Faceplate type and finish to match electrical outlets in the project.

E. Input Cables: Contractor shall provide all interconnection cables shown on the project drawings, as well as end-user input cables at all locations where laptops and other user devices are intended to be connected.

F. Keys: Keys for like equipment shall be identical.

G. Wireless Transceivers: Where wireless transceivers are specified (including, but not limited to wireless microphones, wireless assistive listening devices, etc.) Contractor shall verify frequency band range of existing Owner wireless systems. Contractor shall provide wireless transceiver system(s) compatible with existing equipment for interoperability.

H. Cable Sleeving:

1. Shall be black expandable sleeving, with ends neatly turned under 2”, held in place either by nylon tie-wrap, or heat-shrink tubing. Tie wraps, if used, shall not deform cables within the umbilical. Cables requiring sleeving include:

a. Exposed cabling outside of wire management in console furniture.

b. Cable umbilicals connecting to or from wall, floor, or ceiling plates consisting of more than one wire.

2. Contractor shall coordinate as necessary so that all low-voltage cabling (including Ethernet) are included in a single umbilical

2.04 POWER DEVICES

A. Refer to Section 270000 for additional requirements.

B. All large venue audio amplifiers shall be on sequenced outlets.

2.05 FIRE STOPPING MATERIALS

A. Refer to Section 270000 for additional requirements.

PART 3 - EXECUTION

3.01 EQUIPMENT

A. As required by Section 270000.

1. Safety: Contractor shall use proper structural installation techniques and maintain a minimum 5:1 safety margin.

2. Custom Mounting Finish: Custom mounting hardware shall be painted by Contractor to match either color of wall, ceiling or equipment, at Consultant's discretion.

3.02 SPARE PARTS AND REMOTE CONTROLS

A. Projector lamps and filters

B. Remote controls and batteries

C. Adapters

3.03 EDID AND E-EDID

A. EDID plays a crucial role in the plug-and-play functionality of modern display systems. When a display device is connected to a computer or other graphics source, the source reads the EDID data from the display, configures its output settings accordingly, and ensures a seamless and optimal visual experience for the user. This automation simplifies the setup process and reduces the likelihood of compatibility issues between different hardware components.

B. Computer graphics shall be crisp and focused with respect to color alignment. If color alignment is not registered properly, Contractor shall identify source of problem and correct. EDID and other auto-registration features shall be set within AV equipment where required for optimal system performance.

C. The contactor shall verify that EDID is functioning, and signal sources are distributed correctly.

D. At minimum , the Contactor shall verify that EDID information is correctly being supported throughout the signal chin. Field verify each of the following is reported, supported and functioning:

1. Identification Information: EDID includes basic identification information about the display, such as its manufacturer name, model number, and serial number.
    a. This data helps the computer or graphics source recognize and differentiate between different display devices.
2. Supported Resolutions and Refresh Rates: One of the most crucial pieces of information in EDID is the list of supported display resolutions and refresh rates.
    a. This allows the graphics source to select the most suitable settings for the display, ensuring that the image appears correctly and without distortion.
3. Supported Display Modes: EDID provides details about the display modes that the monitor or screen supports, including information on aspect ratios and color depth.
    a. This helps the graphics source choose the appropriate display mode for optimal image quality.
4. Timing Information: EDID includes timing information that specifies how the display refreshes its screen (e.g., vertical and horizontal synchronization frequencies).
    a. This data is crucial for synchronizing the graphics output with the display's refresh rate to avoid flickering or screen tearing.
5. Color Characteristics: EDID contains data about the display's color capabilities, including color temperature, gamma correction, and color space support.
    a. This ensures that the displayed colors are accurate and consistent.
6. Audio Support: In addition to video-related information, some EDID versions also include details about the display's audio capabilities, including the presence of built-in speakers or audio output options.
7. Display Connection Type: EDID specifies the type of video connectors supported by the display, such as HDMI, DisplayPort, VGA, or DVI.
    a. This information is essential for determining the appropriate cable and compatibility between the graphics source and the display.
8. Compliance Information: EDID may include information regarding compliance with various industry standards, such as VESA (Video Electronics Standards Association) standards.
    a. This helps ensure interoperability and adherence to best practices in the display industry.

9. Checksum and Verification Data: To ensure the integrity of the EDID data, a checksum and other verification information are included in the structure. This allows the graphics source to verify the authenticity of the EDID information.

E. As required provide Active end line devices to lock or manage the EDID information.

3.04 INTERCONNECTION

A. As required by Section 270000.

1. Interpretation: Contractor shall make system interconnections as indicated on Drawings and specified herein. Contractor shall interpret Drawings using an understanding of the equipment and general system topology (both existing and future/specified). Contractor shall provide power and control lines to and from power supplies, remotely controlled equipment and other devices even though not explicitly indicated on Drawings or listed in equipment tables.

2. Additional: Contractor shall be responsible for associated equipment signals not specifically documented in provided drawings. These include synchronizing signals, transmitting and receiving antennas, and LAN connections to equipment provided and/or installed by Contractor.

3. Mass Notifications: Contractor shall ensure that audio systems are appropriately managed by emergency notifications so that emergency notifications are not impeded by the audio system.

3.05 CABLE MANAGEMENT

A. As required by Section 270000.

1. Above Ceiling: Cabling located above ceilings shall be tied off to and supported by ceiling supports or other structures at a minimum of eighteen (18) inches above the ceiling.

2. Not on Ceiling: Cabling shall not lie on the ceiling.

3. Wall Cabling: Cables installed in a horizontal fashion along wall surfaces shall be installed in surface raceway approved by Owner and Consultant.

4. Floor Cabling: Cabling placed at floor level such as microphones shall be installed on the floor in the shortest possible route to the nearest wall considering traffic patterns and in an enclosure designed for that use and offering protection from foot traffic.

5. Desk Cabling: Where a cable is installed inside desk furniture, a means of protecting the cables and holding cabling to a fixed surface shall be installed.

6. Grommets: Holes in horizontal furniture surfaces for cable pass-through shall be provided with appropriate sized grommet. Grommet shall be black unless otherwise specified or required.

7. Stub-ups: Where conduit is stubbed-up through the floor and exposed, Contractor shall wrap cables with black expandable sleeving and secure at least three (3) inches below level of conduit top.

    a. Where conduit is stubbed-up through floor and concealed within furniture, Contractor shall install tether comprised of aircraft cabling to limit the distance furniture may be moved away from stubbed-up conduit. Cabling service loop exiting stubbed-up conduit and entering furniture shall be longer than the corresponding tether, providing protection against movement of furniture that would otherwise damage installed cabling.

8. Umbilicals: Exposed cable umbilicals, such as those between instructional furniture and a floor- or wall-mounted plate, shall be covered in black expandable sleeving, with neatly finished ends (heat-shrink or Consultant-approved method).

3.06 CONNECTOR TERMINATION

A. As required by Section 270000.

1. Video Connectors: Video connectors (BNC, RCA, and F) shall be terminated using a crimp tool or dies designed specifically for the connectors being applied.

2. XLR Connectors: Terminate XLR type connectors wired pin 2 high, pin 3 low, and pin 1 shield.

3. UTP: UTP cable shall be terminated with appropriate crimps tools or tools specified by manufacturer.

3.07 GROUNDING

A. Audiovisual equipment racks shall be grounded to the telecommunication grounding system with a minimum 6 AWG grounding cable. Refer to Section 270000 for additional grounding requirements.

3.08 TESTING & INSPECTION

A. General Information: As required by Section 270000.

B. Notification: Prior to start of testing, provide a list to Consultant of test equipment make, model numbers and calibration dates that will be used.

C. Testing: Contractor shall perform complete testing on system before inspection. Selected systems may be retested during inspection at Owner’s discretion.

D. Display/Output checks: Contractor shall verify that visual and audio outputs from the system are high-quality and without noticeable distortion or feedback at normal operating levels.

E. Wiring and Labeling: Contractor shall check all inputs and outputs for correct wiring and labeling.

F. Loudspeakers: Contractor shall measure the impedance of each speaker line leaving the equipment racks. For full range devices, use a frequency of 1000 Hz. For band limited devices, use a frequency appropriate for the operating range of the transducer. When documenting results, Contractor shall include the calculated impedance based on number of units on a line and the size and distance of the run. Contractor shall correct any field readings that differ more than 20% from the calculated impedance. Contractor shall use an electronic polarity checker to test each reinforcement speaker. Speakers shall have the same relative polarity.

3.09 COMPUTER GRAPHICS

A. Computer graphics shall be crisp and focused with respect to color alignment. If color alignment is not registered properly, Contractor shall identify source of problem and correct. EDID and other auto-registration features shall be set within AV equipment where required for optimal system performance.

3.10 TRAINING

A. General Information: As required by Section 270000 and following section(s).

B. Coordination and Personnel: Training shall be coordinated with Owner's schedule, and Contractor personnel who provide training are subject to Owner's approval.

3.11 PROJECT CLOSEOUT

A. Completion: System shall be considered complete when all of the following has occurred:

1. Testing has been completed to the satisfaction of Owner and Consultant.
2. Punch-listed items have been addressed to the satisfaction of Owner.
3. As-built drawings and system documentation has been turned over to Owner and Consultant.
4. Complete operational training has been conducted with Owner's staff.
5. System Commissioning Process has been completed.

B. Acceptance: Contractor shall secure written Acceptance of systems in the form of authorized Owner signature on Acceptance Document. This shall constitute the Date of Acceptance.

END OF SECTION

SECTION 274100 – AUDIO VISUAL SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. Refer to Section 270000 for additional project scope information.

B. Provide audio visual systems as well as training and warranty services for those systems as described herein.

1.02 RELATED WORK

A. Section 270000 – General Technology Requirements

B. Section 270500 – Communications General Requirements

C. Section 270526 – Grounding and Bonding for Technology Systems

D. Section 270528 – Pathways for Technology Systems

E. Section 270537 – Firestopping for Technology Systems

F. Section 271500 – Communications Horizontal Cabling

G. Section 271600 – Communications Connecting Cords

H. Section 271800 – Communications Labeling and Identification

I. Section 274000 – AV/Multimedia General Requirements

1.03 REFERENCE

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 270000 and 274000 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

3. Execution: Coordination, testing, training, warranty, and cable management.

1.04 CORRECTION PERIOD

A. General Information: Products shall be covered by Contractor correction period as required by Sections 270000 and 274000.

B. Correction Period: Contractor’s obligation for correction period shall not abrogate manufacturers’ warranty periods.

C. Commencement: Correction Period begins on Date of Acceptance.

1.05 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 270000.

1.06 OWNERSHIP

A. General: Upon completion of the project, all programming and configuration of control hardware, touch panels, and other devices shall be property of Owner.

B. Property Rights: Contractor assigns to Owner any and all intellectual property rights and applications made by Contractor, or its agents or employees in connection with the performance of this contract. Contractor also acknowledges and agrees that services rendered in connection with the performance of this contract shall be a “work made for hire” within the meaning of Section 201 inventions of the Copyright Law of 1976.

C. No Passwords: Contractor shall not use any passwords to prevent access to code files except as specified herein.

1.07 TURN-OVER CABLES

A. Contractor shall provide an end-user input cable for every wall plate connection or other end-user input location.

B. Turn-over cables shall match the quality and requirements of the main cable run for that signal type; refer to 274000.

C. Turn-over cables shall be 10-feet in length except where noted otherwise or where required for system functionality.

1.08 MANUFACTURER COORDINATION

A. Contractor shall contact the manufacturer(s) to obtain master quote information if available. Master quotes often contain additional products that may not explicitly appear in the specifications.

1.09 SYSTEM DESCRIPTIONS

A. General

1. This specification is intended to describe the general system types/locations and components, not every connection or room. The technology drawings more fully describe these systems and must be reviewed thoroughly in conjunction with the specification.

2. The technology floor plans indicate AV device locations, including input plates, speakers, projectors, flat panel displays, wall controllers, AV cabinets, etc.

3. The technology schematics (located on the “Technology Details” drawing sheets) indicate AV components in each system type and how they are connected. The components are described generally (ex: “AMPLIFIER”) with the specified model indicated below. Some device model numbers are not indicated in these written AV specifications and must be found on the technology drawing schematics located in the detail sheets. The schematics also indicate specific installation and functional requirements not shown elsewhere.
4. The loudspeaker schedule (located on the “Technology Details” drawing sheets) indicates speaker models and other requirements. It specifies which model speaker shall be provided at each location type by using numbered identifiers that appear on the symbols on the floorplans (ex: “S1” for speaker type 1).
5. The display schedule (located on the “Technology Details” drawing sheets) indicates the anticipated display size for a given location, as well as the intended use and a reference to the associated AV schematic drawing. For example, “FP1” will be defined here to tell you the purpose, size, height, and associated AV system detail that applies anywhere you see an “FP1” symbol on the floor plans. Be aware that a room’s name on the architectural floor plans may not match the system name for the space. Use the flat panel numbers to determine what system is required.
6. Each system description includes a list of anticipated equipment. This list generally describes the type and quantity of major components. For detailed specification requirements regarding these components, refer to Part 2 as well as the AV schematic line drawings. Interconnecting cables are generally not listed as “major components” but are required and assumed to be included.

PART 2 - PRODUCTS

2.01 ASSISTIVE LISTENING SYSTEMS

A. Assistive listening systems shall include stationary transmitter (and antenna distribution if needed) with receivers, earphones, neckloops, and signage.

B. Provide all components necessary to meet ADA / IBC and local code requirements for the space. Quantity of receivers, earphones, and neckloops shall be calculated to meet ADA / IBC formulas.

C. In addition to ADA-required components, provide locking carrying cases with charging bases and rechargeable batteries to match the number of receivers.

D. Technology:

1. IR – Provide infrared system in smaller spaces where information being shared is secret or confidential and in buildings where there are many such systems and not enough RF spectrum for the channel count.

2. RF – Provide radio frequency system (72 MHz or 216 MHz) in locations where a large coverage area is needed, and information being shared is not expected to be secret or confidential.
3. Wi-Fi – Provide a Wi-Fi/network system as a secondary solution in all spaces with assistive listening
4. Loop – Provide an underfloor hearing loop where required by local code and/or indicated in the system description or design details

E. Manufacturers: Listen Technologies, Williams Sound, or equal

2.02 AUDIO AMPLIFIERS

A. Amplifiers shall be sized to match the speaker manufacturer's recommended amplifier power plus 20% additional headroom

B. Large venue systems

1. Rack-mountable, 2 RU
2. Network capable with internal DSP
3. 2 ohm, 4 ohm, 8 ohm, and 70v operation
4. Manufacturers: Powersoft Quattrocanali, QSC CX-Q Series, or approved equal

C. Small systems

1. Rack-mountable, 1 RU half rack width
2. High-efficiency class D amplifier
3. ENERGY STAR qualified
4. 4 ohm, 8 ohm, and 70V operation
5. Minimum of 300 watts total, with option for single bridged output or 2-channel or 4-channel operation
6. Manufacturers:
   a. Crestron AMP-X300
   b. Extron XPA U 1004 SB or XPA U 2002 SB
   c. QSC SPA4-100 or SPA2-200

D. Smaller systems with paging override

1. Plenum rated
2. 50 watts @ 4 ohms

3. Three mixable inputs
4. Stereo or mono bridgeable speaker outputs
5. P/A override with 25V-100V sensing
6. Green sleep mode
7. Manufacturers: Roemtech PMA-350H

2.03 AV NETWORK SWITCHES

A. Provide network switches for AV systems as necessary.

B. Switches shall be sized to match the number of connections and PoE/PoE+ load.

C. For AV systems where the AV manufacturer publishes a list of recommended or approved switches, the network switches must be on this list.

1. For AV systems where the AV manufacturer does not publish a list, the network switches must meet the minimum specifications required by the AV equipment and recommended by the manufacturers.

D. Provide Netgear M4250 or M4300 Series

2.04 BLUETOOTH EXTENDER PLATES

A. Single-gang, Decora style in-wall Bluetooth audio interface

B. One button pairing/connect with LED indicator

C. Serial control protocol for integration with control system

D. Defeatable pairing button for restricted use applications with control system

E. Balanced mono/stereo analog outputs

F. Compatible with smartphones, Apple iPads, and Android tablets

G. Manufacturer: QSC Atterotech unBT2A kit or approved equal

2.05 CABLE

A. Cable shall be provided and installed as detailed herein. Cable installed that does not conform to these standards or that has not been given prior approval by Consultant shall be removed by Contractor and replaced at Contractor’s sole expense.

B. Plenum: Plenum-rated cables shall be used where required by code or by best practices. All cables run beneath raised floor shall be plenum-rated.

C. High Definition Digital Video (HDMI)

1. Due to HDMI distance limitations, anywhere the cable distance exceeds 20 feet, an acceptable solution shall include some form of extension. Extension shall be via UTP/XTP extenders. Contractor shall provide extenders where cables exceed 20 feet regardless of whether they are explicitly shown or specified. At locations where the end-to-end cable distance is 20 feet or less, commercial-grade passive HDMI cables may be used. Provide a cable channel that is reliable and functions with all source devices the Owner may use.
2. Acceptable solution shall support HDMI 2.0a and 4K@60Hz 4:4:4
3. Acceptable solution shall be manufactured by a Pro AV manufacturer with 5+ years in the AV industry and an existing install base in the region.
4. Manufacturers:
    a. Atlona
    b. Broadata
    c. Crestron
    d. Extron
    e. Liberty AV

D. USB

1. Due to USB distance limitations, anywhere the cable is routed within the wall or above the ceiling, an acceptable solution shall include some form of extension. Extension shall be via UTP/XTP extenders. Contractor shall provide extenders where cables route through walls or ceilings regardless of whether they are explicitly shown or specified.
2. Acceptable solution shall support at a minimum USB 2.0 except where noted otherwise.
3. Acceptable solution shall be manufactured by a Pro AV manufacturer with 5+ years in the AV industry and an existing install base in the region.
4. Manufacturers:
    a. Atlona
    b. Broad Ata
    c. Crestron
    d. Extron
    e. Liberty AV
    f. QSC

E. Installed Line Level and Microphone (single line): Audio signal cable shall have twisted pair #22 stranded tinned copper conductors, polyethylene conductor insulation, aluminum-

polyester foil shield, #24 stranded tinned copper drain wire and chrome PVC jacket. Belden 8761, West Penn 291, Canare L-2T2S, Liberty 24-2P-STAR, or equal. Plenum cable, Belden 88761 or equal.

F. Portable Microphone, Enclosure and Breakout Line Level Audio: Cable shall have 4 conductors per channel arranged in star quad double-balanced pairing, #24 stranded conductors of at least 40 tinned annealed copper wires, 100% coverage wrap shield, tinned copper braid shield of approximately 50% coverage, uniformly round form and black PVC jacket. Canare L-4E6S, Belden 8723, WestPenn 355, or equal. Plenum Cable, Belden 88723, Liberty 24-4P-PLCSH-WHT, or equal.

G. Broadband Video Antenna Cable: For runs shorter than 15', RG-59. For runs 15'-50', RG-6.

H. Wireless Microphone Antenna Extension Cable: 50-Ohm coaxial cable, or as directed by microphone manufacturer.

I. Loudspeaker Wire: 12 AWG minimum.

J. Subwoofer Wire: 10 AWG minimum.

K. UTP Cable: Shall be consistent with specific recommendations by hardware manufacturer of transmission equipment. Where no clear recommendation is made, the cable shall at a minimum meet the Category 6 performance requirements outlined in 271500.

L. Control: Shall be as recommended by equipment manufacturer, with the appropriate number of conductors for the application.

M. Cable Construction: Contractor shall fabricate interconnecting cables using products defined in this section unless equipment manufacturer-provided cable is of a specialized or proprietary nature. Pre-manufactured cables are subject to prior approval by Consultant.

N. Labels: Labels shall include a white paper or vinyl slip with typed or machine printed designations, secured in place with a wider section of clear heat shrink tubing or integral clear adhesive-backed plastic.

O. Terminations: Provide specialized terminating hardware as required.

P. Schedule: Contractor shall submit schedule prior to installation for Consultant review indicating cable types that will be used on the project

2.06 CEILING ENCLOSURE BOX

A. Certain locations noted on plans shall receive a large flush-mount ceiling box that replaces a 2'x2' ceiling tile. This box shall function as a centralized location for display connectivity (data, power, AV) as well as a space to house any electronics feeding or controlling the display.

B. The ceiling box shall include knockouts where single-gang boxes can be attached on at least three sides.

C. Contractor shall be responsible for proposing an enclosure that accommodates all anticipated equipment and includes sufficient passive or active ventilation for the heat load generated.

D. Manufacturers: Chief, FSR, Legrand Wiremold, Premier Mounts, or approved equal

1. FSR CB-224S – provide at any location where a single component is greater than 1 RU or where the sum of the components is greater than 2 RU

2.07 CONFERENCING SYSTEM

A. All-in-one soundbar

1. Conferencing soundbar with speaker, camera, and microphone in a single enclosure and one USB connector.

2. Single USB 3.0 interface

3. Built-in 180-degree far field microphone array

4. Built-in intelligent 1080p video camera with digital autozoom and autoframing

5. High powered 2-way stereo speakers

6. Manufacturer: Crestron UC-SB1-CAM or approved equal

B. Conference room kit

1. Manufacturer: Logitech Rally & Rally Plus kit solutions

2.08 CONNECTORS

A. Connectors shall be provided and installed as detailed herein. Connectors installed that do not conform to these standards or that have not been given prior approval by Consultant shall be removed by Contractor and replaced at Contractor's sole expense.

B. HDMI (Video/Audio/Control): Cables to be factory-terminated with molded strain relief.

C. XLR: Strain relief shall be sized to fit the cable. Connector shell shall be isolated from all contacts. Neutrik CA-NC series or equal.

D. Mini-XLR: Strain relief shall be sized to fit the cable. Connector shell shall be isolated from all contacts. Switchcraft or equivalent.

E. Phono (RCA): Phono/RCA connectors shall have gold contact and solid center pin with metal strain relief. Canare F-10 or Canare F-09 or equal.

F. Phone (1/4 inch): Reinforced one-piece body shall have brass bar running length of handle. Canare F-15 (TS) or Canare F-16 (TRS) or equal.

G. Mini (1/8 inch): Shall be Canare F-11 (TS) or Canare F-12 (TRS) or equal.

H. RJ45: RJ45 jacks that are field-terminated shall be punch-down type. All flexible connectivity to AV devices shall be factory-molded patch cables. Where a field-terminated plug is required by manufacturer recommendations, Contractor shall use appropriate connector type to the type of cable used (solid vs. stranded).

I. Shielded cable to be terminated with shielded connectors or as required by manufacturer recommendations.

J. DM, DM8G+: Shall be Crestron shielded RJ-45 and fiber connectors, as recommended by manufacturer of DM or DM8G+ system.

K. Schedule: Contractor shall submit schedule prior to installation for Consultant review indicating connectors that will be used on the project.

2.09 CONTROL SYSTEMS

A. Control system processor with ability to control all major system components and functions within a given room, including items such as: flat panel displays, media players, projectors, projection screens, presentation switcher, digital mixer, digital signal processor, power sequencers, etc.

B. Control system may be built into a presentation switcher or standalone

C. Each control system shall include a control interface. In large venue or complex spaces, this shall be a touch panel controller – 7” or 10” minimum diagonal size depending on requirements. In smaller spaces and simpler systems, this could be a keypad or button panel.

D. Control systems shall be network manageable. Contractor shall set up manufacturer’s network interface for Owner to use.

E. Manufacturers: Crestron, Extron, QSC, or approved equal

2.10 DIGITAL SIGNAL PROCESSOR

A. Minimum 4 input, 4 output audio DSP. Provide larger model and/or additional expansion I/O modules as necessary to support the number of connections in a given system.

B. Supports Acoustic Echo Cancellation on microphone inputs

C. RS-232 and/or Ethernet control to interface with AV control system.

D. Dante support where applicable

E. Manufacturers: QSC or Approved equal

2.11 EQUIPMENT RACKS

A. Sized to fit all system equipment with space for airflow and future expansion

B. Casework/millwork locations

1. Sized to fit all system equipment with space for airflow and future expansion
2. Coordinated to fit inside of casework; refer to architectural plans
    a. Fan kit with thermostatic fan control
    b. Coordinate active cooling and ventilation with millwork contractor
    c. Ventilation shall include passive air intake at the bottom and exhaust at the top
3. Manufacturer: Middle Atlantic SRSR Series

C. Instructor lectern locations

1. Rack shall be built into the lectern.
2. All finishes shall be coordinated with Owner. An approved proof of concept is required prior to ordering.
3. AV Contractor shall coordinate with Architect and furniture provider to ensure the appropriate rack space and cable pathways are provided.

D. Fixed wall locations

1. Provide with:
    a. 1 RU vented blank panels between all major components (e.g. amplifiers) and equipment groupings (e.g. wireless receivers, media players, etc.)
    b. 4 RU rack drawer for housing microphones and cables
    c. Locking vented front door
    d. Quiet fan kit with thermostatic fan control
2. Manufacturers: Middle Atlantic SR-Series or equal

2.12 FLAT PANEL DISPLAYS

A. Displays

1. Flat panel displays shall be commercial grade. Any displays used in common spaces shall be rated for 24/7 operation. All other locations shall be rated for 16/7 operation.
2. Flat panel displays shall support all necessary connections, including – at a minimum – two HDMI inputs and RS-232 control.
3. Flat panel displays shall have a minimum of 3840x2160p resolution (Ultra High Definition) except where noted otherwise
4. Flat panel displays shall have built-in speakers, except where the display is connected to a separate sound system

5. Manufacturers:
    a. LG, NEC, Samsung, Viewsonic, or approved equal

B. Mounts
1. Commercial grade mounts shall be used for all flat panel displays
2. Mounts shall match the size and load of the display
3. All mounts shall have downward tilt
4. Total depth of mount and display off the wall shall not exceed ADA allowed distance for protruding objects
5. Manufacturer:
    a. Extending mounts – Chief Thinstall Dual Swing Arm Series or approved equal
    b. Fixed mounts – Chief Fusion Series or approved equal

C. In-Wall Equipment Box
1. Each display location shall receive a large flush-mount wall box. This box shall function as a centralized location for display connectivity (data, power, AV) as well as a space to house any electronics feeding or controlling the display.
2. The wall box shall include knockouts where single-gang boxes can be attached on at least three sides.
3. Manufacturer: Chief, FSR, Hoffmann, Legrand Wiremold, or approved equal

D. Storage
1. In rooms without a ceiling storage box or equipment rack, all AV equipment shall be mounted behind the flat panel display
2. Provide appropriate quantity and size of mounting accessories to securely mount all AV equipment components
3. Manufacturer: Chief component storage panels or approved equal

2.13 MEDIA PLAYER

A. Professional/commercial-grade rack-mount media player

B. If used in a system that has video and audio, media player should support Blu-Ray, DVD, and CD playback.

C. If used in a system that has only audio, media player should support CD playback, Bluetooth, USB, and aux audio

D. Supports RS-232 and/or IP controls

E. Balanced audio outputs

F. Manufacturer:

1. Denon DN-500BD (audio and video), DN-500CB (audio only)

2. Tascam

3. Or approved equal

2.14 MICROPHONES

A. Conferencing and Distance Learning Microphone Array

1. Manufacturer: Shure MXA910 with Intellimix and Shure Intellimix P300 audio conferencing processor

B. Wired Microphones

1. Manufacturer: Shure Beta 58A (vocal), Shure Beta 57A (instrument), Shure SM58S (vocal switchable)

C. Wireless Microphone Systems

1. 24-bit / 48 kHz digital audio

2. Single, dual, and quad receiver options; provide dual and quad receivers whenever wireless channels exceed two and four, respectively.

3. Networkable

4. Provide with rechargeable batteries (one per transmitter plus a spare for every three transmitters) and charging bays

5. Manufacturers:

a. Wireless Transmitter & Receiver: Shure ULX-D Series

b. Earset & Lavalier: Point Source Audio CR-8S and CR-8L

D. Push-to-talk Microphones

1. Gooseneck on solid base

2. Manufacturer: Shure MX412D/C

E. Microphone Stands

1. Manufacturer:

a. Floor – Ultimate Support Pro Series or equal

b. Desktop – Atlas DS7E or equal

F. Microphone Receptacles

1. One-gang stainless steel plate with female XLR mic receptacle
2. Provide one for each wired microphone
3. Manufacturer: Neutrik or Switchcraft

2.15 POWER SOLUTIONS

A. Large Systems

1. Rack mount main sequencer with additional modules as necessary. Provide power sequencers at all large venue AV racks or any rack with an audio amplifier greater than 50W. Does not apply to systems where the amplifier is intended to remain on; ex: Energy Star amplifiers in ceiling enclosures.
2. Power output shall match recommended input power for system equipment. Main sequencer shall have 120V/20A output. Additional modules with 120V/30A or 220V/20A output may be required for certain amplifiers.
3. Provide with surge protection and remote switch
4. Minimum of six rear outlets and three sequenced groups of outlets
5. RS-232 and/or Ethernet control to interface with AV control system
6. Manufacturers: Furman, Middle Atlantic, Surge-X

B. Small Systems

1. Provide a rack mount 1 RU horizontal power strip with surge suppression at each equipment rack
2. Manufacturers: Furman, Middle Atlantic, Surge-X

2.16 PRESENTATION SWITCHERS

A. Mixture of digital video extender inputs, digital video extender outputs, HDMI inputs, and HDMI outputs. Quantity of each based upon needs of space.

B. Supports signal resolutions up to 4K/60 with 4:4:4 color sampling

C. Audio de-embedding to route audio from HDMI sources into sound system

D. May include built-in control processor

E. Manufacturer: Crestron, Extron, or approved equal

2.17 PROJECTION SYSTEMS

A. Projectors

1. Laser light source
2. WUXGA (1920x1200) resolution minimum
3. Minimum of 100 fL (footLambert) image brightness on associated screen
4. Model with optional lenses for range of throw distances when necessary
5. Manufacturers: Epson, Panasonic, Sony

B. Projection Screens

1. Widescreen aspect ratio, 16:10
2. Recessed in ceiling whenever feasible
3. Screen surface shall match installation conditions. For front projection, provide HD-compatible screen with 0.9, 1.1, or 1.3 screen gain depending on ambient light. For rear projection, provide screen surface capable of both front and rear projection. Minimum of 0.9 gain and 65-degree half angle.
4. Screen sizes shall be sized to provide clear visibility to the furthest viewer. Follow AVIXA sizing requirements.
5. The screen size and black drop will be calculated so that the bottom of the image area is approximately 48” above finished floor, and never lower than 42” AFF.
6. Refer to technology drawings for screen sizes and types per location.
7. Contractor shall coordinate exact mounting details with Architect
8. Manufacturer: Da-Lite, Draper, or approved equal

C. Projector Mounts

1. Mounts should be appropriate for the projector size and installation conditions
2. Provide with protective cage when mounted in gymnasiums and other spaces where there may be projectiles or other potential damage.
3. Manufacturer: Chief
    a. 2x2 lay-in ceilings – Chief SYSAU Series
    b. Wall-mount long throw – Chief WMA2S dual stud wall mount
    c. Ultra-short throw – provide model recommended by projector manufacturer

2.18 SPEAKERS

A. Refer to technology drawings

2.19 USER CONNECTIVITY INTERFACES

A. Provide at furniture locations to allow users to connect to power, data, and AV inputs without having to reach down to floor boxes or wall outlets.

B. Applies to conference tables, lecterns, and other furniture where noted in the AV system descriptions or on the drawing set.

C. Confirm exact model, color, and components with Architect prior to ordering.

2.20 WALL PLATES

A. All faceplates and plate devices shall be coordinated with the architect to ensure that the finish is consistent with the aesthetic of the space

B. All device plates shall support the same signal transmission requirements as the interconnecting cables. Refer to the “Cables” sections for more information.

C. Passive HDMI plates shall include a pigtail on the back to facilitate appropriate bend radius and smooth transition into conduit.

D. Contractor shall provide custom plates where necessary to support the designed signal and/or connector types.

E. Manufacturers: RCI Custom or Liberty AV

2.21 WIRELESS PRESENTATION DEVICE

A. Wireless presentation connectivity, with support for Windows, macOS, Android, and iOS devices, with browser-based support for Chromebook and Linux

B. App-free sharing options including: AirPlay, Miracast, Browser sharing, Wired HDMI input

C. Support for touch and 4K UHD displays

D. Manufacturers:

1. Barco ClickShare
2. Or approved equal

PART 3 - EXECUTION

3.01 EQUIPMENT LOCATION

A. Coordination: Where device locations are not shown on rack/console elevations and project drawings, Contractor shall coordinate with Consultant to identify desired/optimal locations.

B. Contractor shall verify all wall-mounted monitor mounting heights on preconstruction submittals.

3.02 AESTHETIC REQUIREMENTS

A. Printing: Button labels shall be engraved where applicable, or machine-printed where no engraved button/bezel is available. Handwritten labels are not acceptable.

B. Graphics: Icons and graphic representations of equipment and functions shall be crisp, sharp, and easy to identify. Icons shall be used wherever possible.

C. Text: ICS screens shall not use uncommon abbreviations. Text shall be sans serif and shall be sized to be clearly readable.

3.03 EQUIPMENT CONFIGURATION

A. Labeling: Contractor shall configure all equipment for normal use, including setting of levels and presets. Small adhesive labels shall be affixed to equipment indicating nominal levels and settings.

B. EDID, E-EDID: Where devices allow for the customization of EDID information, Contractor shall configure EDID settings of all applicable devices such that the audiovisual system is optimized.

C. Software: Contractor shall utilize Manufacturers official current version of configuration software. Special exemption may be obtained from Consultant if current version contains known issues. In such event, the version immediately preceding shall be utilized.

D. IP Interface: Contractor shall configure/modify IP-based monitoring software to allow Owner to monitor all rooms installed as part of this work. Automatic timed system shutdown shall be configured as part of this software. Shutdown time(s) to be coordinated with Owner.

E. Control System: Contractor shall make adjustments to programming as required by Consultant up to issuance of substantial completion punch list at no additional charge, so long as changes relate to equipment in this bid package.

3.04 DIGITAL SIGNAL PROCESSOR

A. Processor power required of DSP shall not exceed 80% total processing capacity. If processing power required exceeds available processing power, Contractor shall immediately notify Consultant during pre-installation phase.

B. Functional Requirements

1. Functions: The DSP shall be configured to provide:

a. Pre-amplification

b. Filtering and Equalization

c. Dynamics processing

d. Gating

e. Mixing, Automatic mixing – gain sharing or gated

f. Zoning

g. Mix-minus

h. Delay

i. AEC

j. Volume control

k. Emergency/Alarm muting

l. Signal metering

m. Logic functions

2. Gain Structure: The DSP shall be configured to obtain and maintain unity gain structure from input pre-amplification stage to output stage or associated end-user volume control.

3. AEC: The DSP shall be configured to provide AEC for all microphones detecting echo in conferencing and specialty DSP applications. AEC shall be configured per DSP Manufacturer's recommendations and best practices.

4. AEC and Pre-AEC: Where microphones used for speech / sound reinforcement are part of a conferencing system requiring AEC processing, the "Pre-AEC" audio path shall be utilized for speech / sound reinforcement while a separate path processed for AEC shall be utilized for conferencing.

5. Organization: Referring to open-Architecture DSP platforms. Processing objects shall be clearly labeled and organized clearly to follow the intended signal path from left to right, top to bottom. Connection lines between objects shall be routed in an organized fashion.

6. Multiple DSP: Where designs include more than one DSP linked via virtual multi-channel audio buss or digital audio network, all signals shall be routed to a central processor for master routing and 3rd party control. All control points being controlled by ICS controls shall be located on a single DSP operating as the master unit.

7. Latency: Also known as propagation delay, Programmer shall utilize sufficient and efficient processing paths to achieve intended results whilst minimizing latency from input to output.

C. DSP Controls

1. Contractor shall coordinate work of ICS Programmer and DSP Programmer.

2. Volume controls shall be range limited within DSP to provide end-user with adequate adjustment range (typically +/-6dB for microphones and +/-10dB for presentation sources). Operation of DSP from end-user standpoint shall be seamless with ICS system operation.

3. Processing objects within Audio DSP configuration shall be clearly identified where controlled by ICS. Text objects or similar shall identify these objects.

3.05 IT COORDINATION

A. General: Where connection between components or control features are accomplished over the Owner's LAN, Contractor shall coordinate with Owner's IT department for IP addresses, firewall access, and other issues pertaining to successful integration.

B. Permission: It is Contractor's responsibility to obtain necessary information and permissions to implement their system. Any delays or problems with gathering information or coordinating access to the LAN or WAN shall be brought to Consultant immediately for resolution.

3.06 SYSTEM TESTING

A. Contractor shall check that all cables are properly labeled and secured prior to substantial completion inspection.

B. Contractor shall ensure that all work areas are clear of all debris, tools, empty boxes, and extra parts prior to substantial completion inspection.

C. Prior to the substantial completion inspection, Contractor shall notify the Consultant that all items listed below are complete:

1. Contractor shall ensure that all standard functions of equipment are functional.

2. Contractor shall verify all input and outputs of the system for signal quality.

3. Audio: Contractor shall verify all sources are free of destructive noise (excessive noise floor, hiss, grounding interference) and that speakers function properly. The audio system shall be consistent in terms of volume and tone and shall be optimized for the space(s) served by the audio system.

a. Control functionality, verification of presets, volume controls, mute controls, etc.

b. Stable operation, completely free of feedback and distortion throughout entire range of available ICS controls.

c. Correct routing of all signals to intended destinations.

d. Unity gain structure.

e. Output transducer (speaker) protection processing functionality.

f. AEC functionality.

g. Provide measurement test results per ANSI/InfoComm 1M-2009 ACU.

h. Outdoor sound system measurements shall be provided at a minimum of one measurement location per 50 seats. Measurements shall be performed using pink noise test signal at a volume congruent with nominal system operation. Measurements shall indicate:

i. Site plan map of seating areas and test locations.

ii. Frequency response from 80Hz-16kHz in 1/3 octave resolution.

iii. SPL (A weighted) of the test signal as measured from each location.

iv. Weather conditions at time of test; including temperature, humidity and average wind speeds.

4. Video: Contractor shall verify that all EDID and EDID-D information has been configured at each video transmission and processing device. Where signal processing is present, Contractor shall optimize the video system to native resolution of display devices.

D. Immediately prior to final inspection, in the presence of Consultant and/or Owner representative, Contractor shall load DSP program and integrated control system program from Closeout Submittal media and demonstrate full system functionality.

3.07 FIRMWARE

A. Firmware upgrades shall be dated the same as Date of Acceptance. Contractor shall upgrade firmware and software as necessary during project so that latest versions are installed as of Date of Acceptance.

3.08 TRAINING

A. General Information: As required by Sections 270000 and 274000.

B. Contractor shall provide one (1) 60-minute training session for each unique audiovisual room type. Training sessions shall comprise of one half of the time dedicated to instructor led training with the remainder of the session to be used for instructor supervised hands-on end user operation of the system(s):

1. Identification of input locations, source devices, control locations, displays, and other devices requiring end user interaction for successful system operation.

2. Use of control system.

3. Use of source devices and input locations.

4. Switching inputs for each display.

5. Training shall include operation of system in event of control system malfunction – all manual switching and use of remotes.

6. Basic troubleshooting for common user errors.

C. Scheduling: Training shall be scheduled with Owner at least ten (10) days in advance.

D. Quick-Reference Guides: Contractor shall compile quick-reference guide for system operation and basic troubleshooting. Quick-reference guide shall be provided at the training session, and training shall include walking through quick-reference guide steps.END OF SECTION

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283101 - FIRE ALARM AND SMOKE DETECTION SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Where there is an existing fire alarm system it will be expanded upon to provide proper coverage of signaling and detection per applicable codes.

B. The contractor shall remove the existing field devices (where applicable) from the building prior to demolition. The contractor shall provide new field equipment to supplement the quantity of existing devices to meet applicable building codes for the new construction. In new construction, all devices and equipment shall be new.

C. The contractor shall furnish and install a complete distributed microprocessor based 24VDC, electrically supervised, MULTIPLEX, integrated fire alarm and voice evacuation (where applicable) system as specified herein and indicated on the drawings. The system shall include, but not be limited to, all control equipment, remote transponders, printer, power supplies, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system.

D. The system shall operate as a non-coded, continuous sounding system which will sound alarm devices until manually silenced, as herein specified.

E. The system shall be wired as a Class B supervised system for all circuits.

F. The installing contractor shall include at minimum 6 months of monitoring services. Monitoring services shall be provided by the authorized Fort Bend County fire alarm services provider.

1.2 CODES AND STANDARDS

A. The system shall comply with the applicable Codes and Standards as follows:

1. National Electrical Code - Article 760.
2. National Fire Protection Association Standards: NFPA 70 NEC
3. NFPA 72 National Fire Alarm Code (2013) NFPA 90A Air Conditioning
4. NFPA 101 Life Safety Code UL 1971 Visual Devices ANSI 117.1 Visual Devices
5. Local & State Building Codes (Including all adopted amendments)
6. Texas Accessibility Standards (TAS) 05 Americans with Disabilities Act (ADA)
7. Requirements of Local Authorities having Jurisdiction

8. Underwriters Laboratory Requirements and Listings for use in Fire Protective Signaling Systems as follows:

9. UL 864 Control Panels (9th Edition) UL 268 Smoke Detectors - Systems UL 268A Duct Smoke Detectors

10. UL 521 Heat Detectors

11. UL 228 Door Holder-Closers

1.3 INSTALLING CONTRACTOR'S RESPONSIBILITY

A. The installing fire alarm contractor is responsible for the design of a code compliant system, which meets the intent of all State and Local Authority Having Jurisdiction Codes and their adopted amendments along all permitting of such plans and associated permit fees. Reference and coordinate with all contract specifications and plans.

1.4 ACCEPTABLE MANUFACTURERS

A. A. To establish the type, quality, and features of system required, the equipment specified is that of the NOTIFIER Fire Systems. System must be compatible with Notifier Onyx workstation where applicable.

B. All equipment, materials, accessories, devices, etc. covered by the specifications and/or noted on the contract drawings shall be new and unused and be U.L. listed for their intended use.

C. All references to manufacturer's or supplier's model numbers and other pertinent information herein is intended to establish a minimum standard of quality, performance and features required. All equipment proposed as an EQUAL to that specified shall COMPLETELY conform to the specifications herein.

D. Equipment of other manufacturer's or supplier's may be considered as an equal to that specified provided that completely marked and identified catalog sheets of all proposed equipment is provided to the architect/ engineer for review ten (10) days prior to the date of bid for evaluation. In addition, a list of the contractor's qualifications and any exceptions to the specifications must be provided for review. Approval for any such substitution of equipment must be obtained in writing from the architect/engineer five (5) days prior to bid.

E. Acceptable fire alarm systems manufacturer:

1. NOTIFIER Fire Systems (Must be an Authorized Distributor)

2. Other manufacturers will be considered upon approval by Fort Bend County.

1.5 GENERAL REQUIREMENTS

A. Contractor Qualifications:

1. The equipment supplier shall be an authorized and designated representative of the Fire Alarm Manufacturer to sell, install, and service the proposed manufacturer's equipment and shall be approved by the Fort Bend County Fire Marshall to perform the work.

2. The equipment supplier and installing contractor shall be licensed by the State Fire Marshall to sell, install, and service fire alarm systems as required by Article 5.43-2 of the Texas Insurance Code.

3. The installing contractor and/or equipment supplier shall have on his staff a minimum of three (3) installation superintendents who are licensed by the State Fire Marshall's office for such purpose and under whose supervision installation, final connections, and check out will take place as required by the Texas Insurance Code.

4. The installing contractor or equipment supplier shall have on staff a minimum of one (1) certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place.

5. The installing contractor shall provide 24 hour, 365 days per year emergency service with qualified and state licensed service technicians.

6. The installing contractor shall have been actively engaged in the business of selling, installing, and servicing fire alarm systems for at least ten (10) years.

1.6 SUBMITTALS

A. The installing contractor and/or equipment manufacturer shall provide complete and detailed shop drawings and include:

1. Control panel configuration including wiring and interconnection schematics.

2. Complete point to point wiring diagram showing terminal connections to all system devices.

3. Riser wiring diagram and associated zoning/addressing configurations with associated conduit sizes.

4. Complete floor plan drawings locating all devices associated with the fire alarm system. Floor plan drawings shall include conduit and wiring routing complete with conduit sizing and number of conductors by type. Floor plans shall be on AutoCAD.

5. Factory data sheets on each piece of equipment to be used and so marked as to model, dimensions, size, voltage, and configuration.

6. Detailed system description in this specification format describing system functions and operation. All specification variations and deviations shall be clearly noted and marked.

7. Complete Bill of Material for reference.

8. Programming matrix defining all input/output functions and zoning.

9. Power supply and battery calculations.

10. Written certification from the manufacturer stating that the distributor is authorized to sell, service and install the proposed fire alarm system.

B. All submittal data will be in bound form with contractor's name, supplier's name, project name, and state fire alarm license number adequately identified.

C. Only basic equipment devices have been shown on the contract drawings. Specific wiring between equipment/devices has not been shown. It is the contractor's responsibility to submit for approval the COMPLETE ENGINEERED system configuration and layout showing all devices, wiring, conduit, and locations along with other required information as specified herein.

1.7 COORDINATION

A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the fire alarm system with all trades including, but, not exclusive of: electrical contractor, sprinkler contractor, and HVAC/controls contractor and intercom system. Adequate coordination shall be provided to insure proper installation and interface to all peripheral items required to interact with the fire alarm and communication system to provide a complete and functional life safety system.

PART 2 - GENERAL

2.1 SYSTEM FUNCTIONAL OPERATION

A. Alarm Detection

1. When a fire alarm condition is detected via the main fire control panel by any of the system alarm initiating devices, the following functions shall occur:
   a. The system common alarm LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledging the alarm condition shall silence the audible trouble device and revert the flashing common alarm LEDs to a steady state.
   b. A 640 character back-lit LCD Display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location, and time of alarm. Location and zoning messages shall be custom field programmed to respective premises.
   c. Any remote annunciator LCD display associated with the alarm zone shall be activated as herein specified.

d. The remote off-site monitoring shall transmit alarm signals to an Approved Central Supervising Station. (Central station connection, phone lines and service provided by Owner).
e. All automatic events programmed to the alarm point shall be executed and the associated indicating devices and/or outputs activated.
f. Alarm tones shall sound throughout the facility. Upon expiration of the alert tone, a digitized predetermined voice evacuation message shall be automatically transmitted throughout the facility. The system shall have the capability to generate multiple distinct digital messages as determined by event-initiated programs.
g. Flash all strobe lights (visual signals) throughout the facility.
h. Recall elevators to ground floor as specified herein, or to the alternate floor if the alarm condition originates on the ground floor.
i. Unlock all electrically locked doors.

B. Print status on the system printer (where applicable).

1. All designated "non-silenceable" auxiliary control functions shall remain in operation (even upon silencing of audible alarms) until such time as the control panel is cleared and reset manually (i.e. fan control outputs, central station interface, elevator recall interface, etc.).

2. In addition, remote annunciators shall be located where indicated. The annunciators shall duplicate the control panel alarm status indicators (for selected system zones/points) and in addition, annunciate any system trouble conditions and operate as herein specified.

C. SUPERVISORY CONDITION

1. When a supervisory condition is detected via the main fire control panel by any of the system supervisory initiating devices, the following functions shall occur:
   a. The system common supervisory LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledging the supervisory condition shall silence the audible device and revert the flashing common supervisory LED's to a steady state.
   b. A 640 character back-lit LCD Display shall indicate all applicable information associated with the supervisory condition including: zone, device type, device location, and time of the supervisory condition. Location and zoning messages shall be custom field programmed to respective premises.
   c. Any remote annunciator LCD display associated with the supervisory signal shall be activated as herein specified.
   d. The remote off-site monitoring shall transmit supervisory signals to an Approved Central Supervising Station.
   e. Print status on the system printer.

D. TROUBLE CONDITION

1. When a trouble condition is detected by the CPU, one of the system initiating alarm or SLC Circuit(s), the following functions shall immediately occur:
   a. The system trouble LED on the CPU module shall flash and the internal audible trouble device shall sound. Acknowledgment of the trouble condition shall silence the audible trouble device and cause all trouble LED's to illuminate steady.
   b. The 640 character alphanumeric LCD annunciator shall display all applicable information via the alphanumeric display associated with the respective trouble condition and its location.
   c. The system common trouble indicator on associated remote annunciators shall be illuminated as specified herein.
   d. The remote off-site monitoring shall transmit supervisory signals to an Approved Central Supervising Station.
   e. Print status on the system printer.

2.2 ZONING

A. The system shall have the inherent capability to employ "Intelligent" smoke detectors and addressable interface devices capable of being recognized and annunciated at the main control panel on an individual basis. All zoning/device location information shall be totally field programmable to exact job requirements as approved by the architect/engineer.

B. The system shall utilize remote amplifier cabinets for distributed voice communications (if needed), notification appliance circuits, and auxiliary control output circuits. Remote transponder panels shall communicate with the main CPU via the SLC data loop and be capable of being intermixed on the same loop as intelligent smoke detection and control modules.

2.3 ZONING

A. The fire alarm control panel shall be Notifier series NFS2-640/NFS2-320/NFS2-3030 of which should be sized according to manufacturer specs. The control panel shall be modular in design utilizing DISTRIBUTED solid state MICROPROCESSORS and be capable of future expansion. The microprocessor based CPU shall be completely FIELD PROGRAMMABLE. CPU module shall provide for programmable non-volatile RAM memory utilizing integral lithium-based memory IC chips. All circuitry shall be U.L. listed for power-limited application.

B. Central Processing Unit Module (CPU): The CPU shall contain and execute all custom time control functions or control-by-event programs for specified events. Time control events/programs shall be automatically overridden by priority fire alarm events. All programs shall be held in non-volatile programmable RAM memory and shall not be lost even if both system primary and secondary power failure occurs. The system shall include a trouble reminder feature to alert operating personnel to the continued presence of system trouble conditions.

C. Display Interface Board (DIA): The DIA shall provide a 640-character back-lit, super-twist Liquid Crystal Display (LCD). It shall provide Light-Emitting Diodes (LED's) for AC POWER; SYSTEM ALARM; SYSTEM TROUBLE; DISPLAY TROUBLE; and DISABLE. The DIA shall provide a 25-key membrane keypad with control capability to command all system functions, status readouts, manual control action, and entry of any alphabetic or numeric information. The keypad shall

include means to enter multiple five digit passwords to prevent unauthorized manual control or programming.

D. CONTROL SWITCHES

1. Acknowledge/step Switch

2. Signal Silence Switch

3. System Reset Switch 04 System Test Switch

4. Lamp Test

E. Loop Control/Expander Module (LCM/LEM): The LCM/LEM shall communicate and provide power to all devices on its loop over a single pair of wires. Each signaling line circuit shall provide the capability to support up to 159 smoke detectors and 159 monitor and control modules. The LCM/LEM shall receive digital/ANALOG information from all "intelligent" detectors and shall process this information to determine normal, alarm, trouble, and sensitivity conditions. The analog information may be used for automatic test and determination of maintenance requirements. The LCM/LEM module shall individually monitor all "intelligent" detectors for sensitivity variation initiating a trouble condition should detector sensitivity "drift" become excessive. The system control unit shall have the capability to remotely read each detectors sensitivity, and if need be, electronically adjust the detector sensitivity as required for existing conditions within U.L. recommended limits. In addition, the system shall incorporate a "day/night" sensitivity feature.

F. Non-Lock Walk Test: The system shall include a special non-lock "walk test" mode. The walk test mode can be initiated by loop, software zone, or globally as field selected. The following reports shall be capable of being generated:

1. General results of all walk tested devices.

2. Report all un-programmed devices installed.

3. Report all programmed devices not installed.

4. Report all devices not tested.

G. Automatic Detector Test: The system shall include a special automatic detector test feature which permits reading and adjustment of the sensitivity of all intelligent detectors from the main control panel. In addition, the automatic test feature shall also permit the functional testing of any "intelligent" detector or addressable interface device individually from the main control panel. An automatic detector test shall occur automatically fourteen times each twenty-four hour period or be initiated manually from the FACP as desired. Automatic detector test sequencing shall be terminated upon receipt of a true alarm condition.

H. Special System Reports: The system shall have the ability to generate and print, upon command, system and point status reports. Selection of 'system' read status provides the operator with

global system programming information. Selection of 'point' read status provides the operator with selected individual point programming data.

I. Field Programming: The system shall be 100% field programmable without the need for external computers or PROM programmers, and shall NOT require replacement of memory IC's. Systems requiring factory programming/re-programming OR REPLACEMENT OF MEMORY I.C. CHIPS shall not be acceptable. All programs shall be stored in non-volatile RAM memory. Programming shall be accomplished only after entering an appropriate and pre-selected five digit password security code. System programming mode shall not require the system to be taken off-line nor prohibit the system from performing its normal operations and routines. The system shall be capable of revising/changing programmed functions or system expansion at any time subsequent to initialization as described herein without factory modifications or factory programming. Field programming via the use of external computers may be considered provided programming can be accomplished on- site and the owner permanently furnished with required programming apparatus and software as part of this contract.

J. Event History: The main fire alarm control panel shall have the resident ability to store a minimum of 4000 events as well as a separate 1000 event alarm-only file in chronological order of occurrence. Event history shall include all system alarms, troubles, operator actions, unverified alarms, circuit/point alterations, and component failures. Events shall be time and date stamped. Events shall be stored in non-volatile buffer memory. Access to history buffer shall be secured via five digit password security code. Systems not employing event history memory storage shall be required to furnish a printer/recorder for recording system events.

K. Power Supply: The power supply shall provide all control panel and peripheral power needs with filtered power as well as regulated 24VDC power for external audio-visual devices. The audio-visual power may be increased as needed by adding additional modular expansion power supplies. All power supplies shall be designed to meet U.L. and NFPA requirements for POWER-LIMITED operation on all external signaling lines, including initiating circuits and indicating circuits. Power dedicated circuit and label as such on panels. Input power shall be 120VAC 60Hz. The power supply shall provide internal supervised batteries and automatic charger. The power supply shall provide both positive and negative ground fault supervision, battery/charger fail condition, A.C. power fail indicators. The power supply shall also provide supervision of modular expansion power supplies as may be required. Contractor shall connect the 120V circuits to the emergency circuit/panels backed up by the generator. Batteries shall have 24 hours of standby capacity and 15 minutes of alarm capacity. Battery charger shall recharge batteries from full discharge to full charge over a 24-hour period. Switching from normal power to battery power and back shall occur automatically.

2.4 VOICE COMMUNICATIONS (WHERE APPLICABLE)

A. The NOTIFIER Notifer Model NFC-50/100 or DVC with DAA Voice Command voice communications panel shall be modular in design utilizing solid state MICROPROCESSOR circuitry. The voice evacuation system shall integrate with the main fire alarm control panel. Side car voice evacuation systems are not acceptable. Voice system shall be used where required per code and local AHJ requirements.

B. Communications Controls: The communications control panel shall incorporate the following controls and indicators:

1. All call
2. General alarm
3. Audio trouble LED
4. AUDIO LEVEL LED
5. Manual tone/MESSAGE select switches with LED indicators.
6. Communications zone select switches and select indicators
7. Communications monitor speaker with volume control
8. Dynamic paging microphone

C. Paging

1. The microprocessor based one way paging system shall be provided with a means to selectively activate voice, tones or digitized messages to any or all zones in the system via electronic membrane touch-pad controls. In addition, visual indication by zone will be provided.
2. Each audio/speaker circuit will be totally supervised for opens, shorts or grounds with direct shorts prohibiting selection of the respective zone. All audio circuits shall be POWER LIMITED. Each speaker zone shall be provided with an amber trouble LED for circuit trouble conditions and an active/on LED indicator.
3. Alarm/Paging zones shall be provided as required.

D. Voice

1. The voice communications center DVC with DAA shall be a microprocessor based, supervised, multi-function, audio generator. The communications generator shall contain:
   a. Independent Voice communications CPU.
   b. Non-volatile
   c. One custom digitized message circuit.
   d. Up to four selectable tone generator/oscillators.
   e. Each sub-circuit of the communications center shall be fully supervised and failure of any tone oscillator or digital message generator shall revert the system to the default standby generator.
2. The system shall be provided with a custom field programmable digitized message.

3. The system shall provide adequate audio amplification. The system shall be capable of amplifier capacity and expansion as required. Each amplifier shall be continuously monitored electronically for proper output level. Each unit shall be equipped with diagnostic indicators. Each amplifier shall provide a minimum of 50 watts of 25 VRMS of power. Each unit shall be equipped with its own individual power/pilot LED, audio input trouble LED, battery input trouble LED, and amplifier trouble/fail LED. Provide amplification for 1/2 watt per speaker plus 25% spare capacity. Electrical Contractor shall provide and install a 120 VAC dedicated circuit to each remote amplifier cabinet (if needed).

4. Secondary cell dialer shall be Model # Starlink SLE-LTEVI Fire or owner approved equal.

2.5 FIELD DEVICES

A. Multi Criteria Smoke and Heat Detector (FCO-951 or FCO-951IV):

1. Notifier Model FAPT-851 or latest intelligent multi criteria acclimating detector shall be provided where shown on the drawings. The intelligent multi criteria Acclimate Plus and/or Clip Mode detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.

2. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).

3. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.

4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base.

B. Intelligent Duct Detector

1. Notifier model DNR series duct mounted "intelligent" photoelectric smoke detectors shall be provided where shown on the drawings. Detectors shall operate on the same principles and exhibit the same basic characteristics as area type "intelligent" photoelectric smoke sensors. The unit shall be capable of interchanging/accepting either photo-electronic or ionization type sensors. The detector shall operate in air velocities of

300 FPM to 4,000 FPM. Each detector shall interface directly to the system SLC loop without the requirement of interface zone modules.

2. The unit shall consist of a clear molded plastic enclosure with integral conduit knockouts. The unit shall be provided with clear faceplate cover to provide visual viewing of detector/sensor for monitoring sensor operation and chamber condition. The duct housing shall be provided with gasket seals to insure proper seating of the housing to the associated ductwork. Each unit's sampling tubes shall extend the width of the duct and be provided with porosity filters to reduce sensor/chamber contamination. Detectors shall be installed per NFPA 90A, and be listed with the fire alarm control panel. A remote LED shall be located on the corridor ceiling adjacent to the respective detector where detectors are not plainly visible or concealed from view.

C. Intelligent Thermal Detectors

1. Notifier Model FST-951R analog, fixed temperature, thermal detectors shall be provided where indicated on the drawings. The detectors shall use dual electronic thermostats to measure temperature levels in the chamber and shall, on command from the control panel, send data to the panel representing the analog temperature level.

2. The detectors shall provide dual alarm and power/status LED's. Status LED's shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED's may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also be provided in the base to connect an external remote alarm LED.

3. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base.

D. Addressable Manual Stations

1. Notifier Model NBG-12LX manual stations shall be provided where indicated on the drawings. The manual stations shall contain the intelligence for reporting address, identity, alarm and trouble to the fire alarm control panel
   a. The manual pull station shall be constructed of durable molded polycarbonate material, and shall be RED in color with raised white lettering. Stations shall be of the dual action type.
   b. Manual stations (when required), shall be located not more than 5 feet from the entrance to each exit. Additional manual stations shall be located so that the travel distance to the nearest manual station does not exceed 200 feet.
   c. Manual station heights shall be a minimum of 42” and a maximum of 48” measured vertically, from the finished floor level to the activating handle or lever.
   d. Systems using automatic smoke detection or water flow detection devices to initiate the fire alarm system, not less than one (1) manual station shall be provided to initiate a fire alarm signal. The manual station shall be located where required by the Authority Having Jurisdiction, per NFPA 101. Provide Stopper II cover on all manual stations where shown on plans.

E. Monitor Module

1. Notifier model FMM-101 addressable monitor modules shall be provided where required to interface to contact alarm devices. The monitor module shall be used to connect a supervised zone of conventional initiating devices to an intelligent SLC loop.

2. The monitor module shall provide address-setting means using rotary decimal switches. No binary coding shall be required.

F. Control Module

1. Notifier model FCM/FRM control/relay modules or approved equal shall be provided where required to provide audible alarm interface and/or relay control interface. The control module shall be used to connect a supervised zone of conventional indicating devices to an intelligent loop. The zone may be wired class A or class B - field selected. The control module may be optionally wired as dry contact (form C) relay.

2. The control module shall provide address-setting means using rotary decimal switches. No binary coding shall be required. A status LED shall be provided which shall flash under normal conditions, indicating that the control module is operational and in regular communication with the control panel. The LED shall illuminate steady when the device is actuated via the fire alarm control panel.

G. Remote LCD Alpha-Numeric Annunciators, Remote Mic with Switches

1. Provide where indicated on the drawings, a Notifier LCD-160 640 character remote LCD alpha-numeric annunciator or approved equal to annunciate all system events and duplicate the displayed status at the main FACP. The annunciator shall be a backlit eighty-character LCD display and operate via the system RS485 or RS232 serial output terminal from the main FACP. The LCD display shall automatically illuminate upon receipt of an alarm or trouble condition. The illumination source shall extinguish during normal/standby mode to conserve power. The unit shall operate from FACP 24VDC power and function during system power failure while the system resides on standby batteries. The remote LCD annunciator shall include:
   a. Integral time-date clock
   b. Time-date select switch
   c. Time-date/contrast adjust
   d. Display/step switch
   e. System reset
   f. f. System silence
   g. System acknowledge
   h. Integral trouble buzzer
   i. Point enable/disable capability
   j. Full QWERTY keypad for system programming.

2. Annunciator shall upon command display the first system alarm, last alarm, and system alarm count. The unit shall be equipped with an integral lamp test feature. The unit shall be semi flush mounted where shown.

H. Speakers/Horn (Where Applicable)

1. Speakers shall be listed under U.L. standard 1480, meet all specifications of the Life Safety Code and be capable of reproducing both tone alerts and voice communication instructions. Speakers/Horns shall be System Sensor L Series or equal by Wheelock. Speakers or approved equal shall have built in matching transformer, field selectable multiple power taps and circuitry for speaker/line supervision. Speakers shall be provided with screw terminal connection points. Speakers shall be 4" square or round with textured white decorative grill. Speakers shall be tapped to produce a minimum sound-pressure level of 87 dBA at 10 feet. Speakers shall be ceiling mounted as located on the drawings.

I. Speakers/Horns with Integral Strobe Light

1. Speakers shall be listed under U.L. standard 1480, meet all specifications of the Life Safety Code and be capable of reproducing both tone alerts and voice communication instructions. Speakers/strobe units shall be System Sensor L Series. Speakers shall have built in matching transformer, field selectable multiple power taps and circuitry for speaker/line supervision. Speakers shall be provided with screw terminal connection points. Speaker/Strobes shall be white. Each speaker/strobe shall be equipped with an integral high intensity visual alarms shall be Xenon strobe type producing a minimum of 15 candela on a 24 VDC limited energy supervised circuit. Each strobe light shall be capable of providing multi candela output. Alarm devices shall be designated to be ceiling mounted as indicated on the drawings. Signals shall operate in unison with audible alarm appliances. High intensity visual signals shall be of solid state low current design and listed to U.L. Standard 1971 All strobe lights shall be synchronized.

J. High Intensity Visual Signals

1. Provide System Sensor L Series or equal by Wheelock strobe lights were shown on the drawings. High intensity visual signals shall be installed where shown on the drawings and as may be required by the Americans with Disabilities Act (Public Law 101-336), Texas Accessibility Standards and NFPA 72, Chapter 6. Strobe lights shall be red. High intensity visual alarms shall be Xenon strobe type producing a minimum of 15 candela on a 24 VDC limited energy supervised circuit. Each strobe light shall be capable of providing multi candela output. Alarm devices shall be designated to be wall or ceiling mounted as indicated on the drawings. Signals shall operate in unison with audible alarm appliances. High intensity visual signals shall be of solid state low current design and listed to U.L. Standard 1971. All strobe lights shall be synchronized.

K. Protective Covers

1. Provide protective covers on fire alarm notification appliance devices located in multi-purpose rooms and gymnasium locker rooms. These protective covers shall be manufactured by Safety Technology International, Inc. (STI). These covers shall be provided on all devices including but not limited to audible and visual devices, and manual pull stations. The mounting of a device shall be reinforced to enable the protective covers to protect the fire alarm devices. In gymnasiums, provide wire guards or approved equal. No horns in covers.

L. Sprinkler Waterflow Switch

1. Sprinkler waterflow switches shall be installed where indicated on the drawings. Each unit shall contain one set of SPDT alarm contacts. Waterflow switches shall be provided and installed by the fire protection contractor, and connected by the fire alarm contractor.

M. Sprinkler Valve Supervisory Switch

1. Sprinkler valve supervisory switches shall be installed on each valve as indicated on the drawings. Each unit shall contain on set of SPDT contacts. Sprinkler valve supervisory switches shall be provided, installed, and adjusted by the fire protection contractor, and connected by the fire alarm contractor.

N. Auxiliary AHU Relays

1. Notifier/Air Products Model MR-101/C relays or approved equal shall be provided for HVAC and AHU control and interface. Relays shall be heavy duty type and rated up to 10 amps at 24 VDC, 60 HZ. Relays shall be provided with NEMA I dust cover assembly and be provided with SPDT contacts as well as activated LED indicator. All interface relays shall be connected to a supervised notification appliance circuit.

O. Field Charging Power Supplies

1. Provide Notifier FCPS-24S6/8 or PSE-10 power supplies with battery backup as required. Electrical Contractor shall provide a 120 VAC dedicated emergency circuit to each power supply.

P. Conventional Weatherproof Thermal Detector

1. When heat detection devices are located in harsh and/or moist environments, such as showers and similar areas, which are subject to high humidity, the following device shall be provided: Weatherproof Heat Detector 135 F Rate Compensated shall be provided. The detector shall mount in a weatherproof 4” electrical box with a ½” N.P.T. threaded hub. This detector shall be connected to an addressable monitor module.

Q. Digital Alarm Transmitter Communicator

1. Provide Digital alarm communicator shall be multi-channel UDACT-2. Provide point ID reporting to central monitoring station. (Owner will provide Analog or Digital to Analog Telephone lines cabling to the fire alarm panel, Service and Connection by owner).

R. Provide a minimum of (50) initiating points for future portable buildings where applicable. Provide (2) dedicated NAC circuits pulled to the exit point above the ceiling. Refer to floor plan for location.

S. Contractor shall provide a 120 VAC dedicated emergency circuit to each amplifier.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wiring:

1. All wiring shall be in accordance with NFPA 72 and the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.

2. Limited energy FPLP wire shall be installed provided such wire is U.L. Listed to U.L. TEST910 for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so approved by the local authority having jurisdiction.

3. All wiring for SLC signaling circuits shall be of the twisted, low capacitance type to guard against outside RF and EMF interference and induced noise.

4. All wiring shall be run in a supervised fashion (i.e. no branch wiring or dog- legged wiring) per NFPA requirements such that any wiring disarrangement will initiate the appropriate trouble signals via the main control panel per NFPA and U.L. requirements.

5. Wiring splices shall be kept to a minimum with required splices to be made in designated terminal boxes or at field device junction boxes. Transposing or color code changes of wiring will not be permitted. End-of-line supervisory devices shall be installed with the last device on the respective circuit. Said device shall be appropriately marked designating it as the terminating device on the respective circuit.

6. No A.C. wiring or any other wiring shall be run in the same conduit as fire alarm wiring.

B. Open Wiring

1. Systems utilizing open wiring techniques with low smoke plenum cable.

2. Support wire clear of knock out panels, access panels, and maintenance spaces for equipment. Wire and cable shall be run using wire management techniques supporting cable as close as possible to within one foot of the floor or roof rafters. Wire supports shall be directly fastened to the structure on a maximum of five foot centers. Wire routing shall be parallel and perpendicular to building lines. The wire and cable shall be secured with tie wraps or carrier wire. Sagging in excess of three inches will not be allowed nor will bending of the supporting ring structure.

C. Conduit/Raceway and 120 VAC Power wiring

1. Electrical Contractor to provide conduit and raceway system and shall be installed in the mechanical, electrical and telephone rooms and as required by NFPA 70. Electrical Contractor shall provide and install all required dedicated 120 VAC power circuits for the fire alarm system including the main fire alarm panel, remote amplifier panels and

remote strobe light power supplies. Contractor shall connect the 120V circuits to the emergency circuit/panels backed up by the generator.

D. Minimum Wire Sizes Shall Be as Follows:

1. Signaling Line Circuits: 18 AWG Twisted (Low Capacitance)

2. Notification Appliance Circuits: 14 AWG

3. Relay Control Circuits: 18 AWG

4. Speaker Circuits: 16 AWG Twisted/Shielded

E. All wire shall be plenum rated.

3.2 TEST AND REPORTS

A. A state licensed and factory trained technical representative of the manufacturer shall supervise the final control panel connections and testing of the system. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system. Instruction shall be 4 hours minimum.

B. The installing contractor shall functionally test each and every device in the entire system for proper operation and response. In addition, each circuit in the system shall be fully tested for wiring supervision. Any items found not properly installed or non-functioning shall be replaced or repaired and re-tested. Provide a device list of every device and tested results in an excel format.

C. The installing contractor shall provide a complete written report on the functional test of the entire system. A copy of the test report shall be provided with maintenance manuals. The test report shall be signed and dated by the licensed fire alarm superintendent responsible for supervising the final system test and checkout.

D. The installing contractor's fire alarm technician shall test the entire system in the presence of the local authorities having jurisdiction. The contractor shall be responsible for making any changes, adjustments, or corrections as may be required by the local authorities.

E. It is the intent of these specifications and of the architect/engineer that a continued program of system maintenance be continued by the owner in compliance with NFPA Standard 72, Chapter 7. It is mandatory that the installing contractor shall provide such services and make available these services to the owner upon completion of the project.

3.3 WARRANTY

A. The fire alarm system, including labor and material, shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of acceptance or beneficial occupancy, whichever shall occur first. Any equipment or workmanship

shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner.

B. The equipment manufacturer shall be represented by a local service organization and the name of such shall be furnished to the Owner, Architect, and Engineer.

3.4 FLOOR PLANS

A. Provide (1) electronic copy and (1) hard copy of the approved fire alarm drawings as well as a FML-009 with approved State of Texas installation tags posted at fire panel.

END OF ECTION 283101

SECTION 328000 - LANDSCAPE IRRIGATION SYSTEM

PART 1 -- GENERAL

1.1 SCOPE:

A. Furnish all work and materials, appliances, tools, equipment, facilities, transportation, and services necessary for and incidental to performing all operations in connection with the installation of underground sprinkler irrigation system complete, as shown on drawings and/or specified herein. When the term "Contractor" is used in this section, it shall refer to the irrigation Subcontractor.

1.2 QUALITY ASSURANCE:

The following Codes, Regulations, Reference Standards, and Specifications apply to work included in this section: ASTM: D2241, D2464, D2466, and D2564.

1.3 WARRANTY AND MAINTENANCE:

A. The Contractor shall warranty material and workmanship for one year after final acceptance including repair and replacement of defective materials, workmanship, and repair of backfill settlement.

B. Maintenance during warranty shall include, but not necessarily be limited to, the following:

1. Adjustment of sprinkler height and plumb to compensate for settlement and/or plant growth.
2. Backfilling of all trenches.
3. Adjustment of head coverage (arc of spray) as necessary.
4. Unstopping heads plugged by foreign material.
5. Adjustment of controller as necessary to insure proper sequence and watering time.
6. All maintenance necessary to keep the system in good operating order. Repair of damage caused by vandals, other contractors or weather conditions shall be considered extra to these specifications.

C. Warranty and maintenance after final acceptance does not include alterations as necessitated by re-landscaping, re-grading, addition of trees or the addition and/or changes in sidewalks, walls, driveways, etc.

D. Maintenance shall continue for one month after final acceptance.

1.4 SUBMITTALS:

A. The Contractor shall submit shop drawings or manufacturer's "cut sheet" for each type of sprinkler head, pipe, controller, valves, check valve assemblies, valve boxes, wire, conduit, fittings, and all other types of fixtures and equipment proposed to install on the job. The submittal shall include the manufacturer's name, model number, equipment capacity, and manufacturer's installation recommendation, if applicable, for each proposed item.

B. No partial submittal will be accepted, and submittals shall be neatly bound into a brochure and logically organized. After the submittal has been approved, substitutions will not be allowed except by written consent of the Landscape Architect.

C. Shop drawings shall include dimensions, elevations, construction, details, arrangements, and capacity of equipment, as well as manufacturer's installation recommendations.

1.5 "APPROVED EQUAL" SUBSTITUTIONS:

Where items on the plans are specified by a manufacturer's brand name and catalog number, followed by the phrase "or approved equal". This is not intended to unduly restrict competitive procurements or bidding but is done to assure a minimum standard of quality which is believed to be best for the item specified and to match existing equipment.

1.6 CODES/PERMITS:

A. All work under this section shall comply with the provisions of these Specifications, as illustrated on the accompanying drawings, or as directed by the Owner and shall satisfy all applicable local codes, ordinances, or regulations of the governing bodies and all authorities having jurisdiction over this Project.

B. Installation of equipment and materials shall be done in accordance with requirements of the National Electrical Code, City Plumbing Code, and standard plumbing procedures. The drawings and these Specifications are intended to comply with all the necessary rules and regulations; however, some discrepancies may occur, the Contractor shall immediately notify the Landscape Architect in writing of the discrepancies and apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with the regulations shall be paid for as covered by these Contract documents.

C. The Contractor shall give all necessary notices, obtain all permits, and pay all costs in connection with his work; file with all governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver to the Owner.

D. The Contractor shall include in the work any labor, materials, services, apparatus, or drawings in order to comply with all applicable laws, ordinances, rules, and regulations whether or not shown on the drawings and/or specified.

E. The installation of the irrigation system shall be made by an individual or firm duly licensed under Article No. 8751 VTCS, Titled "Licensed Irrigators Act", S.B. No. 259 as passed by the 66th Texas Legislature.

1.7 EXISTING UTILITIES:

A. Locations and elevations of various utilities included with the scope of this work have been obtained from the most reliable sources available and should serve as a general guide without guarantee to accuracy. The Contractor shall examine the Site and verify to his own satisfaction the locations and elevation of all utilities and availability of utilities and services required. The Contractor shall inform himself as to their relation to the work and the submission of bids shall be deemed as evidence thereof. The Contractor shall repair at his own expense, and to the satisfaction of the Owner, for damage to any utility shown or not shown on the plans.

B. Should utilities not shown on the plans be found during excavations, Contractor shall promptly notify the Owner for instructions as to further action.

C. Contractor shall make necessary adjustments in the layout as may be required to connect to existing stub-outs, should such stub- outs not be located exactly as shown and as may be required to work around existing work, at no increase in cost to the Owner. All such work will be recorded on record drawings and turned over to the Owner prior to final acceptance.

1.8 RECORD DRAWINGS:

A. Record dimensioned locations and depths for each of the following:

1. Point of connection.
2. Sprinkler pressure line routing (provide dimensions for each 100 lineal feet (maximum) along each routing, and for each change in directions).
3. Gate valves.
4. Sprinkler control valves (buried only).
5. Control wire routing.
6. Other related items as may be directed by the Landscape Architect.

B. Locate all dimensions from two permanent points (buildings, monuments, sidewalks, curbs, or pavements).

C. Record all changes which are made from the Contract drawings, including changes in the pressure and non-pressure lines.

D. Record all required information on a set of reproducible drawing files.

E. Maintain information daily. Keep Contract drawings at the Worksite at all times and available for review by the Owner's representative.

1.9 CONTROLLER CHARTS:

A. Do not prepare charts until record drawings have been approved by the Owner's representative.

B. Provide one controller chart for each automatic controller installed.

1. Chart may be a reproduction of the record drawing, if the scale permits fitting within the controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
2. Chart shall be blackline print of the actual system, showing the area covered by that controller.

C. Identify the area of coverage of each remote control valve, using a distinctly different pastel color, drawn over the entire area of coverage.

D. Following approval of charts by the Owner's representative, they shall be hermetically sealed between two layers of 20 mil. thick plastic sheet.

E. Charts must be completed and approved prior to final acceptance of the irrigation system.

1.10 OPERATING AND MAINTENANCE MANUALS:

A. Provide individual bound manuals detailing operating and maintenance requirements for irrigation systems.

B. Manuals shall be delivered to the Owner's representative for review and approval no later than 10 days prior to completion of work. Revise manual as required.

C. Provide descriptions of all installed materials and systems in sufficient detail to permit maintenance personnel to understand, operate, and maintain the equipment.

D. Provide the following in each manual:

1. Index sheet, stating Irrigation Contractor's name, address, telephone number, and name of person to contact.
2. Duration of guarantee period.
3. Equipment list providing the following for each item:
    a. Manufacturer's name.
    b. Make and model number.
    c. Name and address of local manufacturer's representative.
    d. Spare parts list in detail.
    e. Detailed operating and maintenance instructions of major equipment.
4. Recommended programs for watering by season.

1.11 CHECKLIST:

A. Provide a signed and dated checklist and deliver to the Owner's representative prior to final acceptance of the work.

B. Use the following format:

1. Plumbing permits: if none required, so note.
2. Material approvals: approved by and date.
3. Pressure line tests: by whom and date.
4. Record Drawings: received by and date.
5. Controller charts: received by and date.
6. Materials furnished: received by and date.
7. Operation and maintenance manuals: received by and date.
8. System and equipment operation instructions: received by and date.
9. Manufacturer's warranties if required: received by and date.
10. Written guarantee: received by and date.
11. Lowering of heads in lawn areas: if incomplete, so state.

1.12 ELECTRIC POWER:

Electric power shall be provided within five feet of each controller location by the G.C. The irrigation contractor shall provide final hardwire connection.

1.13 WATER FOR TESTING:

Unless noted otherwise on the plans or elsewhere, furnish all water necessary for testing, flushing, and jetting.

1.14 BORINGS, SLEEVES AND ELECTRICAL CONDUITS:

Sleeves and electrical conduits are the responsibility of the Irrigation Contractor to install prior to paving or related construction and should be installed as noted on the drawings and specifications. Contractors shall be responsible for locating all sleeves and conduits at no additional cost to the

Authority. Borings under existing paving will be required where noted on the drawings and shall be provided at no additional cost to the Owner. Borings shall be a minimum of 18 inch depth and new pipes shall be incased in PVC sleeves as noted on the plans.

1.15 SPARE PARTS:

The Contractor shall supply the Owner with five spray heads, one for each head designated on the plan. The Contractor shall supply one additional key and hose swivel for every six quick couplers (one minimum).

PART 2 -- PRODUCTS

2.1 GENERAL:

Unless otherwise noted on the plans, all materials shall be new and unused. The irrigation equipment catalog numbers used for reference in these Specifications are to establish minimum quality standards and may be substituted with an "approved equal" as outlined in Paragraph 1.5 of this section.

2.2 POLYVINYL CHLORIDE PIPE (PVC PIPE):

PVC pipe manufactured in accordance with ASTM Standards noted herein.

A. Marking and Identification: PVC pipe shall be continuously and permanently marked with following information: Manufacturer's name, size, type of pipe, and material, SDR number, Product Standard number, and the NSF (National Sanitation Foundation) Seal.

B. PVC pipe fittings: Shall be of the same material as the PVC pipe specified and compatible with PVC pipe furnished. Solvent weld type fittings shall be Schedule 40.

C. PVC Pipe: Shall be as noted on the plans. Sizes up to 3” diameter shall be solvent weld type. Pipe sizes of 4” diameter and larger shall be o-ring gasket type with ductile iron gasket fittings.

D. Pipe sleeves: Shall be as noted on the plans.

2.3 SWING JOINTS:

Swing joints shall be O-ring seal type, Lasco or approved equal.

2.4 WIRE AND SPLICES:

A. Valve wire shall be as noted on the plans, minimum 14 gauge with type UF insulation which is Underwriters Laboratory approved for direct underground burial when used in a National Electrical Code Lass II Circuit (30 volts AC or less) as per Articles 725 and 300. Voltage drop shall be taken into consideration.

B. All connectors shall be UL listed, rated 600 volt, for PVC insulated wire. No wire splices shall be buried.

2.5 QUICK COUPLING VALVES:

A. Quick coupling valves shall be composed of a bronze cast body with a purple, (NP) cover.

B. The valve shall accept a single lug 3/4 inch bronze valve key for operation unless noted otherwise.

2.6 MANUAL VALVES:

A. Unless noted otherwise, manual valves 2-1/2 inches and smaller shall be all brass, globe type with composition disc rated at 150 pounds W.O.G. Manual valve size 4” and larger shall be Kennedy cast iron type.

B. All valves shall have wheel handles unless cross handles are called for on the plan.

2.7 VALVE BOXES:

A. A box shall be provided for all valves.

B. Valve boxes shall be made of high-strength plastic suitable for turf irrigation purposes.

C. Boxes shall be suitable in size and configuration for the operability and adjustment of the valve.

D. Extension sections will be used as appropriate to the depth of piping.

E. All valve box covers shall bolt down or have locking mechanisms and shall be colored green or black as selected by the Contracting Officer, or purple where required, as noted.

2.8 POP-UP SPRAY, BUBBLERS AND ROTARY HEADS:

A. Sprinkler heads are specified on the drawings. Spray heads shall have a minimum 4 inch pop-up.

B. The sprinkler body and all related parts shall be plastic cycolac or polycarbonate. They shall have a spring retraction for positive return action of the pop-up nozzle.

C. The spring for retraction and the adjustable nozzle screw shall be made of corrosion resistant materials.

2.9 DRIP TUBE WITH PRESSURE COMPENSATING EMITTERS:

Drip tube shall be of the manufacturer and model as noted on the plans. Pressure compensating emitters with internal check valves are required unless noted otherwise.

A. Barbed Insert Fittings

1. All barbed insert fittings shall be constructed of molded, ultra-violet-resistant plastic having nominal inside dimension (I.D.) of 0.24”.
2. Each fitting shall have a minimum of two ridges or barbs per outlet with a raised barb nearest the fitting outlet. All fittings shall be of one manufacturer and shall be available in one of the following end configurations:

a. Barbed insert fittings, or
b. Male pipe threads (MPT) with barbed insert fittings, or
c. Female pipe threads (FPT) with barbed insert fittings.

2.10 ELECTRIC CONTROLLER:

A. The electric irrigation controller shall be as noted on the plans. The system may be designed to operate multiple section valves at a time, per controller unless otherwise noted.

B. Power source shall be 110v A.C. Output for operation of companion solenoid actuated valves shall be 24 volts 60 Cycle AC.

2.11 ELECTRIC REMOTE CONTROL VALVES:

A. Electric remote control valves shall have plastic bodies and covers and shall be globe-type diaphragm valves of normally closed design. The valves are specified on the drawings.

B. Operation shall be accomplished by means of integrally mounted heavy-duty 24-V DC solenoid complying with National Electrical Code, Class II Circuit. Solenoid coil shall be potted in epoxy resin within a plastic coated stainless steel housing. Solenoids shall be completely waterproof, suitable for direct underground burial.

C. A flow stem adjustment shall be included in each valve.

2.12 BACKFLOW PREVENTER:

A. An approved backflow prevention device is required, as noted on the plans. The device shall include all materials as required by the local municipality and shall be inspected accordingly.

2.13 TEMPERATURE SENSORS & RAIN SENSORS:

A. Rain and freeze sensors shall be provided and installed as noted on the plans.

PART 3 – EXECUTION

3.1 INSTALLATION, GENERAL:

A. Design Pressure: This irrigation system has been designed to operate with a minimum static inlet water pressure as indicated on the drawings. The Contractor shall take a pressure reading prior to beginning construction. If the pressure reading is 5% less than above, the Contractor shall notify the Owner's Representative.

B. Contractor Responsibility: The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in equipment usage, area dimensions or water pressure exist that might not have been considered in the engineering. Such obstructions or differences shall be brought to the attention of the Owner's Representative in writing. In the event this notification is not performed, the Contractor shall assume full responsibility for any revision necessary.

C. Staking: Before installation is started, place a stake or flag where each sprinkler head and each valve box is to be located, in accordance with drawing. Staking shall be approved by the Landscape Architect before proceeding.

D. Piping Layout: Piping layout is diagrammatic. Route piping around existing trees and root zones in such a manner as to avoid damage to plantings. Do not dig within the ball of newly planted trees or shrubs.

E. In areas where trees are present, trenches will be adjusted on site to provide a minimum clearance of four times the trunk diameter of the tree (at its base) between any tree and any trench.

F. All material and equipment shall be delivered to the Worksite in unbroken reels, cartons or other packaging to demonstrate that such material is new and of a quality and grade in keeping with the intent of these Specifications.

3.2 EXCAVATION AND TRENCHING:

A. The Contractor shall perform all excavation to the depth indicated in these Specifications and Contract drawings. The banks of trenches shall be kept as nearly vertical as practicable. Trenches shall be wide enough to allow a minimum of 4" between parallel pipelines or electrical wiring. Where rock excavation is required, or where stones are encountered in the bottom of the trench that would create a concentrated pressure on the pipe, the rock or stones shall be removed to a depth of six (6) inches minimum below the trench depth indicated. The over depth rock excavation and all excess trench excavation shall be backfilled with loose, moist earth or sand, thoroughly tamped. Whenever wet or otherwise unstable soil that is incapable of properly supporting the pipe is encountered in the trench bottom, such shall be removed to a depth and length required, and the trench backfilled to trench bottom grade as hereinafter specified, with course sand, fine gravel or other suitable material.

B. Bottom of trench grade shall be continued past ground surface deviations to avoid air pockets and low collection points in the line. The minimum cover specifications shall govern regardless of variations in ground surface profile and the occasional deeper excavation required at banks and other field conditions. Excavation shall be such that a uniform trench grade variation will occur in all cases where variations are necessary.

C. Trench excavation shall comprise the satisfactory removal and disposition of all materials and shall include all shoring and sheeting required to protect the excavation and to safeguard employees.

D. During excavation, material suitable for backfilling shall be stockpiled in an orderly manner a sufficient distance back from edge of trenches to avoid overloading and prevent slides or cave-ins. Material unsuitable for backfilling shall be wasted as directed by the Owner's Representative. When excavated material is of a rocky nature and the topsoil or any other layer of excavated material is suitable for pipe bedding and backfill in the vicinity of the pipe, such material shall be separately stockpiled for use in such bedding and pipe backfill operations, unless satisfactory imported material is used.

E. All excavations and backfill shall be unclassified and covered in the basic bid. No additional compensation will be allowed for rock encountered.

F. Restore all surfaces, existing underground installations, etc., damaged or cut as a result of the excavations to their original conditions in a manner acceptable to the Owner's Representative.

3.3 PIPE INSTALLATION:

A. Sprinkler Mains: Sprinkler mains are that portion of piping from water source to electric valves. This portion of piping is subject to surges since it is a closed portion of the sprinkler system. Sprinkler mains shall be installed in a trench with a minimum of 18 inches of cover.

B. Lateral Piping: Lateral piping is that portion of piping from electrical valve to sprinkler heads. This portion of piping is not subject to surges since it is an "open end" portion of the sprinkler system. Lateral piping shall be installed in a trench with a minimum of 12 inches of cover.

3.4 PVC PIPE AND FITTING ASSEMBLY:

A. Solvent: Use only solvent recommended by manufacturer to make solvent-welded joints following standards noted herein. Thoroughly clean pipe and fittings of dirt, dust, and moisture with an approved PVC primer before applying solvent.

B. PVC to Metal Connection: Work metal connections first. Use a non-hardening pipe dope such as Permatex No. 2 or "Teflon" tape on threaded PVC to metal joints. Use only light wrench pressure.

C. Threaded PVC Connections: Where required, use threaded PVC adapters into which pipe may be welded.

D. Remove lumber, rubbish, and rocks from trenches. Provide firm, uniform bearing for entire length of each pipeline to prevent uneven settlement. Wedging or blocking of pipe will not be permitted. Remove foreign matter or dirt from inside of pipe before welding and keep piping clean during and after laying pipe.

E. PVC pipe shall not be installed where there is water in the trench, nor shall PVC pipe be laid when temperature is 40 deg. F or below or when rain is imminent. PVC pipe will expand and contract as the temperature changes. Therefore, pipe shall be snaked from side to side of trench bottom to allow for expansion and contraction.

3.5 HYDROSTATIC TESTS:

Pressure Test: After the pipe is laid, the joints completed, and the trench partially backfilled, leaving the joints exposed for examination, the newly laid mainline pipe or any valved section of main pressure line piping shall, unless otherwise specified, be subjected for four hours to a hydrostatic pressure test of normal city water pressure. Each valve shall be opened and closed during the test. Enclosed pipe, joints, fittings, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade, as necessary. Cracked or defective pipe, joints, fittings, or valves discovered in consequence of this pressure test shall be repeated until the test results are satisfactory. All replacement and repair shall be at contractor's cost.

3.6 CONTROL WIRE INSTALLATION:

A. All control wire less than 500 feet in length shall be continuous without splices or joints from the controller to the valves. Connections to the electric valves shall be made within 18 inches of the valve using connectors specified in Paragraph 2.4 of this section, unless otherwise approved by the Owner’s Representative in writing.

B. All control wires shall be installed at least 18 inches deep. Contractor shall obtain the Owner’s Representative's approval for wire routing when installed in a separate ditch. Control wires may be installed in a common ditch with piping, however wires must be installed a minimum of 4 inches below or to one side of piping.

C. All wire passing under existing or future paving, sidewalk, construction, etc., shall be encased in PVC conduit extending at least 2 feet beyond edges of paving, sidewalks, or construction.

3.7 POP-UP SPRAY, BUBBLER HEADS:

A. Provide heads and nozzles as specified and install in locations as shown on the Contract Drawings.

B. Pop-up spray heads shall be installed with connections to rigid PVC pipe as detailed on the Contract drawings. Rotary heads shall be installed on a double swing joint connected to the lateral pipe as detailed on the drawings.

C. Heads shall be installed with underside of flange flush with the finished grade.

D. Contractor will be required to adjust heads as necessary after establishment of grass or other plant material.

3.8 DRIP EQUIPMENT:

A. Drip tube can be installed in one of the following methods:

1. Over-excavation: Over-excavate the entire area to a depth of 2" to 4" below finish grade. Plant all specimen trees and shrubs 15 gallon size and larger, then place drip tube at the row spacing interval indicated on the plans.
2. Pipe Pulling: Where ground disruption is to be minimized, pneumatic tire, pipe-pulling machinery shall be used. Potholes shall be used at the ends of each run for making connection to supply and exhaust headers of rigid PVC pipe or polyethylene pipe.
3. Trenching: Hand or mechanically trench to the pipe depth indicated on the plans or in these specifications and backfill flush with finish grade. Avoid mechanically trenching within the dripline of existing trees. Hand-trench around existing tree roots when roots of 2" and larger are encountered. Remove all rock 1½" and larger when excavating and remove from site. Do not backfill trenches with rock that will come in direct contact with tubing or rigid PVC piping.

B. Placement of Rigid PVC Piping: Install pipe in a serpentine (snaked) manner to allow for expansion and contraction in trench before backfilling. Install pipes at temperatures over 40°F. Pipe markings shall face upward out of the trench whenever possible.

C. Drip tube: Drip tube can be installed with the water outlets facing up, down, or sideways. In irregular areas, some water outlets could end up too close to fixed improvements and may have to be capped off with a dripper plug ring.

D. Cover: Install underground piping horizontally and as evenly as possible to a maximum depth of 4", unless otherwise specified. (Typical pipe depth is 2" shrub beds, 4" in turf unless periodic aeration is anticipated, and then pipe depth should be lowered to 6".)

E. Barbed Insert Fittings: Connect drip tube to barbed insert fittings by pushing the tubing on and over both barbs of the fitting until the tubing has seated against another piece of tubing or has butted against another portion of the barbed fitting. For water pressures in excess of the 30 psi, or the maximum stated system pressure for the drip tube, whichever is less, use stainless steel clamps.

F. Clamping: When design-operating pressure exceeds 30 psi, or maximum stated system pressure for the drip tube, whichever is less, stainless steel pipe clamps shall be used. Slip clamps over tubing before slipping tubing over barbed insert fitting. Place clamp between the first and second ridge of the barbed fittings and crimp the "ear" of the clamp tightly. Crimp the "ear" twice to ensure proper seating.

3.9 QUICK COUPLING VALVES:

A. Quick coupling valves shall be installed with the underside of flange flush with the finished grade.

B. Quick coupling valves shall be installed on a swing joint assembly as detailed on the drawings.

C. Under the warranty, the Contractor shall return after grass is established and adjust valves and valve boxes to proper grade.

3.10 MANUAL VALVES:

A. Manual valves shall be sized and located where shown on the Contract drawings.

B. Valve boxes shall be adjusted to be flush with finished grade. The Contractor will be required to adjust after establishment of grass.

C. Valve boxes shall be properly supported and of sufficient construction that tractors and mowers crossing over the boxes will not push boxes down and crush the pipe, valve, or box.

3.11 VALVE AND VALVE BOX PLACEMENT:

A. All manual, electric, and quick coupling valves shall be in boxes as specified in Paragraph 2.7 of this section and shall be set with a minimum of six (6) inches of space between their top surface and the bottom of the valve box. The base of the box shall be filled with pea gravel as shown on plan.

B. Valves shall be fully opened and fully closed to ensure that all parts are in operating condition.

C. Valve boxes shall be set plumb, vertical, and concentric with the valve stem.

D. Any valve box which has moved from this required position so as to prevent the use of the operating wheel of the valve shall be reset by the Contractor at his own expense.

3.12 ELECTRIC CONTROLLER:

A. Electric controller location shall be confirmed with the L.A. before installation, as shown on the plans.

3.13 ELECTRIC REMOTE CONTROL VALVES:

A. Remote control valves shall be located and sized as shown on the plans. All electrical connections shall be made when the weather is dry with connection kits as specified in Paragraph 2.4 of this section in strict accordance with manufacturer's recommended procedures. All remote control valves shall be installed in a horizontal position, in accordance to the manufacturer's published installation instructions.

B. It shall be the responsibility of the Contractor to furnish and install the proper size wire on each of the low voltage circuits from the master control center to the various electric remote control valves.

C. Consideration shall be given to each circuit for allowance of voltage drop and economy consistent with accepted practices of electrical installation. Under no circumstances shall the voltage of any branch circuit be reduced more than proper due to length of run exceeding the maximum allowable for the wire size used.

3.14 BACKFILL AND COMPACTION:

A. After system is operating and required tests and inspections have been made, the trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand, gravel, soft shale, or other approved materials, free from large clods of earth or stone. Rock, broken concrete, or pavement, and large boulders shall not be used as backfill material. The backfill shall be thoroughly compacted and evened with the adjacent soil level.

B. Compact trenches in areas to be planted by thoroughly flooding the backfill. Compact all other areas by flooding or hand tamping. The jetting process may be used in areas when flooding.

C. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to a minimum of 90% density.

D. Any trenches improperly backfilled, or where settlement occurs, shall be reopened to the depth required for compaction, then refilled and compacted with the surface restored to the required grade and left in a completed surface condition as described above.

E. Specifically tamp backfill under heads and around the flange of heads for one foot (1') by a suitable means after trench backfill has dried from flooding to prevent heads loosening in the ground.

3.15 FINAL ADJUSTMENT:

A. After installation has been completed, make final adjustment of sprinkler system prior to Owner’s Representative's final inspection.

B. Completely flush system to remove debris from lines by removing nozzle from heads on ends of lines and turning on system.

C. Check sprinklers for proper operation and proper alignment for direction of throw.

D. Check each section for operating pressure and balance to other sections by use of flow adjustment on top of each valve.

E. Check nozzles for proper coverage. Prevailing wind conditions may indicate that arc or angle of spray should be other than as shown on drawings. In this case, change nozzles to provide correct coverage and furnish record data to Owner’s Representative with each change.

F. After system is thoroughly flushed and ready for operation, each section of sprinklers shall be adjusted to control pressure at heads. Use the following method, one section at a time:

1. Remove last head on section and install a temporary riser above grade. Install tee with pressure gauge attached on top of riser and re-install head with nipple onto tee.
2. Correct operating pressure at last head of each section as follows: Spray and rotor heads - 30-35 psi.
3. After replacing head, at grade, tamp thoroughly around head.
4. Drip zone valve pressure regulating devices shall be set at not to exceed 40 psi.

3.16 CLEAN-UP:

A. The Worksite shall be thoroughly cleaned of all waste materials and all unused or salvaged materials, equipment, tools, etc.

B. After completion of the work, areas disturbed shall be leveled and the Worksite shall be raked clean and left in an orderly condition.

END OF SECTION

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The scope of work includes all labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of turf and grasses (also known as "landscaping") complete as shown on the drawings and as specified herein.

1. Soil Preparation

2. Sodding.

3. Maintenance

B. Related Documents:

1. Drawings and general provisions of contract including general and supplementary conditions and Division I specifications apply to work of this section

2. Related Sections include the following:

a. Earthwork: See Civil Drawings
b. Section 328400: “Planting Irrigation”.
c. Section 329300: “Plants”.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by blending soils or sand with organic soil amendments.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Certification of Sod: From sod vendor for each seed mixture for sod identifying source.

C. Product Certificates: For soil amendments and fertilizers.

D. Qualification Data: For landscape Installer.

E. Material Test Reports: For existing surface soil and imported topsoil.

F. Planting Schedule: Indicating anticipated planting dates for each type of planting.

G. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of lawns during one (1) calendar year.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment. Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

1. Installer Field Supervision: When any planting work is in progress, installer shall maintain, on site, a full-time supervisor who can communicate in English with the Owner's Representative.

2. Installer's field supervisor shall have a minimum of five years experience as a field supervisor installing plants and trees of the quality and scale of the proposed project, and can communicate in English with the Owner's Representative.

3. The installer's crew shall have a minimum of 3 years experienced in the installation of Planting Soil, Plantings, and Irrigation (where applicable) and interpretation of soil plans, planting plans and irrigation plans.

4. Submit references of past projects, employee training certifications that support that the Contractors meets all of the above installer qualifications and applicable licensures.

B. Soil-Testing Laboratory Qualifications: Provide soil test analysis from an independent laboratory or university laboratory, recognized by the State Department of Agriculture with the experience and capability to conduct the testing indicated and that specializes in tests to be performed.

C. Soil Analysis: Furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Landscape Architect. A minimum of four (4) representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.

2. Report suitability of tested soil for turf growth.

3. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. (92.9 sq. m) or volume per cu. yd. (0.76 cu. m)

4. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

5. Notify Landscape Architect of sources of planting materials minimum seven (10) days in advance of delivery to site.

1.6 WARRANTY

A. Warrant lawns and grasses and workmanship for the warranty period indicated, against defects, poor health, unsatisfactory growth, and death, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner or Owner’s Maintenance Contractor or incidents that are beyond Contractor’s control.

1. Warranty period: One (1) year from date of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding." Remove from palettes immediately upon delivery and install.

1.8 SCHEDULING

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance until date of Substantial Completion.

1. Spring Planting: between March 15 – May 1

2. Fall Planting: between August 15 – November 1

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.9 MAINTENANCE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable grass is established but for not less than the following periods:

1. Sodded Turf: 60 days from Substantial Completion.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: State-certified seed of grass species.

C. Seed Species:

1. Common Bermuda Grass: hybrid, high quality, extra fancy grade, hulled and treated, 98 percent purity and 85 percent germination.

2.2 SOD

A. Turfgrass Sod: Approved [Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects], complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

2.3 TOPSOIL

A. Topsoil: Refer to notes in drawing, Sheet L2.

B. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 2-5 percent organic material content; free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs or marshes.

2. Topsoil Source: Import topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs or marshes.

3. Topsoil Source: Amend existing in-place surface soil to produce topsoil. Verify suitability of surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

    a. Surface soil may be supplemented with imported or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs or marshes.

2.4 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

1. Class: Class T, with a minimum 99 percent passing through No. 8 (2.36-mm) sieve and a minimum 75 percent passing through No. 60 (0.25-mm) sieve.

2. Class: Class O, with a minimum 95 percent passing through No. 8 (2.36-mm) sieve and a minimum 55 percent passing through No. 60 (0.25-mm) sieve.

3. Provide lime in form of dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 (3.35-mm) sieve and a maximum 10 percent passing through No. 40 (0.425-mm) sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

F. Sand: Clean, washed, natural or manufactured, free of toxic materials.

G. Diatomaceous Earth: Calcined, diatomaceous earth, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

H. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.5 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1/2-inch (12.5-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 60 percent of dry weight.

2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with at least 0.15 lb (2.4 kg) of ammonium nitrate or 0.25 lb (4 kg) of ammonium sulfate per cubic foot (cubic meter) of loose sawdust or ground bark.

C. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.6 PLANTING ACCESSORIES

A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required f or Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

2.7 FERTILIZER

Fertilizers should only be applied after the soil is tested and a deficiency that cannot be amended with compost is shown. This shall be approved by the Landscape Architect prior to installation. The contractor shall tests soils prior to fertilizer application.

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 1 percent nitrogen and 10 percent phosphoric acid.

B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. (0.45 kg/92.9 sq. m) of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.

2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.8 MULCHES

A. Hardwood Double Shredded Mulch: stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 60 percent of dry weight.

2. Produced within 100 miles of the site.

2.9 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

B. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92 lb/sq. yd. (0.5 kg/sq. m), with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive lawns and grasses for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Notify Landscape Architect at least 10 working days prior to start of seeding operations.

B. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations. Protect adjacent and adjoining areas from hydroseeding overspray. Perform seeding only after planting and other work affecting ground surface ahs been completed.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

D. Restrict traffic from lawn areas until grass is established. Erect signs, flagging, and barriers as necessary.

3.3 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with nonasphaltic tackifier.
2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply mulch at a minimum rate of 1500-lb/acre (15.3-kg/92.9 sq. m) dry weight but not less than the rate required to obtain specified seed-sowing rate.

3.4 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.

2. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches (38 mm) below sod.

3.5 NATIVE GRASS

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Do not use wet seed or seed that is moldy or otherwise damaged.

B. Sow seed at the net rate as indicated on the drawings.

C. Brush seed into top 1/16 inch (1.6 mm) of topsoil, roll lightly, and water with fine spray.

D. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch within 24 hours after completing seeding operations. Soak and scatter uniformly to a depth of 3/16 inch (4.8 mm) and roll to a smooth surface.

E. Water newly planted areas and keep moist until meadow is established.

3.6 SATISFACTORY LAWNS

A. Satisfactory Sodded Lawn: At Substantial Completion, a healthy, well-rooted, even-colored, viable lawn, free of weeds, open joints, bare areas, and surface irregularities.

B. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

3.7 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established. Remove erosion-control measures after grass establishment period.

END OF SECTION 329200

SECTION 329300 - PLANTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The scope of work includes all labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of plant (also known as "landscaping") complete as shown on the drawings and as specified herein.

B. The scope of work in this section includes, but is not limited to, the following:

1. Locate, purchase, deliver and install all specified plants.
2. Water all specified plants.
3. Mulch, fertilize, stake, and prune all specified plants.
4. Maintenance of all specified plants until the beginning of the warranty period.
5. Plant warranty.
6. Clean up and disposal of all excess and surplus material.
7. Maintenance of all specified plants during the warranty period.

1.3 CONTRACT DOCUMENTS

A. Shall consist of specifications and general conditions and the construction drawings. The intent of these documents is to include all labor, materials, and services necessary for the proper execution of the work. The documents are to be considered as one. Whatever is called for by any parts shall be as binding as if called for in all parts.

1.4 RELATED DOCUMENTS AND REFERENCES

A. Related Documents:

1. Drawings and general provisions of contract including general and supplementary conditions and Division I specifications apply to work of this section
2. Related Specification Sections
   a. Section 328400 - Irrigation
   b. Section 329200 – Turf and Grasses

B. References: The following specifications and standards of the organizations and documents listed in this paragraph form a part of the specification to the extent required by the references thereto. In the event that the requirements of the following referenced standards and specification conflict with this specification section the requirements of this specification shall prevail. In the event that the requirements of any of the following

referenced standards and specifications conflict with each other the more stringent requirement shall prevail or as determined by the Owners Representative.

1. ANSI Z60.1 American Standard for Nursery Stock, most current edition.
2. “Grades and Standards”, latest edition of Texas Association of Nurserymen Specifications, Austin, Texas 78704.
3. ANSI A 300 – Standard Practices for Tree, Shrub and other Woody Plant Maintenance, most current edition and parts.
4. Interpretation of plant names and descriptions shall reference the following documents. Where the names or plant descriptions disagree between the several documents, the most current document shall prevail.
   a. USDA - The Germplasm Resources Information Network (GRIN) http://www.ars-grin.gov/npgs/searchgrin.html
   b. Manual of Woody Landscape Plants; Michael Dirr; Stipes Publishing, Champaign, Illinois; Most Current Edition.
   c. The New Sunset Western Garden Book, Oxmoor House, most current edition.
5. Pruning practices shall conform to recommendations “Structural Pruning: A Guide For The Green Industry” most current edition; published by Urban Tree Foundation, Visalia, California.
6. Glossary of Arboricultural Terms, International Society of Arboriculture, Champaign IL, most current edition.

1.5 VERIFICATION

A. All scaled dimensions on the drawings are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and quantities, and shall immediately inform the Owner’s Representative of any discrepancies between the information on the drawings and the actual conditions, refraining from doing any work in said areas until given approval to do so by the Owner’s Representative.

B. In the case of a discrepancy in the plant quantities between the plan drawings and the plant call outs, list or plant schedule, the number of plants or square footage of the planting bed actually drawn on the plan drawings shall be deemed correct and prevail.

1.6 PERMITS AND REGULATIONS

A. The Contractor shall obtain and pay for all permits related to this section of the work unless previously excluded under provision of the contract or general conditions. The Contractor shall comply with all laws and ordinances bearing on the operation or conduct of the work as drawn and specified. If the Contractor observes that a conflict exists between permit requirements and the work outlined in the contract documents, the Contractor shall promptly notify the Owner’s Representative in writing including a description of any necessary changes and changes to the contract price resulting from changes in the work.

B. Wherever references are made to standards or codes in accordance with which work is to be performed or tested, the edition or revision of the standards and codes current on the effective date of this contract shall apply, unless otherwise expressly set forth.

C. In case of conflict among any referenced standards or codes or between any referenced standards and codes and the specifications, the more restrictive standard shall apply or Owner's Representative shall determine which shall govern.

1.7 PROTECTION OF WORK, PROPERTY AND PERSON

A. The Contractor shall adequately protect the work, adjacent property, and the public, and shall be responsible for any damages or injury due to his/her actions.

1.8 CHANGES IN THE WORK

A. The Owner's Representative may order changes in the work, and the contract sum should be adjusted accordingly. All such orders and adjustments plus claims by the Contractor for extra compensation must be made and approved in writing before executing the work involved.

B. All changes in the work, notifications and contractor's request for information (RFI) shall conform to the contract general condition requirements.

1.9 CORRECTION OF WORK

A. The Contractor, at their own cost, shall re-execute any work that fails to conform to the requirements of the contract and shall remedy defects due to faulty materials or workmanship upon written notice from the Owner's Representative, at the soonest as possible time that can be coordinated with other work and seasonal weather demands.

1.10 DEFINITIONS

All terms in this specification shall be as defined in the "Glossary of Arboricultural Terms" or as modified below.

A. Boxed trees: A container root ball package made of wood in the shape of a four-sided box.

B. Container plant: Plants that are grown in and/or are currently in a container including boxed trees.

C. Defective plant: Any plant that fails to meet the plant quality requirement of this specification.

D. End of Warranty Final Acceptance: The date when the Owner's Representative accepts that the plants and work in this section meet all the requirements of the warranty. It is intended that the materials and workmanship warranty for Planting, Planting Soil, and Irrigation work run concurrent with each other.

E. Field grown trees (B&B): Trees growing in field soil for at least 12 months prior to harvest.

F. Healthy: Plants that are growing in a condition that expresses leaf size, crown density, color; and with annual growth rates typical of the species and cultivar's horticultural description, adjusted for the planting site soil, drainage and weather conditions.

G. Kinked root: A root within the root package that bends more than 90 degrees.

H. Maintenance: Actions that preserve the health of plants after installation and as defined in this specification.

I. Maintenance period: The time period, as defined in this specification, which the Contractor is to provide maintenance.

J. Normal: the prevailing protocol of industry standard(s).

K. Owner's Representative: The person appointed by the Owner to represent their interest in the review and approval of the work and to serve as the contracting authority with the Contractor. The Owner's Representative may appoint other persons to review and approve any aspects of the work.

L. Reasonable and reasonably: When used in this specification relative to plant quality, it is intended to mean that the conditions cited will not affect the establishment or long term stability, health or growth of the plant. This specification recognizes that it is not possible to produce plants free of all defects, but that some accepted industry protocols and standards result in plants unacceptable to this project.

M. When reasonable or reasonably is used in relation to other issues such as weeds, diseased, insects, it shall mean at levels low enough that no treatment would be required when applying recognized Integrated Plant Management practices.

N. This specification recognizes that some decisions cannot be totally based on measured findings and that professional judgment is required. In cases of differing opinion, the Owner's Representative's expert shall determine when conditions are judged as reasonable.

O. Root ball: The mass of roots including any soil or substrate that is shipped with the tree within the root ball package.

P. Root ball package. The material that surrounds the root ball during shipping. The root package may include the material in which the plant was grown, or new packaging placed around the root ball for shipping.

Q. Root collar (root crown, root flare, trunk flare, flare): The region at the base of the trunk where the majority of the structural roots join the plant stem, usually at or near ground level.

R. Shrub: Woody plants with mature height approximately less than 15 feet.

S. Spade harvested and transplanted: Field grown trees that are mechanically harvested and immediately transplanted to the final growing site without being removed from the digging machine.

T. Stem: The trunk of the tree.

U. Substantial Completion Acceptance: The date at the end of the Planting, Planting Soil, and Irrigation installation where the Owner's Representative accepts that all work in these sections is complete and the Warranty period has begun. This date may be different than the date of substantial completion for the other sections of the project.

V. Stem girdling root: Any root more than ¼ inch diameter currently touching the trunk, or with the potential to touch the trunk, above the root collar approximately tangent to the trunk

circumference or circling the trunk. Roots shall be considered as Stem Girdling that have, or are likely to have in the future, root to trunk bark contact.

W. Structural root: One of the largest roots emerging from the root collar.

X. Tree: Single and multi-stemmed plants with mature height approximately greater than 15 feet.

1.11 SUBMITTALS

A. See contract general conditions for policy and procedure related to submittals.

B. Product data: Submit manufacturer product data and literature describing all products required by this section to the Owner's Representative for approval. Provide submittal eight weeks before the installation of plants.

C. Plant growers' certificates: Submit plant growers' certificates for all plants indicating that each meets the requirements of the specification, including the requirements of tree quality, to the Owner's Representative for approval. Provide submittal eight weeks before the installation of plants.

D. Samples: Submit samples of each product and material where required by the specification to the Owner's Representative for approval. Label samples to indicate product, characteristics, and locations in the work. Samples will be reviewed for appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

E. Plant sources: Submit sources of all plants as required by Article – "Selection of Plants" to the Owner's Representative for approval.

F. Close out submittals: Submit to the Owner's Representative for approval.

G. Plant maintenance data and requirements.

H. Warranty period site visit record: If there is no maintenance during the warranty period, after each site visit during the warranty period, by the Contractor, as required by this specification, submit a written record of the visit, including any problems, potential problems, and any recommended corrective action to the Owner's Representative for approval.

1.12 OBSERVATION OF THE WORK

A. The Owner's Representative may observe the work at any time. They may remove samples of materials for conformity to specifications. Rejected materials shall be immediately removed from the site and replaced at the Contractor's expense. The cost of testing materials not meeting specifications shall be paid by the Contractor.

B. The Owner's Representative shall be informed of the progress of the work so the work may be observed at the following key times in the construction process. The Owner's Representative shall be afforded sufficient time to schedule visit to the site. Failure of the Owner's Representative to make field observations shall not relieve the Contractor from meeting all the requirements of this specification.

1. SITE CONDITIONS PRIOR TO THE START OF PLANTING: review the soil and drainage conditions.
2. COMPLETION OF THE PLANT LAYOUT STAKING: Review of the plant layout.
3. PLANT QUALITY: Review of plant quality at the time of delivery and prior to installation. Review tree quality prior to unloading where possible, but in all cases prior to planting.
4. COMPLETION OF THE PLANTING: Review the completed planting.

1.13 QUALITY ASSURANCE

A. Substantial Completion Acceptance - Acceptance of the work prior to the start of the warranty period:

1. Once the Contractor completes the installation of all items in this section, the Owner's Representative will observe all work for Substantial Completion Acceptance upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of the observation.
2. Substantial Completion Acceptance by the Owner's Representative shall be for general conformance to specified size, character and quality and not relieve the Contractor of responsibility for full conformance to the contract documents, including correct species.
3. Any plants that are deemed defective as defined under the provisions below shall not be accepted.

B. The Owner's Representative will provide the Contractor with written acknowledgment of the date of Substantial Completion Acceptance and the beginning of the warranty period and plant maintenance period (if plant maintenance is included).

C. Contractor's Quality Assurance Responsibilities: The Contractor is solely responsible for quality control of the work.

D. Installer Qualifications: The installer shall be a firm having at least 5 years of successful experience of a scope similar to that required for the work. The same firm shall install planting soil (where applicable) and plant material.

1. The bidders list for work under this section shall be approved by the Owner's Representative.
2. Installer Field Supervision: When any planting work is in progress, installer shall maintain, on site, a full-time supervisor who can communicate in English with the Owner's Representative.
3. Installer's field supervisor shall have a minimum of five years experience as a field supervisor installing plants and trees of the quality and scale of the proposed project, and can communicate in English with the Owner's Representative.
4. The installer's crew shall have a minimum of 3 years experienced in the installation of Planting Soil, Plantings, and Irrigation (where applicable) and interpretation of soil plans, planting plans and irrigation plans.
5. Submit references of past projects, employee training certifications that support that the Contractors meets all of the above installer qualifications and applicable licensures.

1.14 WARRANTY

A. Plant Warranty:

1. The Contractor agrees to replace defective work and defective plants. The Owner's Representative shall make the final determination if plants meet these specifications or that plants are defective.
   Plants warranty shall begin on the date of Substantial Completion Acceptance and continue for the following periods, classed by plant type:
   a. Trees – 1 Year.
   b. Shrubs – 1 Year.
   c. Ground cover and perennial flower plants – 1 Year.
2. When the work is accepted in parts, the warranty periods shall extend from each of the partial Substantial Completion Acceptances to the terminal date of the last warranty period. Thus, all warranty periods for each class of plant warranty, shall terminate at one time.
3. All plants shall be warrantied to meet all the requirements for plant quality at installation in this specification. Defective plants shall be defined as plants not meeting these requirements. The Owner's representative shall make the final determination that plants are defective.
4. Plants determined to be defective shall be removed immediately upon notification by the Owner's Representative and replaced without cost to the Owner, as soon as weather conditions permit and within the specified planting period.
5. Any work required by this specification or the Owner's Representative during the progress of the work, to correct plant defects including the removal of roots or branches, or planting plants that have been bare rooted during installation to observe for or correct root defects shall not be considered as grounds to void any conditions of the warranty. In the event that the Contractor decides that such remediation work may compromise the future health of the plant, the plant or plants in question shall be rejected and replaced with plants that do not contain defects that require remediation or correction.
6. The Contractor is exempt from replacing plants, after Substantial Completion Acceptance and during the warranty period, that are removed by others, lost or damaged due to occupancy of project, lost or damaged by a third party, vandalism, or any natural disaster.
7. Replacements shall match adjacent specimens of the same species. Replacements shall be subject to all requirements stated in this specification. Make all necessary repairs due to plant replacements. Such repairs shall be done at no extra cost to the Owner.
8. The warranty of all replacement plants shall extend for an additional one-year period from the date of their acceptance after replacement. In the event that a replacement plant is not acceptable during or at the end of the said extended warranty period, the Owner's Representative may elect one more replacement items or credit for each item. These tertiary replacement items are not protected under a warranty period.
9. During and by the end of the warranty period, remove all tree wrap, ties, and guying unless agreed to by the Owner's Representative to remain in place. All trees that do not have sufficient caliper to remain upright, or those requiring additional anchorage in windy locations, shall be staked or remain staked, if required by the Owner's Representative.
10. Submit a letter of warranty containing the following:

a. "We hereby guarantee that the landscape planting we have furnished and installed is free from disease and in good condition, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defects in material or workmanship which may develop during the period of one (1) year from acceptance, and also to repair or replace any damage resulting from the repairing or replacing of such defects, at no additional cost to the owner. We shall make such repairs or replacements within a reasonable time, as determined by the owner, after receipt of written notice.
In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from the owner by certified mail, we authorize the owner to proceed to have said repairs or replacements made at our expense, and we will pay the costs and charges therefore, upon demand."

B. End of Warranty Final Acceptance - Acceptance of plants at the end of the warranty period.

1. At the end of the warranty period, the Owner's Representative shall observe all warranted work, upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date for final observation.
2. End of Warranty Final Acceptance will be given only when all the requirements of the work under this specification and in specification sections Planting Soil and Irrigation have been met.

1.15 SELECTION AND OBSERVATION OF PLANTS

A. The Owner's Representative may review all plants subject to approval of size, health, quality, character, etc. Review or approval of any plant during the process of selection, delivery, installation and establishment period shall not prevent that plant from later rejection in the event that the plant quality changes or previously existing defects become apparent that were not observed.

B. Plant Selection: The Owner's Representative reserves the right to select and observe all plants at the nursery prior to delivery and to reject plants that do not meet specifications as set forth in this specification. If a particular defect or substandard element can be corrected at the nursery, as determined by the Owner's Representative, the agreed upon remedy may be applied by the nursery or the Contractor provided that the correction allows the plant to meet the requirements set forth in this specification. Any work to correct plant defects shall be at the contractor's expense.

1. The Owner's Representative may make invasive observation of the plant's root system in the area of the root collar and the top of the root ball in general in order to determine that the plant meets the quality requirements for depth of the root collar and presence of roots above the root collar. Such observations will not harm the plant.
2. Corrections are to be undertaken at the nursery prior to shipping.

C. The Contractor shall bear all cost related to plant corrections.

D. All plants that are rejected shall be immediately removed from the site and acceptable replacement plants provided at no cost to the Owner.

E. Submit to the Owner's Representative, for approval, plant sources including the names and locations of nurseries proposed as sources of acceptable plants, and a list of the plants they will provide. The plant list shall include the botanical and common name and the size at the time of selection. Observe all nursery materials to determine that the materials meet the requirements of this section.

F. Trees shall be purchased from the growing nursery. Re-wholesale plant suppliers shall not be used as sources unless the Contractor can certify that the required trees are not directly available from a growing nursery. When Re-wholesale suppliers are utilized, the Contractor shall submit the name and location of the growing nursery from where the trees were obtained by the re-wholesale seller. The re-wholesale nursery shall be responsible for any required plant quality certifications.

G. The Contractor shall require the grower or re-wholesale supplier to permit the Owner's Representative to observe the root system of all plants at the nursery or job site prior to planting including random removal of soil or substrate around the base of the plant. Observation may be as frequent and as extensive as needed to verify that the plants meet the requirements of the specifications and conform to requirements.

H. Each tree shall have a numbered seal applied by the Contractor. The seal shall be placed on a lateral branch on the north side of the tree. The seal shall be a tamper proof plastic seal bearing the Contractors name and a unique seven-digit number embossed on the seal.

1. Do not place seals on branches that are so large that there is not sufficient room for the branch growth over the period of the warranty.

I. The Owner's Representative may choose to attach their seal to each plant, or a representative sample. Viewing and/or sealing of plants by the Owner's Representative at the nursery does not preclude the Owner's Representative's right to reject material while on site. The Contractor is responsible for paying any up charge for the Owner's Representative to attach their seal to specific plants.

J. Where requested by the Owner's Representative, submit photographs of plants or representative samples of plants. Photographs shall be legible and clearly depict the plant specimen. Each submitted image shall contain a height reference, such as a measuring stick and indicate the date of the photograph. The approval of plants by the Owner's Representative via photograph does not preclude the Owner's Representative's right to reject material while on site.

1.16 PLANT SUBSTITUTIONS FOR PLANTS NOT AVAILABLE

A. Submit all requests for substitutions of plant species, or size to the Owner's Representative, for approval, prior to purchasing the proposed substitution. Request for substitution shall be accompanied with a list of nurseries contacted in the search for the required plant and a record of other attempts to locate the required material. Requests shall also include sources of plants found that may be of a smaller or larger size, or a different shape or habit than specified, or plants of the same genus and species but different cultivar origin, or which may otherwise not meet the requirements of the specifications, but which may be available for substitution.

1.17 INCIDENTAL REPAIRS

A. The landscape contractor shall coordinate repairs of damage to irrigation system incidental to the planting operation by either own forces or by irrigation subcontractor. Above repairs shall be made immediately so as to not interfere with the automatic cycling of the irrigation system. All repairs shall be permanent and include all flushing required to clean the lines of debris deposited by such damage.

B. Incidental damage to work by other subcontractors during landscape installation shall be made immediately and at no extra cost to the owner.

1.18 SITE CONDITIONS

A. It is the responsibility of the Contractor to be aware of all surface and sub-surface conditions, and to notify the Owner's Representative, in writing, of any circumstances that would negatively impact the health of plantings. Do not proceed with work until unsatisfactory conditions have been corrected.

   1. Should subsurface drainage or soil conditions be encountered which would be detrimental to growth or survival of plant material, the Contractor shall notify the Owner's Representative in writing, stating the conditions and submit a proposal covering cost of corrections. If the Contractor fails to notify the Owner's Representative of such conditions, he/she shall remain responsible for plant material under the warranty clause of the specifications.

B. It is the responsibility of the Contractor to be familiar with the local growing conditions, and if any specified plants will be in conflict with these conditions. Report any potential conflicts, in writing, to the Owner's Representative.

C. This specification requires that all Planting Soil and Irrigation (if applicable) work be completed and accepted prior to the installation of any plants.

   1. Planting operations shall not begin until such time that the irrigation system is completely operational for the area(s) to be planted, and the irrigation system for that area has been preliminarily observed and approved by the Owner's Representative.

D. Actual planting shall be performed during those periods when weather and soil conditions are suitable in accordance with locally accepted horticultural practices.

   1. Do not install plants into saturated or frozen soils. Do not install plants during inclement weather, such as rain or snow or during extremely hot, cold or windy conditions.

1.19 PLANTING AROUND UTILITIES

A. Contractor shall carefully examine the civil, record, and survey drawings to become familiar with the existing underground conditions before digging.

B. Determine location of underground utilities and perform work in a manner that will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until

parties concerned mutually agree upon removal.

C. Notification of Local Utility Locator Service is required for all planting areas: The Contractor is responsible for knowing the location and avoiding utilities that are not covered by the Local Utility Locator Service.

PART 2 – PRODUCTS

2.1 PLANTS: GENERAL

A. Standards and measurement: Provide plants of quantity, size, genus, species, and variety or cultivars as shown and scheduled in contract documents.

1. All plants including the root ball dimensions or container size to trunk caliper ratio shall conform to ANSI Z60.1 “American Standard for Nursery Stock” latest edition, unless modified by provisions in this specification. When there is a conflict between this specification and ANSI Z60.1, this specification section shall be considered correct.
2. Plants larger than specified may be used if acceptable to the Owner’s Representative. Use of such plants shall not increase the contract price. If larger plants are accepted the root ball size shall be in accordance with ANSI Z-60.1. Larger plants may not be acceptable if the resulting root ball cannot be fit into the required planting space.
3. If a range of size is given, no plant shall be less than the minimum size and not less than 50 percent of the plants shall be as large as the maximum size specified. The measurements specified are the minimum and maximum size acceptable and are the measurements after pruning, where pruning is required.

B. Proper Identification: All trees shall be true to name as ordered or shown on planting plans and shall be labeled individually or in groups by genus, species, variety and cultivar.

C. Compliance: All trees shall comply with federal and state laws and regulations requiring observation for plant disease, pests, and weeds. Observation certificates required by law shall accompany each shipment of plants.

D. Plant Quality:

1. General: Provide healthy stock, grown in a nursery and reasonably free of die-back, disease, insects, eggs, bores, and larvae. At the time of planting all plants shall have a root system, stem, and branch form that will not restrict normal growth, stability and health for the expected life of the plant
2. Plant quality above the soil line:
   a. Plants shall be healthy with the color, shape, size and distribution of trunk, stems, branches, buds and leaves normal to the plant type specified. Tree quality above the soil line shall comply with the project Crown Acceptance and the following:
      1.) Crown: The form and density of the crown shall be typical for a young specimen of the species or cultivar pruned to a central and dominant leader.
         a.) Crown specifications do not apply to plants that have been specifically trained in the nursery as topiary, espalier, multi-stem, clump, or unique selections such as contorted or weeping cultivars.
      2.) Leaves: The size, color, and appearance of leaves shall be typical for the time of

year and stage of growth of the species or cultivar. Trees shall not show signs of prolonged moisture stress or over watering as indicated by wilted, shriveled, or dead leaves.

3.) Branches: Shoot growth (length and diameter) throughout the crown should be appropriate for the age and size of the species or cultivar. Trees shall not have dead, diseased, broken, distorted, or otherwise injured branches.
   a.) Main branches shall be distributed along the central leader not clustered together. They shall form a balanced crown appropriate for the cultivar/species.
   b.) Branch diameter shall be no larger than two-thirds (one-half is preferred) the diameter of the central leader measured 1 inch above the branch union.
   c.) The attachment of the largest branches (scaffold branches) shall be free of included bark.

4.) Trunk: The tree trunk shall be relatively straight, vertical, and free of wounds that penetrate to the wood (properly made pruning cuts, closed or not, are acceptable and are not considered wounds), sunburned areas, conks (fungal fruiting bodies), wood cracks, sap leakage, signs of boring insects, galls, cankers, girdling ties, or lesions (mechanical injury).

5.) Temporary branches, unless otherwise specified, can be present along the lower trunk below the lowest main (scaffold) branch, particularly for trees less than 1 inch in caliper. These branches should be no greater than 3/8-inch diameter. Clear trunk should be no more than 40% of the total height of the tree.

b. Trees shall have one central leader. If the leader was headed, a new leader (with a live terminal bud) at least one-half the diameter of the pruning cut shall be present.
   1.) All trees are assumed to have one central leader trees unless a different form is specified in the plant list or drawings.

c. All graft unions, where applicable, shall be completely closed without visible sign of graft rejection. All grafts shall be visible above the soil line.

d. Trunk caliper and taper shall be sufficient so that the lower five feet of the trunk remains vertical without a stake. Auxiliary stake may be used to maintain a straight leader in the upper half of the tree.

3. Plant quality at or below the soil line:
   a. Plant roots shall be normal to the plant type specified. Root observations shall take place without impacting tree health. Root quality at or below the soil line shall comply with the project Root Acceptance details and the following:
      1.) The roots shall be reasonably free of scrapes, broken or split wood.
      2.) The root system shall be reasonably free of injury from biotic (e.g., insects and pathogens) and abiotic (e.g., herbicide toxicity and salt injury) agents. Wounds resulting from root pruning used to produce a high quality root system are not considered injuries.
      3.) A minimum of three structural roots reasonably distributed around the trunk (not clustered on one side) shall be found in each plant. Root distribution shall be uniform throughout the root ball, and growth shall be appropriate for the species.
         a.) Plants with structural roots on only one side of the trunk (J roots) shall be rejected.
      4.) The root collar shall be within the upper 2 inches of the substrate/soil. Two

structural roots shall reach the side of the root ball near the top surface of the root ball. The grower may request a modification to this requirement for species with roots that rapidly descend, provided that the grower removes all stem girdling roots above the structural roots across the top of the root ball.

5.) The root system shall be reasonably free of stem girdling roots over the root collar or kinked roots from nursery production practices.
   a.) Plant Grower Certification: The final plant grower shall be responsible to have determined that the plants have been root pruned at each step in the plant production process to remove stem girdling roots and kinked roots, or that the previous production system used practices that produce a root system throughout the root ball that meets these specifications. Regardless of the work of previous growers, the plant's root system shall be modified at the final production stage, if needed, to produce the required plant root quality. The final grower shall certify in writing that all plants are reasonably free of stem girdling and kinked roots as defined in this specification, and that the tree has been grown and harvested to produce a plant that meets these specifications.

6.) At time of observations and delivery, the root ball shall be moist throughout. Roots shall not show signs of excess soil moisture conditions as indicated by stunted, discolored, distorted, or dead roots.

E. Submittals: Submit for approval the required plant quality certifications from the grower where plants are to be purchased, for each plant type. The certification must state that each plant meets all the above plant quality requirements.

1. The grower's certification of plant quality does not prohibit the Owner's Representative from observing any plant or rejecting the plant if it is found to not meet the specification requirements.

2.2 ROOT BALL PACKAGE OPTIONS:

The following root ball packages are permitted. Specific root ball packages shall be required where indicated on the plant list or in this specification. Any type of root ball packages that is not specifically defined in this specification shall not be permitted.

A. BALLED AND BURLAPPED PLANTS

1. All Balled and Burlapped Plants shall be field grown, and the root ball packaged in a burlap and twine and/or burlap and wire basket package.
2. Plants shall be harvested with the following modifications to standard nursery practices.
   a. Prior to digging any tree that fails to meet the requirement for maximum soil and roots above the root collar, carefully removed the soil from the top of the root ball of each plant, using hand tools, water or an air spade, to locate the root collar and attain the soil depth over the structural roots requirements. Remove all stem girdling roots above the root collar. Care must be exercised not to damage the surface of the root collar and the top of the structural roots.
   b. Trees shall be dug for a minimum of 4 weeks and a maximum of 52 weeks prior to shipping. Trees dug 4 to 52 weeks prior to shipping are defined as hardened-off.

Digging is defined as cutting all roots and lifting the tree out of the ground and either moving it to a new location in the nursery or placing it back into the same hole. Tress that are stored out of the ground shall be placed in a holding area protected from extremes of wind and sun with the root ball protected by covering with mulch or straw and irrigated sufficiently to keep moisture in the root ball above wilt point and below saturation

c. If wire baskets are used to support the root ball, a “low profile” basket shall be used. A low profile basket is defined as having the top of the highest loops on the basket no less than 4 inches and no greater than 8 inches below the shoulder of the root ball package.
   1.) At nurseries where sandy soils prevent the use of “low profile baskets”, baskets that support the entire root ball, including the top, are allowable.
d. Twine and burlap used for wrapping the root ball package shall be natural, biodegradable material. If the burlap decomposes after digging the tree then the root ball shall be re-wrapped prior to shipping if roots have not yet grown to keep root ball intact during shipping.

B. SPADE HARVESTED AND TRANSPLANTED

1. Spade Harvested and Transplanted Plants shall meet all the requirements for field grown trees. Root ball diameters shall be of similar size as the ANSI Z60.1 requirements for Balled and Burlapped plants.
2. Trees shall be harvested prior to leafing out (bud break) in the spring or during the fall planting period except for plants know to be considered as fall planting hazards. Plants that are fall planting hazards shall only be harvested prior to leafing out in the spring.
3. Trees shall be moved and planted within 48 hours of the initial harvesting and shall remain in the spade machine until planted.

C. CONTAINER (INCLUDING ABOVE-GROUND FABRIC CONTAINERS AND BOXES) PLANTS

1. Container plants may be permitted only when indicated on the drawing, in this specification, or approved by the Owner’s Representative.
2. Provide plants shall be established and well rooted in removable containers.
3. Container class size shall conform to ANSI Z60.1 for container plants for each size and type of plant.

2.3 ANNUAL FLOWERING AND SEASONAL COLOR PLANTS

A. Container or flat-grown plants should be sized as noted in the planting plan. Plants shall be well-rooted and healthy.

2.4 PLANTING SOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 6 percent organic material content. All topsoil, regardless of source, shall be fertile, friable, natural loam surface soil free of subsoil, clay lumps, brush, weeds, weed seed, litter, roots, stumps, stones larger than one (1) inch in any dimension and any other extraneous or toxic matter harmful to human, animal, or plant life. Contractor shall provide required sample and soil analysis to Landscape

Architect prior to delivery of any soil materials to site.

1. Planting Soil: Existing, in-place surface soil. Verify suitability of existing surface soil to produce viable planting soil. Remove stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix surface soil with the following soil amendments and organic fertilizers- as applicable - in the following quantities to produce planting soil.
   a. Ratio of Loose Compost to Surface Soil by Volume: 1:4
   b. Ratio of Loose Wood Derivatives to Surface Soil by Volume: 1:4
2. Planting Soil: Imported topsoil or manufactured topsoil from off-site sources only after all existing soils for reuse has been consumed. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep and within 100 miles of the project site; soil characteristics need to match the project site; do not obtain from greenfields, agricultural land, bogs, or marshes.
   a. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1 inch (25 mm) or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, pl aster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nut sedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes; grubs; or other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled pore space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.
   b. Mix imported topsoil or manufactured topsoil with the following soil amendments and organic fertilizers in the following quantities to produce planting soil:
      1) Ratio of Loose Compost to Topsoil by Volume: 1:4 or until achieved desired results
      2) Ratio of Loose Wood Derivatives to Topsoil by Volume: 1:4

2.5 PRE-EMERGENCE WEED CONTROL

A. Landscape areas shall be treated with all organic pre-emergent herbicide whenever possible.

B. Organic pre-emergent herbicide shall be Corn Gluten Crumbs available at San Jacinto Environmental Supplies, 2221 A West 34th Street, Houston, TX 77018, 713-957-0909 Corn Gluten Crumbs herbicide shall be applied during spring with an application rates of 20lb/1,000 sq. feet. Contractor may submit alternative organic pre-emergent herbicide for approval.

C. If applying organic pre-emergent herbicide is not feasible, commercial chemical herbicide

may be used with prior approval from landscape architect or owner’s representative. Pre-emergent herbicide shall be Team Pro as manufactured by Bonus Corp Fertilizer, Houston, TX, or approved equal. Apply pre-emergent over all planting areas prior to spreading mulch at the rate of 7 lbs/1000 sq. feet.

D. If necessary, contact herbicide shall be Roundup by Monsanto, 800 N. Lindbergh, St. Louis, MO 63167, 314-694-1000, or approved equal. Apply Roundup only if necessary and if approved by owner or owner's representative. Do not exceed manufacturer's recommended rate of application.

2.6 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur.

C. Iron Sulfate: Granulated ferrous sulfate containing min. of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.7 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings. Organic matter content 50 to 60 percent of dry weight.

B. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

2.8 FERTILIZER

A. Post planting fertilization for shrubs and groundcover.

1. Fertilizer should be 100% organic such as Microlife or approved equal. Application should be applied per manufacturer’s recommendation rate.

2.9 PLANTING ACCESSORIES

A. MULCH

1. Native Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of:

a. Type: Native Aged Double Ground Mulch by Nature's Way Resources, 101 Sherbrook Circle, Conroe, Texas 77385, (936) 321- 6990, www.natureswayresources.com, or approved equal; and as follows:
   1.) From recycled fresh green tree and brush material recently alive.
   2.) biological based mulch.

B. TREE STAKING AND GUYING MATERIAL

1. Below ground anchorage systems product to be GTI Stake (as indicated in drawings), manufactured by Ginger Tree Innovations, P.O. Box 1728, Dripping Springs, Texas 78737, www.gingertreeinnovations.com, or approved equal.
2. Tree guying to be flat woven polypropylene material, 3/4 inch wide, and 900 lb. break strength. Color to be Green. Product to be ArborTie manufactured by Deep Root Partners, L.P. or approved equal.
3. Stakes shall be lodge pole stakes free of knots and of diameters and lengths appropriate to the size of plant as required to adequately support the plant.
4. Below ground anchorage systems to be constructed of 2 x 2 dimensional untreated wood securing (using 3 inch long screws) horizontal portions to 4 feet long vertical stakes driven straight into the ground outside the root ball.
5. Submit manufacturer's product data for approval.

C. TREE ROOT BARRIER

1. Tree root barrier shall be product #UB 24-2 as manufactured by DeepRoot® Green Infrastructure, LLC, 530 Washington Street, San Francisco, CA, www.deeproot.com (800.458.7668), or approved equal.
   a. Root barrier shall be recyclable, black, injection molded panels with 0.80" (2.03 mm) wall thickness in modules 24" (609 mm) long and 24" (609 mm) deep.
   b. Root barrier shall be manufactured with 75% reprocessed polypropylene with added ultraviolet inhibitors.

D. EDGING

1. Plant bed edging shall be product Permaloc Cleanline as manufactured by Permaloc Corporation, Holland MI. (800) 356-9660, (616) 399-9600 or approved equal.

PART 3 – EXECUTION

3.1 SITE EXAMINATION

A. Examine the surface grades and soil conditions to confirm that the requirements of the Specification Section – Planting Soil - and the soil and drainage modifications indicated on the Planting Soil Plan and Details (if applicable) have been completed. Notify the Owner's Representative in writing of any unsatisfactory conditions.

3.2 DELIVERY, STORAGE AND HANDLING

A. Protect materials from deterioration during delivery and storage. Adequately protect plants from drying out, exposure of roots to sun, wind or extremes of heat and cold temperatures.

If planting is delayed more than 24 hours after delivery, set plants in a location protected from sun and wind. Provide adequate water to the root ball package during the shipping and storage period.

1. All plant materials must be available for observation prior to planting.
2. Using a soil moisture meter, periodically check the soil moisture in the root balls of all plants to assure that the plants are being adequately watered. Volumetric soil moisture shall be maintained above wilting point and below field capacity for the root ball substrate or soil.

B. Do not deliver more plants to the site than there is space with adequate storage conditions. Provide a suitable remote staging area for plants and other supplies.

1. The Owner's Representative or Contractor shall approve the duration, method and location of storage of plants.

C. Provide protective covering over all plants during transporting.

3.3 PLANTING SEASON

A. Planting shall only be performed when weather and soil conditions are suitable for planting the materials specified in accordance with locally accepted practice.

B. No Planting shall take place during extremely hot, dry, windy or freezing weather.

3.4 COORDINATION WITH PROJECT WORK

A. The Contractor shall coordinate with all other work that may impact the completion of the work.

B. Prior to the start of work, prepare a detailed schedule of the work for coordination with other trades.

C. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Owner's Representative. When planting trees and shrubs after lawns, protect lawn areas and promptly repair any damage caused by planting operations.

D. Coordinate the relocation of any irrigation lines, heads or the conduits of other utility lines that are in conflict with tree locations. Root balls shall not be altered to fit around lines. Notify the Owner's Representative of any conflicts encountered.

3.5 LAYOUT AND PLANTING SEQUENCE

A. Relative positions of all plants and trees are subject to approval of the Owner's Representative.

B. Notify the Owner's Representative, one (1) week prior to layout. Layout all individual tree and shrub locations. Place plants above surface at planting location or place a labeled stake at planting location. Layout bed lines with paint for the Owner's Representative's approval.

Secure the Owner's Representative's acceptance before digging and start of planting work.

C. When applicable, plant trees before other plants are installed.

D. It is understood that plants are not precise objects and that minor adjustments in the layout will be required as the planting plan is constructed. These adjustments may not be apparent until some or all of the plants are installed. Make adjustments as required by the Owner's Representative including relocating previously installed plants.

3.6 SOIL PROTECTION DURING PLANT DELIVERY AND INSTALLATION

A. Protect soil from compaction during the delivery of plants to the planting locations, digging of planting holes and installing plants.

1. Where possible deliver and plant trees that require the use of heavy mechanized equipment prior to final soil preparation and tilling. Where possible, restrict the driving lanes to one area instead of driving over and compacting a large area of soil.
2. Till to a depth of 6 inches, all soil that has been driven over during the installation of plants.

3.7 SOIL MOISTURE

A. Volumetric soil moisture level, in both the planting soil and the root balls of all plants, prior to, during and after planting shall be above permanent wilting point and below field capacity for each type of soil texture within the following ranges.

Soil type	Permanent wilting point	Field capacity
Sand, Loamy sand, Sandy loam	5-8%	12-18%
Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

1. Volumetric soil moisture shall be measured with a digital moisture meter. The meter shall be the Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent.

B. The Contractor shall confirm the soil moisture levels with a moisture meter. If the moisture is too high, suspend planting operations until the soil moisture drains to below field capacity.

3.8 INSTALLATION OF PLANTS: GENERAL

A. Observe each plant after delivery and prior to installation for damage of other characteristics that may cause rejection of the plant. Notify the Owner's Representative of any condition observed.

B. No more plants shall be distributed about the planting bed area than can be planted and watered on the same day.

C. The root system of each plant, regardless of root ball package type, shall be observed by the Contractor, at the time of planting to confirm that the roots meet the requirements for plant root quality in Part 2 Products: Plants General: Plant Quality. The Contractor shall undertake at the time of planting, all modifications to the root system required by the Owner's Representative to meet these quality standards.

1. Modifications, at the time of planting, to meet the specifications for the depth of the root collar and removal of stem girdling roots and circling roots may make the plant unstable or stress the plant to the point that the Owner's Representative may choose to reject the plant rather than permitting the modification.
2. Any modifications required by the Owner's Representative to make the root system conform to the plant quality standards outlined in Part 2 Products: Plants General: Quality, or other requirements related to the permitted root ball package, shall not be considered as grounds to modify or void the plant warranty.
3. The resulting root ball may need additional staking and water after planting. The Owner's Representative may reject the plant if the root modification process makes the tree unstable or if the tree is not healthy at the end of the warranty period. Such plants shall still be covered under the warranty
4. The Contractor remains responsible to confirm that the grower has made all required root modifications noted during any nursery observations.

D. Container and Boxed Root Ball Shaving: The outer surfaces of ALL plants in containers and boxes, including the top, sides and bottom of the root ball shall be shaved to remove all circling, descending, and matted roots. Shaving shall be performed using saws, knives, sharp shovels or other suitable equipment that is capable of making clean cuts on the roots. Shaving shall remove a minimum of one inch of root mat or up to 2 inches as required to remove all root segments that are not growing reasonably radial to the trunk.

E. Exposed Stem Tissue after Modification: The required root ball modifications may result in stem tissue that has not formed trunk bark being exposed above the soil line. If such condition occurs, wrap the exposed portion of the stem in a protective wrapping with a white filter fabric. Secure the fabric with biodegradable masking tape. DO NOT USE string, twine, green nursery ties or any other material that may girdle the trunk if not removed.

F. Do not excavate tree pits more than 24 hours in advance of planting operation.

G. Excavation of the Planting Space: Using hand tools or tracked mini-excavator, excavate the planting hole into the Planting Soil to the depth of the root ball measured after any root ball modification to correct root problems, and wide enough for working room around the root ball or to the size indicated on the drawing or as noted below.

1. For trees and shrubs planted in soil areas that are NOT tilled or otherwise modified to a depth of at least 12 inches over a distance of more than 10 feet radius from each tree, or 5 feet radius from each shrub, the soil around the root ball shall be loosened as defined below or as indicated on the drawings.
    a. The area of loosening shall be a minimum of 3 times the diameter of the root ball at the surface sloping to 2 times the diameter of the root ball at the depth of the root

ball.

b. Loosening is defined as digging into the soil and turning the soil to reduce the compaction. The soil does not have to be removed from the hole, just dug, lifted and turned. Lifting and turning may be accomplished with a tracked mini excavator, or hand shovels.

2. If an auger is used to dig the initial planting hole, the soil around the auger hole shall be loosened as defined above for trees and shrubs planted in soil areas that are NOT tilled or otherwise modified.
3. The measuring point for root ball depth shall be the average height of the outer edge of the root ball after any required root ball modification.
4. If motorized equipment is used to deliver plants to the planting area over exposed planting beds, or used to loosen the soil or dig the planting holes, all soil that has been driven over shall be tilled to a depth of 6 inches.

H. For trees to be planted in prepared Planting Soil that is deeper than the root ball depth, compact the soil under the root ball using a mechanical tamper to assure a firm bedding for the root ball. If there is more than 12 inches of planting soil under the root ball excavate and tamp the planting soil in lifts not to exceed 12 inches.

I. Set top outer edge of the root ball at the average elevation of the proposed finish. Set the plant plumb and upright in the center of the planting hole. The tree graft, if applicable, shall be visible above the grade. Do not place soil on top of the root ball.

J. The Owner's Representative may request that plants orientation be rotated when planted based on the form of the plant.

K. Backfill the space around the root ball with the same planting soil or existing soil that was excavated for the planting space. See Specification Section Planting Soil, for requirements to modify the soil within the planting bed.

L. Brace root ball by tamping Planting Soil around the lower portion of the root ball. Place additional Planting Soil around base and sides of ball in six-inch (6") lifts. Lightly tamp each lift using foot pressure or hand tools to settle backfill, support the tree and eliminate voids. DO NOT over compact the backfill or use mechanical or pneumatic tamping equipment. Over compaction shall be defined as greater than 85% of maximum dry density, standard proctor or greater than 250 psi as measured by a cone penetrometer when the volumetric soil moisture is lower than field capacity.

1. When the planting hole has been backfilled to three quarters of its depth, water shall be poured around the root ball and allowed to soak into the soil to settle the soil. Do not flood the planting space. If the soil is above field capacity, allow the soil to drain to below field capacity before finishing the planting. Air pockets shall be eliminated and backfill continued until the planting soil is brought to grade level.

M. Where indicated on the drawings, build a 4 inch high, level berm of Planting Soil around the outside of the root ball to retain water. Tamp the berm to reduce leaking and erosion of the saucer.

N. Thoroughly water the Planting Soil and root ball immediately after planting.

O. Remove all nursery plant identification tags and ribbons as per Owner's Representative

instructions. The Owner's Representative's seals are to remain on plants until the end of the warranty period.

P. Remove corrugated cardboard trunk protection after planting.

Q. Follow additional requirements for the permitted root ball packages.

3.9 DRAINAGE, DETRIMENTAL SOILS AND OBSTRUCTIONS

A. Test drainage of plant beds and pits by filling with water twice in succession. Conditions permitting the retention of water in planting beds for more than twenty-four (24) hours or percolation of less than one (1") inch per hour shall be brought to the attention of the Landscape Architect.

B. Notify the landscape architect of all soil or drainage conditions contractor considers detrimental to growth of plant material. (State condition and submit proposal and cost estimate for correcting condition.)

C. If rock, hardpan, underground construction work, tree roots or other obstructions are encountered in the excavation of plant pits and beds, alternate locations may be selected by landscape architect. Where locations cannot be changed, submit cost required to remove the obstructions to a depth of not less than six (6") inches below the required pit or bed depth. Proceed with work after approval.

3.10 PERMITTED ROOT BALL PACKAGES AND SPECIAL PLANTING REQUIREMENTS

A. The following are permitted root ball packages and special planting requirements that shall be followed during the planting process in addition to the above General planting requirements.

B. BALLED AND BURLAPPED PLANTS

1. After the root ball has been backfilled, remove all twine and burlap from the top of the root ball. Cut the burlap away; do not fold down onto the Planting Soil.
2. If the plant is shipped with a wire basket that does not meet the requirements of a "Low Rise" basket, remove the top 6 - 8 inches of the basket wires just before the final backfilling of the tree.
3. Earth root balls shall be kept intact except for any modifications required by the Owner's Representative to make root package comply with the requirement in Part 2 Products.

C. SPADE HARVESTED AND TRANSPLANTED PLANTS

1. After installing the tree, loosen the soil along the seam between the root ball and the surrounding soil out to a radius from the root ball edge equal to the diameter of the root ball to a depth of 8 - 10 inches by hand digging to disturb the soil interface.
2. Fill any gaps below this level with loose soil.

D. CONTAINER (INCLUDES BOXED AND ABOVE-GROUND FABRIC CONTAINERS) PLANTS

1. This specification assumes that most container plants have significant stem girdling and

circling roots, and that the root collar is too low in the root ball.
2. Remove the container.
3. Perform root ball shaving as defined in Installation of Plants: General above.
4. Remove all roots and substrate above the root collar and the main structural roots according to root correction details so root system conforms to root observations detail.
5. Remove all substrate at the bottom of the root ball that does not contain roots.
6. Using a hose, power washer or air excavation device, wash out the substrate from around the trunk and top of the remaining root ball and find and remove all stem girdling roots within the root ball above the top of the structural roots.

3.11 GROUND COVER, PERENNIAL AND ANNUAL PLANTS

A. Assure that soil moisture is within the required levels prior to planting. Irrigation, if required, shall be applied at least 12 hours prior to planting to avoid planting in muddy soils.

B. Assure that soil grades in the beds are smooth and as shown on the plans.

C. Plants shall be planted in even, triangularly spaced rows, at the intervals called out for on the drawings, unless otherwise noted. The first row of Annual flower plants shall be 6 inches from the bed edge unless otherwise directed.

D. Dig planting holes sufficiently large enough to insert the root system without deforming the roots. Set the top of the root system at the grade of the soil.

E. Schedule the planting to occur prior to application of the mulch. If the bed is already mulched, pull the mulch from around the hole and plant into the soil. Do not plant the root system in the mulch. Pull mulch back so it is not on the root ball surface.

F. Press soil to bring the root system in contact with the soil.

G. Spread any excess soil around in the spaces between plants.

H. Apply mulch to the bed being sure not to cover the tops of the plants with or the tops of the root ball with mulch.

I. Water each planting area as soon as the planting is completed. Apply additional water to keep the soil moisture at the required levels. Do not over water.

3.12 STAKING AND GUYING

A. Trees that are guyed shall have their guys and stakes removed after one full growing season or at other times as required by the Owner’s Representative.

B. Tree guying shall utilize the tree staking and guying materials specified. Guying to be tied in such a manner as to create a minimum 12-inch loop to prevent girdling. Refer to manufacturer’s recommendations and the planting detail for installation.

C. Plants shall stand plumb after staking or guying.

D. Stakes shall be driven to sufficient depth to hold the tree rigid.

E. For trees planted in planting mix over waterproofed membrane, use dead men buried 24

inches to the top of the dead man, in the soil. Tie the guy to the dead man with a double wrap of line around the dead man followed by a double half hitch. When guys are removed, leave the dead men in place and cut the guy tape 12 inches above the ground, leaving the tape end covered in mulch.

3.13 STRAIGHTENING PLANTS

A. Maintain all plants in a plumb position throughout the warranty period. Straighten all trees that move out of plumb including those not staked. Plants to be straightened shall be excavated and the root ball moved to a plumb position, and then re-backfilled.

B. Do not straighten plants by pulling the trunk with guys.

3.14 SURFACE DRAINAGE OF PLANTING AREAS

A. Contractor shall bear final responsibility for proper surface drainage of planted areas. Any discrepancy in the drawings or specifications, obstructions on the site, or prior work done by another party, which contractor feels precludes establishing proper drainage, shall be brought to the attention of the landscape architect in writing.

3.15 POST PLANTING FERILIZATION

A. Tree Planting

1. Apply organic fertilizer 30-45 days after installation.
2. Infect material specified in Section 2 with a high pressure injector into soil at the depth and diameter show below.

Tree Caliper	Application Points	Radius	Depth	Application Rate Per Tree
Under 2”	3	4”-6”	16”-18”	1-½
2” – 4”	3	4”-6”	18”-24”	2
4”-5”	4	4”-6”	2’-3’	2-1/2
5”-6”	5	4”-6”	3’-4’	3
Above 6”	3’ o.c.	4”-6”		5 gal./100 sf Root Area (Drip Line)

B. Shrub Beds

1. Apply one application of organic fertilizer for all beds within 30 to 45 days of planting. Application rate per manufacturer's recommendation.

3.16 PRUNING OF TREES AND SHRUBS

A. Prune plants as directed by the Owner’s Representative. Pruning trees shall be limited to addressing structural defects as shown in details; follow recommendations in “Structural Pruning: A Guide For The Green Industry” published by Urban Tree Foundation, Visalia CA.

B. All pruning shall be performed by a person experienced in structural tree pruning.

C. Except for plants specified as multi-stemmed or as otherwise instructed by the Owner's Representative, preserve or create a central leader.

D. Pruning of large trees shall be done using pole pruners or if needed, from a ladder or hydraulic lift to gain access to the top of the tree. Do not climb in newly planted trees. Small trees can be structurally pruned by laying them over before planting. Pruning may also be performed at the nursery prior to shipping.

E. Remove and replace excessively pruned or malformed stock resulting from improper pruning that occurred in the nursery or after.

F. Pruning shall be done with clean, sharp tools.

G. No tree paint or sealants shall be used.

3.17 MULCHING OF PLANTS

A. Apply 2 inches of mulch before settlement, covering the entire planting bed area. Install no more than 1 inch of mulch over the top of the root balls of all plants. Taper to 2 inches when abutting pavement.

B. For trees planted in lawn areas the mulch shall extend to a 5 foot radius around the tree or to the extent indicated on the plans.

C. Lift all leaves, low hanging stems and other green portions of small plants out of the mulch if covered.

3.18 PLANTING BED FINISHING

A. After planting, smooth out all grades between plants before mulching.

B. Separate the edges of planting beds and lawn areas with a smooth, formed edge cut into the turf with the bed mulch level slightly lower, 1 and 2 inches, than the adjacent turf sod or as directed by the Owner's Representative. Bed edge lines shall be a depicted on the drawings.

3.19 WATERING

A. The Contractor shall be fully responsible to ensure that adequate water is provided to all plants from the point of installation until the date of Substantial Completion Acceptance. The Contractor shall adjust the automatic irrigation system, if available, and apply additional or adjust for less water using hoses as required.

B. Hand water root balls of all plants to assure that the root balls have moisture above wilt point and below field capacity. Test the moisture content in each root ball and the soil outside the root ball to determine the water content.

3.20 CLEAN-UP

A. During installation, keep the site free of trash, pavements reasonably clean and work area in an orderly condition at the end of each day. Remove trash and debris in containers from the site no less than once a week.

   1. Immediately clean up any spilled or tracked soil, fuel, oil, trash or debris deposited by the Contractor from all surfaces within the project or on public right of ways and neighboring property.

B. Once installation is complete, wash all soil from pavements and other structures. Ensure that mulch is confined to planting beds and that all tags and flagging tape are removed from the site. The Owner's Representative's seals are to remain on the trees and removed at the end of the warranty period.

C. Make all repairs to grades, ruts, and damage by the plant installer to the work or other work at the site.

D. Remove and dispose of all excess planting soil, subsoil, mulch, plants, packaging, and other material brought to the site by the Contractor.

3.21 PROTECTION DURING CONSTRUCTION

A. The Contractor shall protect planting and related work and other site work from damage due to planting operations, operations by other Contractors or trespassers. Maintain protection during installation until Substantial Completion Acceptance. Treat, repair or replace damaged work immediately.

B. Damage done by the Contractor, or any of their sub-contractors to existing or installed plants, or any other parts of the work or existing features to remain, including roots, trunk or branches of large existing trees, soil, paving, utilities, lighting, irrigation, other finished work and surfaces including those on adjacent property, shall be cleaned, repaired or replaced by the Contractor at no expense to the Owner. The Owner's Representative shall determine when such cleaning, replacement or repair is satisfactory.

3.22 SUBSTANTIAL COMPLETION ACCEPTANCE

A. Upon written notice from the Contractor, the Owners Representative shall review the work and make a determination if the work is substantially complete.

   1. Notification shall be at least 7 days prior to the date the contractor is requesting the review.

B. The date of substantial completion of the planting shall be the date when the Owner's Representative accepts that all work in Planting, Planting Soil, and Irrigation installation sections is complete.

C. The Plant Warranty period begins at date of written notification of substantial completion from the Owner's Representative. The date of substantial completion may be different than the date of substantial completion for the other sections of the project.

3.23 MAINTENANCE BY THE CONTRACTOR

A. The contractor shall begin maintenance after each plant is installed and continue until final acceptance.

B. The contractor's maintenance period shall begin upon inspection and approval at Substantial Completion and shall be for 90 days or to be determined by owner.

C. The contractor's maintenance of new planting shall consist of watering, cultivating, weeding, mulching, re-staking, tightening and repair of guys, resetting plants to proper grades or upright position, and furnishing and applying such pesticide sprays and invigorates as are necessary to keep the plantings free of insects and disease and in thriving condition.

D. Protect planting areas and plants at all times against damage of all kinds for duration of maintenance period. Maintenance includes temporary protection barriers and signs as required for protection. If any plants become damaged or injured, because sufficient protection was not provided, treat or replace as directed by landscape architect at no additional cost to the owner.

3.24 END OF WARRANTY FINAL ACCEPTANCE / MAINTENANCE OBSERVATION

A. At the end of the Warranty and Maintenance period the Owner’s Representative shall observe the work and establish that all provisions of the contract are complete and the work is satisfactory.

1. If the work is satisfactory, the maintenance period will end on the date of the final observation.
2. If the work is deemed unsatisfactory, the maintenance period will continue at no additional expense to the Owner until the work has been completed, observed, and approved by the Owner’s Representative.

B. FAILURE TO PASS OBSERVATION: If the work fails to pass final observation, any subsequent observations must be rescheduled as per above. The cost to the Owner for additional observations will be charged to the Contractor at the prevailing hourly rate of the Owners Representative.

3.25 INSPECTIONS

A. Submit requests for inspections to the landscape architect at least five (5) days prior to anticipated inspection date.

B. It is Contractor’s responsibilities to replace or restore any damaged or disturbed areas during planting operation back to its original condition.

END OF SECTION

FRESNO BOYS & GIRLS CLUB

1031 W SYCAMORE RD
FRESNO, TX 77545

S&C PROJECT NO.: N032023
PROJECT ISSUE DATE: FEBRUARY 29, 2024
TDLR PROJECT #: TABS2024011699

SMITH&COMPANY
ARCHITECTS

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STANLEY SPURLING & HAMILTON INC. — *STRUCTURAL ENGINEER*
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LJA ENGINEERING — *CIVIL ENGINEER*
1904 W Grand Parkway N, Suite 100 Katy, Tx 77449
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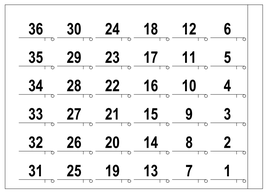
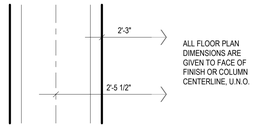


THE NO'S 1 THRU 25 ARE AVAILABLE FOR EACH SHEET AND IF USED ALWAYS APPEAR IN THE LOCATIONS SHOWN. DETAILS MAY BE DRAWN ON ONE OR MULTIPLE MODULES

SHEET FORMAT | NO SCALE | 30



ALL FLOOR PLAN DIMENSIONS ARE GIVEN TO FACE OF FINISH OR COLUMN CENTERLINE, U.N.O.

DIMENSIONING | NO SCALE | 24

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ALL MATERIALS & WORKMANSHIP IN ACCORDANCE W/ ALL APPLICABLE LIFE SAFETY STANDARDS, ORDINANCES & BLDG. COVENANTS & OSHA STANDARDS FOR THIS PROJECT.
2. THE CONTRACTOR SHALL NOTIFY THE ARCHITECT, PRIOR TO THE FINAL BID, OF ANY DISCREPANCIES FOUND IN THESE DOCUMENTS OR CONFLICTS FOUND WITH THE EXISTING SITE CONDITIONS.
3. THE CONTRACTOR SHALL NOTIFY THE ARCHITECT IMMEDIATELY OF ANY DISCREPANCIES IN FIELD CONDITIONS OR DIMENSIONS WHICH ARE NOT RESOLVED BY THESE CONTRACT DOCUMENTS PRIOR TO PROCEEDING W/ THE WORK.
4. THE CONTRACTOR SHALL FIRESTOP, AS REQUIRED BY CODE, ALL NEW PENETRATIONS & ALL ABANDONED PENETRATIONS AS MAY BE GENERATED BY THE WORK IN THIS CONTRACT.
5. THE CONTRACTOR IS RESPONSIBLE FOR CONSTRUCTING WITHIN THE DETERMINED CRITICAL DIMENSIONS. THE CONTR. SHALL VERIFY THE DIMENSIONS OF OWNER PROVIDED ITEMS & ENSURE THESE ITEMS WILL FIT W/ ADEQUATE INSTALLATION & OPERATION CLEARANCES.
6. "ALIGN" AS USED IN THESE DOCUMENTS SHALL MEAN TO ACCURATELY LOCATE FINISHED FACES IN THE SAME PLANE. NEW CONSTRUCTION REQUIRED TO ALIGN W/ EXISTING CONSTRUCTION SHALL BE CONSTRUCTED WITHOUT VISIBLE JOINTS OR SURFACES IRREGULARITIES.
7. "TYP" AS USED IN THESE DOCUMENTS MEANS THAT THE CONDITION OR DIMENSION OR ITEM IS THE SAME OR REPRESENTATIVE FOR SIMILAR CONDITIONS THROUGHOUT, UNLESS NOTED OTHERWISE.
8. PROVIDE FIRE RETARDANT TREATED BLOCKING FOR SUPPORT OF WALL COMPONENTS AS REQUIRED.
9. PROVIDE & COORDINATE THE LOCATION, TYPE, QUANTITY & ARRANGEMENT OF FURRING, NAILERS, BLOCKING, GROUNDS, STUDS, STUD REINFORCEMENT & SIMILAR SUPPORTS SO THAT THE ATTACHED WORK WILL BE ADEQUATELY SUPPORTED & ROUGH CARPENTRY WILL BE PROPERLY LOCATED.
10. ALL WORK BY THE CONTRACTOR SHALL CONFORM TO THE OWNER/CONTRACTOR AGREEMENT. THE PROJECT MANUAL CONTAINS THE GENERAL & SUPPLEMENTARY CONDITIONS, SPECIFICATIONS, DRAWINGS, ADDENDA & SUPPLEMENTAL INSTRUCTIONS ISSUED BY THE ARCHITECT.
11. THE CONTRACTOR SHALL NOT PROCEED W/WORK FOR WHICH ADDITIONAL COMPENSATION IS EXPECTED BEYOND THE CONTRACT AMOUNT, WITHOUT WRITTEN AUTHORIZATION FROM THE OWNER. FAILURE TO OBTAIN SUCH AUTHORIZATION SHALL INVALIDATE ANY SUCH CLAIM FOR EXTRA COMPENSATION.
12. THE CONTRACTOR IS ACCOUNTABLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, PROCEDURES & COORDINATION OF THE WORK PERFORMED BY HIS SUBCONTRACTORS.
13. ALL WORK NOTED "BY OTHERS" OR "N.I.C." IS TO BE ACCOMPLISHED BY A CONTRACTOR OTHER THAN THE GENERAL CONTRACTOR & IS NOT TO BE A PART OF THE CONSTRUCTION AGREEMENT. THE CONTRACTOR IS TO COORDINATE W/ALL "OTHER" CONTRACTORS AS REQUIRED TO COMPLETE THE WORK.
14. THE CONTRACTOR SHALL BID THE ENTIRE SET OF DRAWINGS IN THEIR ENTIRETY. ALL MEP RELATED AND / OR TECHNOLOGY ITEMS MAY NOT BE SHOWN ON THE ARCHITECTURAL DRAWINGS SO COORDINATION BETWEEN CONSTRUCTION TRADES WILL BE REQUIRED.
15. THE ACCURACY OF ORNIGINAL DRAWINGS CAN BE GREATLY REDUCED WHEN COPIES ARE MADE SO THE CONTRACTOR SHALL NOT SCALE OR MEASURE THE DRAWINGS AT ANY TIME. IF A DIMENSION IS NEEDED BUT IS NOT SHOWN
16. THE CONTRACTOR SHALL REPLACE OR REPAIR TO LIKE-NEW CONDITION ALL ITEMS DAMAGED ON THE PREMISES CAUSED BY THE WORK IN THIS CONTRACT.

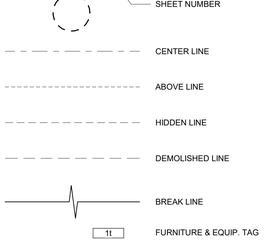
GENERAL NOTES | NO SCALE | 6

A 22,084 S.F. BOYS AND GIRLS CLUB FACILITY TO SERVE THE COMMUNITIES OF TEAL RUN AND ANDOVER FARMS, IN FRESNO TEXAS.

PROJECT DESCRIPTION | NO SCALE | 5

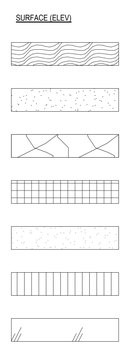
&	AND
L	ANGLE
[	CHANNEL
@	AT
℄	CENTER LINE
ø	DIAMETER OR ROUND
⊥	PERPENDICULAR
#	POUND OR NUMBER
(E)	EXISTING
A.B.S.	ACRYLONITRILE BUTADIENE STYRENE
ABV.	ABOVE
A/C	AIR CONDITIONING
ACOUS.	ACOUSTICAL
A.D.	AREA DRAIN
ADD.	ADDENDUM
A.F.F.	ABOVE FINISH FLOOR
AGG.	AGGREGATE
A.H.U.	AIR HANDLING UNIT
ALLOW.	ALLOWANCE
ALT.	ALTERNATE
ALUM.	ALUMINUM
ANOD.	ANODIZED
APX.	APPROXIMATE
ARCH.	ARCHITECT(URAL)
AUTO.	AUTOMATIC
AUX.	AUXILIARY
AVG.	AVERAGE
BD.	BOARD
BLDG.	BUILDING
BLK.	BLOCK
BLKG.	BLOCKING
BOT.	BOTTOM
CAB.	CABINET
C.B.	CATCH BASIN
CC.TV.	CLOSED-CIRCUIT TELEVISION
CER.	CERAMIC
C.G.	CORNER GUARD
C.H.	COAT HOOK
C.I.	CAST IRON
C.J.	CONTROL JOINT
CLG.	CEILING
CLO.	CLOSET
CLR.	CLEAR
C.M.U.	CONCRETE MASONRY UNIT
COL.	COLUMN
COMP.	COMPONENT
CONC.	CONCRETE
CONST.	CONSTRUCTION
CONT.	CONTINUOUS
CPT.	CARPET
C.R.	CURTAIN ROD
C.S.	CAST STONE
C.T.	CERAMIC TILE
CU.FT.	CUBIC FEET (FOOT)
CU.IN.	CUBIC INCH
CU.YD.	CUBIC YARD
CX.	CONNECTION
DBL.	DOUBLE
DEPT.	DEPARTMENT
DET.	DETAIL
D.F.	DRINKING FOUNTAIN
D.H.	DOUBLE HUNG
DIAG.	DIAGONAL
DIA.	DIAMETER
DIM.	DIMENSION
DIV.	DIVISION
DN.	DOWN
D.O.	DOOR OPENING
DR.	DOOR
DWG.	DRAWING
DWR.	DRAWER
E.	EAST
EA.	EACH
E/A	EXHAUST AIR
E.D.F.	ELECTRICAL DRINKING FOUNTAIN
E.H.D.	ELECTRICAL HAND DRYER
E.J.	EXPANSION JOINT
EL.	ELEVATION
ELEC.	ELECTRIC
ELEV.	ELEVATOR
EMER.	EMERGENCY
ENCL.	ENCLOSURE
EQ.	EQUAL
EQPT.	EQUIPMENT
EXH.	EXHAUST
EXP.	EXPANSION
EXPO.	EXPOSED
EXIST'G	EXISTING
EXT.	EXTERIOR
EW	EACH WAY
EF	EACH FACE
F.A.	FIRE ALARM
F.D.	FLOOR DRAIN
F.D.C.	FIRE DEPARTMENT CONNECTION
F.D.C.C.	FIRE DEPARTMENT CONNECTION CABINET
FDN.	FOUNDATION
F.E.	FIRE EXTINGUISHER
F.E.C.	FIRE EXTINGUISHER CABINET
FEM.	FEMALE
F.H.C.	FIRE HOSE CABINET
F.H.M.S.	FLAT HEAD MACHINE SCREW
F.H.R.	FIRE HOSE RACK
F.H.W.S.	FLAT HEAD WOOD SCREW
F.HY.	FIRE HYDRANT
FIN.	FINISH
FLASH.	FLASHING
FLEX.	FLEXIBLE
FLR.	FLOOR
FLUOR.	FLUORESCENT
F.MIR.	FRAMED MIRROR
F.MIR.SH.	FRAMED MIRROR AND SHELF
F.O.F.	FACE OF FINISH
F.O.S.	FACE OF STUDS
F.S.	FULL SIZE
FT.	FOOT (FEET)
FURR.	FURRED
FUT.	FUTURE
GA.	GAUGE
GALV.	GALVANIZED
G.B.	GRAB BAR
G.I.	GALVANIZED IRON
GL.	GLASS
GYP.	GYPSUM
H.	HIGH
H.B.	HOSE BIB
H.C.	HOLLOW CORE
HDWD.	HARDWOOD
HDWE.	HARDWARE
H.M.	HOLLOW METAL
HORIZ.	HORIZONTAL
H.PT.	HIGH POINT
HR.	HOUR
HT.	HEIGHT
I.D.	INSIDE DIAMETER
IN.	INCH
INCL.	INCLUDE
INSUL.	INSULATION
INT.	INTERIOR
INTM.	INTERMEDIATE
INV.	INVERT
JAN.	JANITOR
JT.	JOINT
KIT.	KITCHEN
K.O.	KNOCK OUT
LAB.	LABORATORY
LAM.	LAMINATE
LAV.	LAVATORY
LB.	POUND
LKR.	LOCKER
L.L.H.	LONG LEG HORIZONTAL
L.L.V.	LONG LEG VERTICAL
L.PT.	LOW POINT
LT.	LIGHT
LTL.	LINTEL
LVL.	LEVEL
LVR.	LOUVER
MAT'L	MATERIAL
MAX.	MAXIMUM
M.B.	MOP BASIN
M.B.H.	MOP-BROOM HOLDER
M.C.	MEDICINE CABINET
MECH.	MECHANICAL
MED.	MEDIUM
MEMB.	MEMBRANE
MET.	METAL
MEZZ.	MEZZANINE
MFR.	MANUFACTURE
MIN.	MINIMUM
MIR.	MIRROR
MISC.	MISCELLANEOUS
MLDG.	MOULDING
MTD.	MOUNTED
MTG.	MOUNTING
MULL.	MULLION
N.	NORTH
N.I.C.	NOT IN CONTRACT
NO.	NUMBER
NOM.	NOMINAL
N.T.S.	NOT TO SCALE
O.A.	OVER ALL
O/A	OUTSIDE AIR
O.C.	ON CENTER
O.D.	OUTSIDE DIAMETER
OFF.	OFFICE
OPNG	OPENING
OPP	OPPOSITE
OPP.H.	OPPOSITE HAND
OZ.	OUNCE
PBD.	PARTICLE BOARD
PL.	PLATE
P.LAM.	PLASTIC LAMINATE
PLAS.	PLASTER
PLYWD.	PLYWOOD
PNL.	PANEL(ING)
POL.	POLISH
PR.	PAIR
P.S.F.	POUNDS PER SQUARE FOOT
P.SH.	PURSE SHELF
PTD.	PAINTED
PT.	POINT
PTN.	PARTITION
Q.T.	QUARRY TILE
QTR.	QUARTER
R.	RISER
R/A	RETURN AIR
RAD.	RADIUS
REF.	REFERENCE
REFR.	REFRIGERATOR
REINF.	REINFORCED
REQ.	REQUIRE(D)
RESIL.	RESILIENT
REV.	REVISE
RM.	ROOM
R.O.	ROUGH OPENING
S.	SOUTH
S/A	SUPPLY AIR
SAM.	SANITARY
S.C.	SOLID CORE
SCHED.	SCHEDULE
S.D.	SOAP DISPENSER
SECT.	SECTION
SH.	SHELF
SHR.	SHOWER
SHT.	SHEET
SIM.	SIMILAR
S.M.D.	SANITARY NAPKIN DISPENSER
S.M.R.	SANITARY NAPKIN RECEPTACLE
S.M.R.	SANITARY NAPKIN-TAMPON DISPENSER
SPECS.	SPECIFICATIONS
SQ.	SQUARE
S.SK.	SERVICE SINK
S.ST.	STAINLESS STEEL
ST.	STEEL
STA.	STATION
STD.	STANDARD
STOR.	STORAGE
STR.	STRUCTURE
SUR.	SURFACE
SUSP.	SUSPENDED
SYM.	SYMMETRICAL
SYS.	SYSTEM
T.	TREAD
T.B.	TOWEL BAR
T.D.	TOWEL DISPENSER
T.D.R.	TOWEL DISPENSER-RECEPTACLE
TEL.	TELEPHONE
TEMP.	TEMPERED
TERR.	TERRAZZO
T&G	TONGUE AND GROOVE
THER.	THERMAL
THK.	THICK(NESS)
THRES.	THRESHOLD
T.T.D.	TOILET TISSUE DISPENSER
TV.	TELEVISION
T.W.	TOP OF WALL
TYP.	TYPICAL
UR.	URINAL
U.N.O.	UNLESS NOTED OTHERWISE
V.C.T.	VINYL COMPOSITION TILE
VERT.	VERTICAL
VEST.	VESTIBULE
V.I.F.	VERIFY IN FIELD
VNR.	VENEER
V.M.C.	VINYL WALL COVERING
W.	WEST
W/	WITH
W.A.U.	WALL ASH URN
W.C.	WALL COVERING
WD.	WOOD
WIN.	WINDOW
W/O	WITHOUT
WP.	WATERPROOF
W.R.	WASTE RECEPTACLE
W/R	WATER RESISTANT
WSCT.	WAINSCOT
WT.	WEIGHT

ABBREVIATIONS | NO SCALE | 25



GRAPHIC SYMBOLS | NO SCALE | 19

SECTION (PLAN)



EARTH
GRANULAR FILL
STRUCTURAL CONCRETE
BRICK
CONCRETE MANSONRY UNIT
STONE
STEEL
ALUMINUM
PLASTER, SAND, MORTAR, GRAUT
EARTH
EARTH
FINISH WOOD
CONTINUOS
BLOCKING
GLASS
GYPSUM WALL BOARD
INSULATION
RIGID INSULATION
ACOUSTICAL TILE OR BOARD

SURFACE (ELEV)

WOOD
MASONRY
STONE
CERAMIC TILE
GYPSUM BOARD/ PLASTER
METAL
GLASS

MATERIALS LEGEND | NO SCALE | 13

SHEET INDEX | NO SCALE | 1

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PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

SYMBOLS, ABBREVIATIONS & GENERAL INFORMATION

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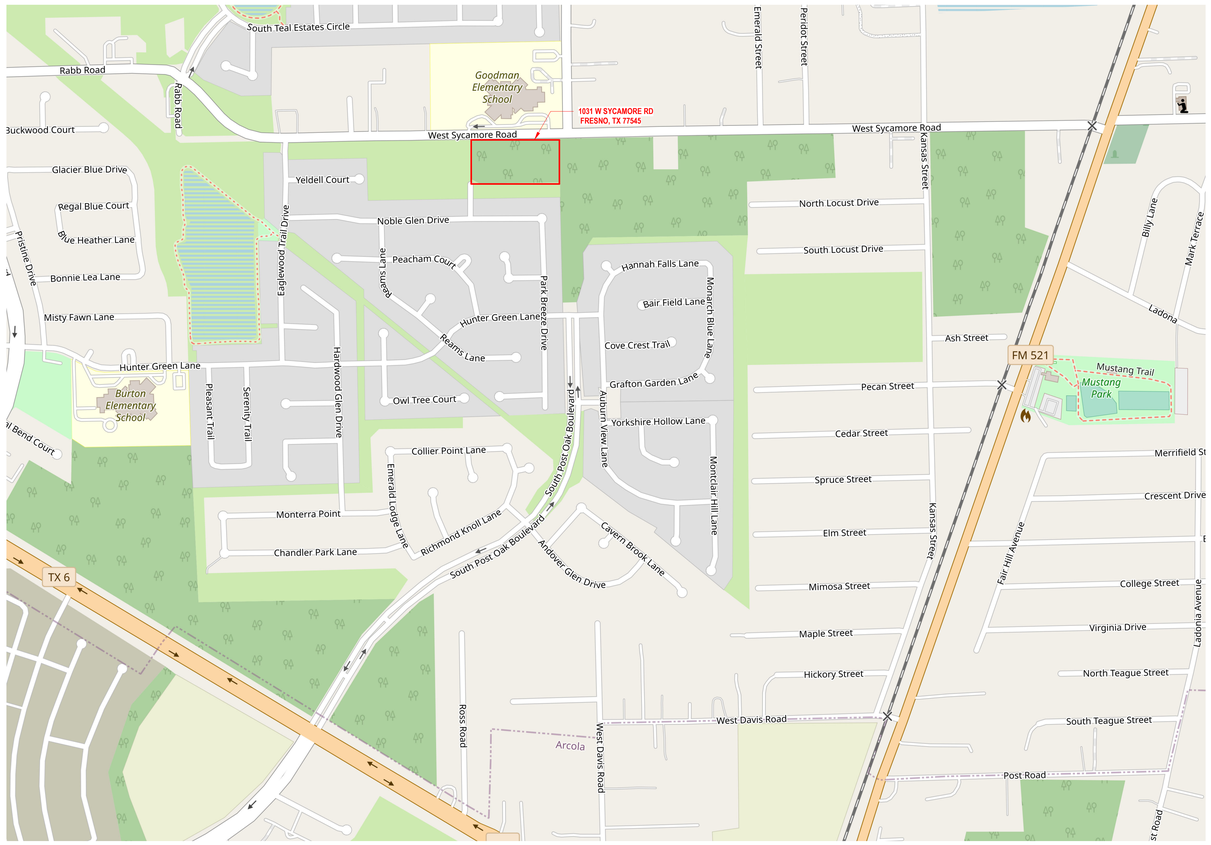

PROJECT LOCATION | NO SCALE | 13

APPLICABLE CODES AND REGULATIONS

INTERNATIONAL BUILDING CODE (IBC):	2021 EDITION
INTERNATIONAL FIRE CODES (IFC):	2021 EDITION
UNIFORM MECHANICAL CODE:	2021 EDITION
UNIFORM PLUMBING CODE:	2021 EDITION
NATIONAL ELECTRIC CODE:	2020 EDITION
TEXAS ACCESSIBILITY STANDARDS:	2012 EDITION

APPLICABLE FORT BEND COUNTY AMENDMENTS

DESIGN CRITERIA

WINDSPEED CRITERIA:	110 MPH EXPOSURE: C IMPORTANCE FACTOR: 1.15
OCCUPANCY CLASSIFICATION:	MIXED OCCUPANCY A-3 PRIMARY OCCUPANCY A-2 / B / E NON-SEPARATED A-2: CAFE A-3: GYM & GAME ROOM B: ADMINISTRATION E: CLASSROOMS
REQUIRED FIRE SEPARATION OF OCCUPANCIES:	A/E/B NO SEPERATION B ACCESORY LESS THAN 10% (TABLE 506.2)
CONSTRUCTION TYPE (TABLE 601):	TYPE IIB, FULLY SPRINKLERED
ALLOWABLE AREA (TABLE 506) INCLUDING EQUATION 5-1:	38,000 SF
ALLOWABLE NO. OF STORIES (TABLE 503):	3
ALLOWABLE HEIGHT (TABLE 504.3)	75' - 0"
MAXIMUM TRAVELD DISTANCE (TABLE 1017.2):	250' - 0"

PROPOSED CONSTRUCTION

SCOPE:	CONSTRUCTION OF A NEW BOYS & GIRLS CLUB FOR THE FORT BEND COUNTY
PROPOSED AREA:	22,084 SF
PROPOSED HEIGHT (TABLE 503):	25' - 0" TO TOP OF ROOF
PROPOSED MAXIMUM TRAVEL DISTANCE:	250' - 0"

FIRE RESISTANCE FOR CONSTRUCTION TYPE IIB (601)

BUILDING ELEMENT	REQUIRED RESISTANCE (HRS)
STRUCTURAL FRAME	0
BEARING WALLS	
EXTERIOR	0
INTERIOR	0
NONBEARING WALLS AND PARTITIONS	
EXTERIOR	0
INTERIOR	0
FLOOR CONSTRUCTION	0
ROOF CONSTRUCTION	0

OCCUPANT LOAD (PER TABLE 1004.1.2)

FUNCTION OF SPACE	OCCUP. LOAD FACTOR	OCC. COUNT	NON-SIMULTANIOUS SPACES
ASSEMBLY (CONCENTRATED) GYM	7 GROSS	958 PEOPLE	0 PEOPLE
BUSINESS (OFFICES) 4 OFFICES CONFERENCE ROOM WARMING KITCHEN	150 GROSS	8 PEOPLE	8 PEOPLE
ASSEMBLY (UNCONCENTRATED) GAME ROOM TEEN ROOM KID'S CAFE	15 NET	159 PEOPLE 71 PEOPLE 50 PEOPLE	159 PEOPLE 71 PEOPLE 0 PEOPLE
STORAGE/MECHANICAL LAUNDRY MECH./ELEC. EQUIPMENT STOR. GYM STOR. STOR. BACKPACK STOR. IT FIRE RISER ROOM MEZZANINE	300 GROSS	9 PEOPLE	0 PEOPLE
EDUCATIONAL (CLASSROOMS) COMPUTER ROOM ART & CRAFTS ROOM LEARNING CENTER LEARNING CENTER	20 NET	20 PEOPLE 35 PEOPLE 42 PEOPLE 39 PEOPLE	20 PEOPLE 35 PEOPLE 42 PEOPLE 39 PEOPLE

REDUCED OCCUPANT LOAD	
TOTAL OCCUPANCY:	TOTAL OCCUPANCY W/O NON-SIMULTANEOUS SPACES:
1,391	387

PLUMBING FIXTURE COUNT PER CHAPTER 29, TABLE 2902.1:

TOTAL OCCUPANTS 387

MALE 194
FEMALE 194

MINIMUM NUMBER OF REQUIRED FIXTURES PER MOST RESTRICTIVE OCCUPANCY CLASSIFICATION - E

REQUIRED FIXTURES	WATER CLOSETS		URINALS	LAVATORIES		DRINKING FOUNTAINS	SERVICE SINK	SHOWERS	OTHER (Health Clinc)	
	MALE	FEMALE		MALE	FEMALE			UNISEX	UNISEX LEV.	UNISEX WC
	3	4	1	4	4	4	1	-	-	-
PROVIDED FIXTURES	3	6	3	4	4	4	1	-	2	2

CODE COMPLIANCE | NO SCALE | 1

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PROJECT #: N032023
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FRESNO, TX 77545

PROJECT LOCATION & CODE COMPLIANCE

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E OCCUPANCY

A-2 OCCUPANCY

A-3 OCCUPANCY

B OCCUPANCY

EGRESS PATH

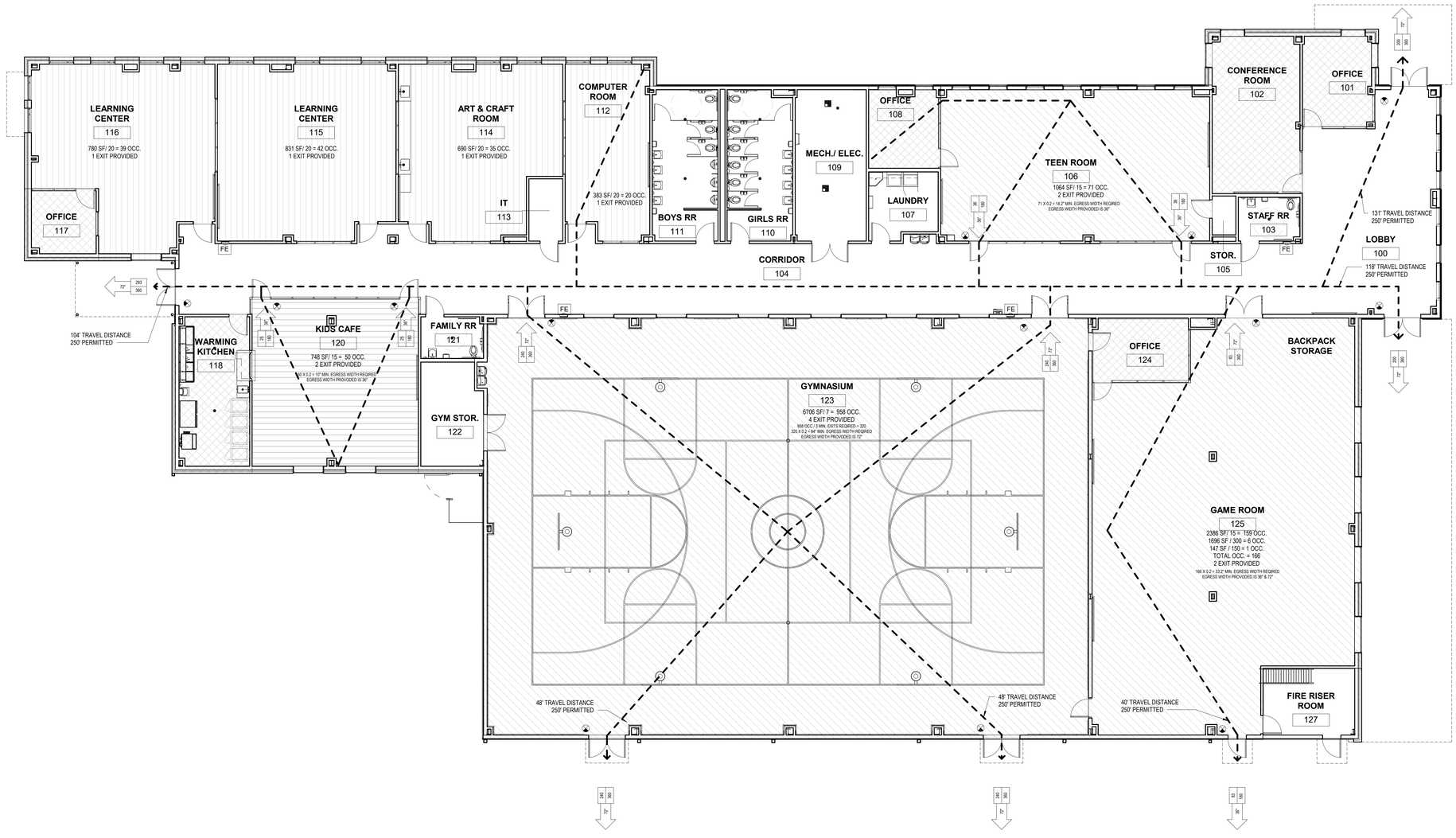
EXIT SIGN, RE: ELEC. DRAWINGS FOR LOCATIONS

FE — FIRE EXTINGUISHER AND CABINET, SEMI-RECESSED AT STUD WALLS

ACTUAL OCCUPANTS
DOOR WIDTH
ALLOWABLE OCCUPANTS
XXX / XXX — DOOR OCCUPANT TAG

EGRESS LEGEND | NO SCALE | 12

CODE ANALYSIS LEGEND | NO SCALE | 6



LIFE SAFETY PLAN | 1/8" = 1'-0" | 1

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LIFE SAFETY PLAN

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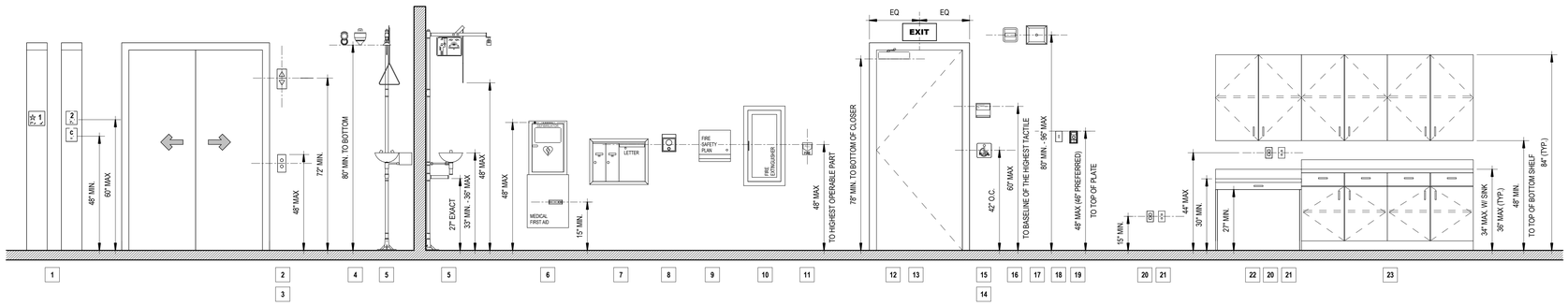
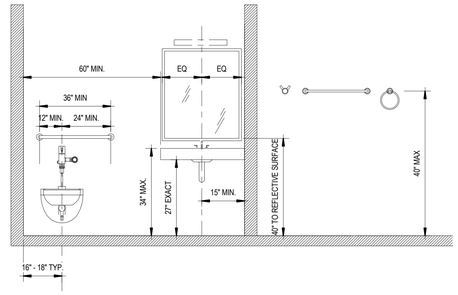
1	ELEVATOR HOISTWAY JAMB ENTRANCE LEVEL SIGNS
2	VISUAL ELEVATOR SIGNAL
3	ELEVATOR CONTROLS
4	WALL MOUNTED SECURITY CAMERA(S)
5	EMERGENCY EYE WASH STATION
6	MEDICAL EQUIPMENT
7	RECESSED MAIL SYSTEM
8	CALL BUTTON(S)
9	FIRE/SAFETY BLANKET
10	FIRE EXTINGUISHER
11	FIRE ALARM PULL
12	DOOR CLOSER
13	ILLUMINATED EGRESS SIGN
14	HANDICAP DOOR PUSH BUTTON
15	ROOM SIGN
16	AUDIO FIRE ALARM
17	AUDIO SPEAKER
18	LIGHT SWITCH
19	THERMOSTAT
20	POWER OUTLET
21	TELEPHONE/DATA OUTLET
22	WORK STATION
23	CASEWORK (UPPER & LOWER)

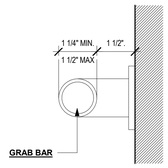
ADA - MOUNTING HEIGHTS LEGEND | NO SCALE | 30



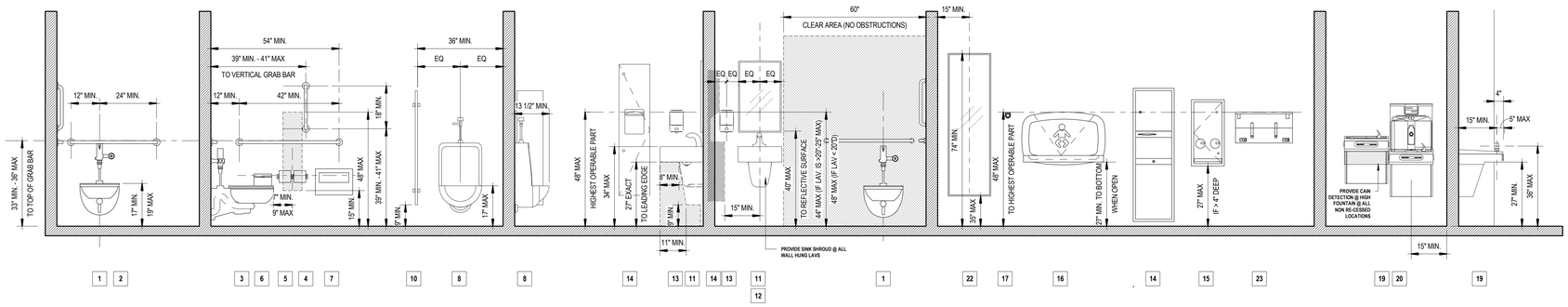
ADA - TYPICAL MOUNTING HEIGHTS | NO SCALE | 10



ADA - RESTROOMS - SINGLE OCCUPANT R.R. | NO SCALE | 14



ADA - GRAB BAR DETAIL | 1/2" = 1'-0" | 9



ADA - RESTROOMS - ADULTS | NO SCALE | 6

1	WATER CLOSET
2	36" REAR GRAB BAR
3	42" SIDE GRAB BAR
4	18" VERTICAL SIDE GRAB BAR
5	TOILET PAPER DISPENSER
6	SANITARY NAPKIN DISPOSAL
7	SEAT COVER DISPENSER
8	URINAL
9	TOILET PARTITION
10	URINAL SCREEN
11	WALL HUNG LAVATORY
12	18 x 30 LAV. MIRROR
13	SOAP DISPENSER
14	SEMI-RECESSED 4"D PAPER TOWEL DISPENSER
15	SANITARY NAPKIN DISPENSER
16	BABY CHANGING STATION
17	COAT HOOK
18	TOWEL BAR
19	DRINKING FOUNTAIN
20	BOTTLE FILLING STATION
21	TOWEL RING
22	FULL LENGTH MIRROR
23	SHELF / MOP & BROOM JANITOR SHELF
24	FOLD-DOWN SHOWER SEAT

LEGEND | NO SCALE | 2

1. FOR ALL NEW WATER CLOSET FIXTURES, FLUSH CONTROLS MUST BE MOUNTED ON WIDE SIDE OF WATER CLOSET / TOILET AREA

ADA - GENERAL NOTES | NO SCALE | 1

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ADA/ARCHITECTURAL BARRIER REMOVAL

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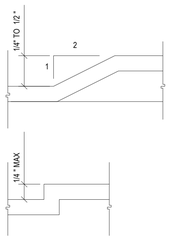
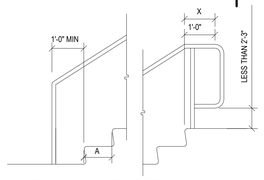


THRESHOLDS NO SCALE 29

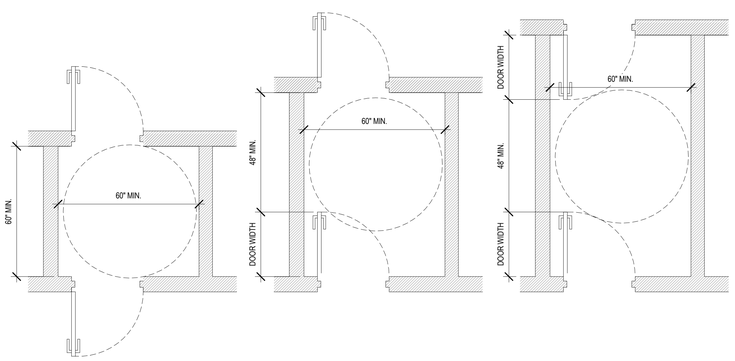


X IS THE 1'-0" MINIMUM HANDRAIL EXTENTION REQUIRED AT EACH TOP RISER

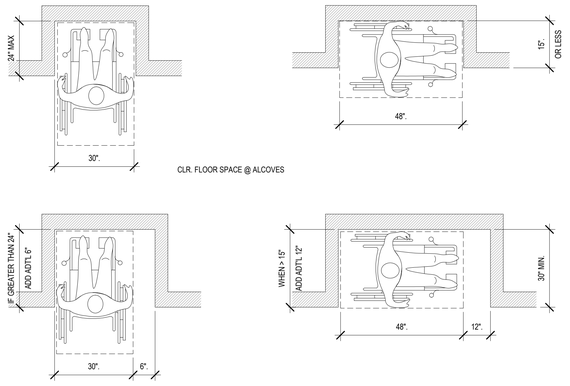
Y IS THE 1'-0" MINIMUM HANDRAIL EXTENSION REQUIRED BEYOND EACH BOTTOM RISER BOTTOM RISER.

PROTRUDING OBJECTS NO SCALE 28

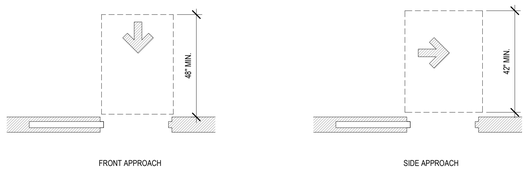
LIMITS OF PROTRUDING OBJECTS NO SCALE 21



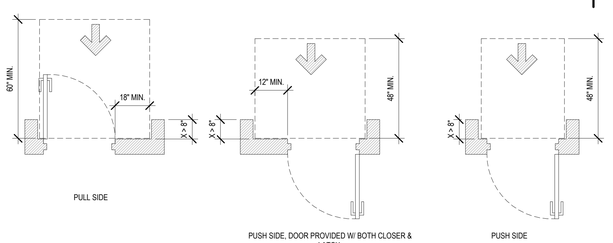
TWO DOORS IN A SERIES NO SCALE 19



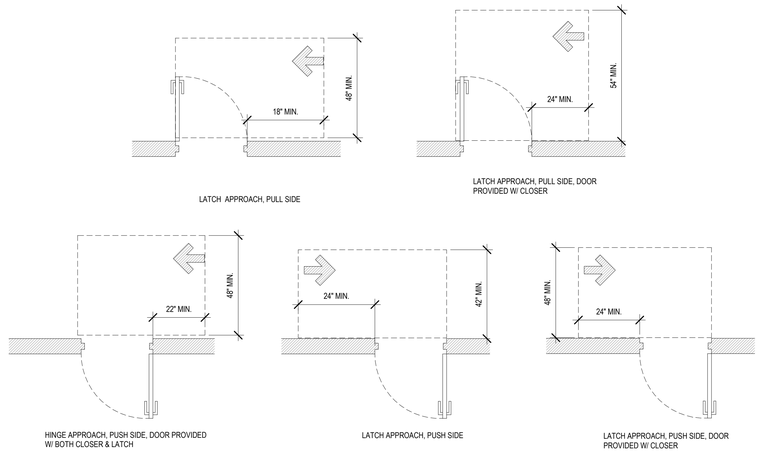
CLEAR FLOOR SPACE @ ALCOVES NO SCALE 16



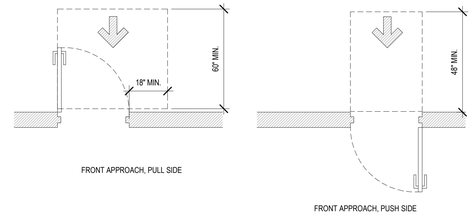
MANEUVERING CLEARANCES AT POCKET DOORS NO SCALE 8



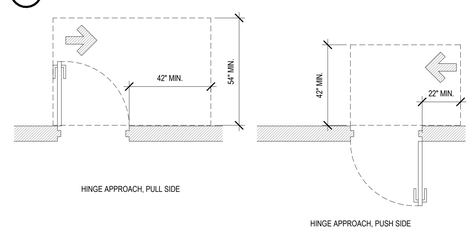
MANEUVERING CLEARANCES AT RECESSED DOORS NO SCALE 7



MANUAL SWING DOOR APPROACHES NO SCALE 4



MANEUVERING CLEARANCES AT MANUAL SWING DOORS NO SCALE 1



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PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

ADA/ARCHITECTURAL BARRIER REMOVAL

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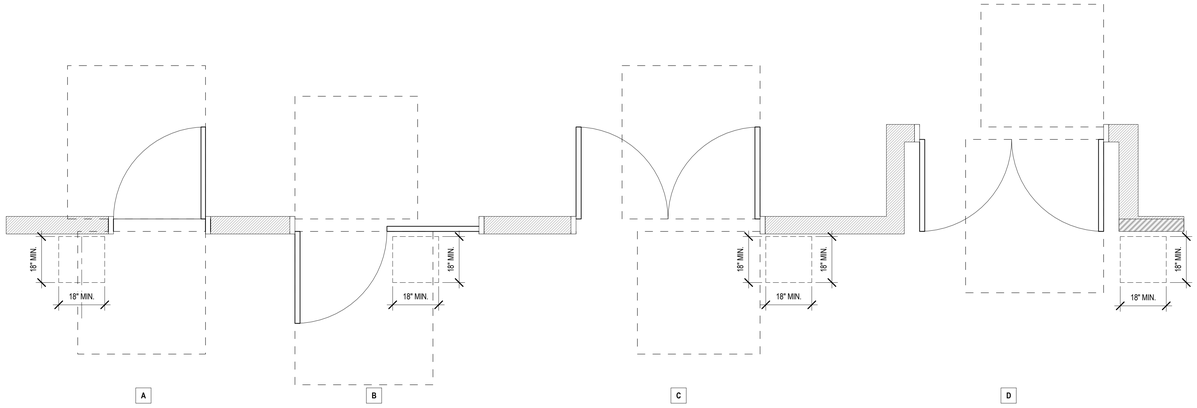
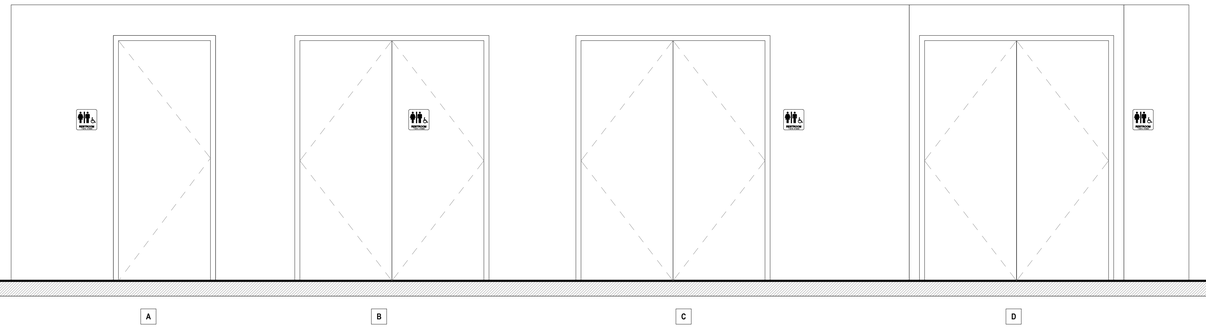




SINGLE DOOR

LOCATION OF SIGNAGE AT LATCH SIDE

DOUBLE DOOR W/ INACTIVE LEAF

LOCATION OF SIGNAGE ON INACTIVE LEAF

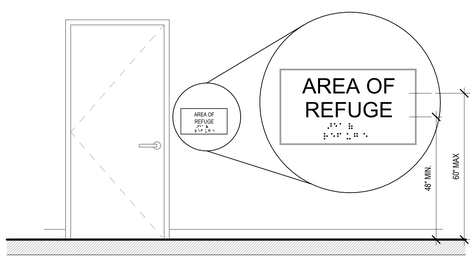
DOUBLE DOOR WITH DOUBLE ACTIVE LEAFS

LOCATION OF SIGNAGE AT RIGHT HAND SIDE OF RIGHT HAND DOOR

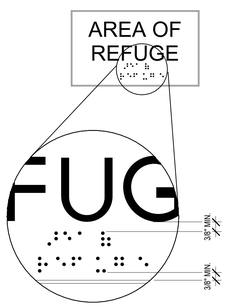
RECESSED DOUBLE DOOR

LOCATION OF SIGNAGE AT NEAREST ADJACENT WALL

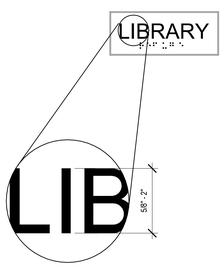
LOCATION OF ROOM SIGNS



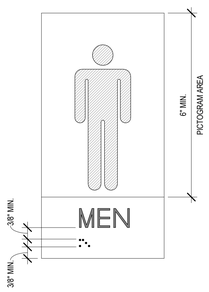
HEIGHT OF TACTILE CHARACTERS ABOVE FINISH FLOOR OR GROUND



BRAILLE DIMENSIONS



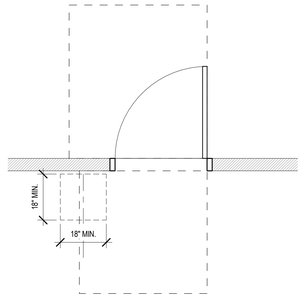
HEIGHT OF RAISED CHARACHTERS



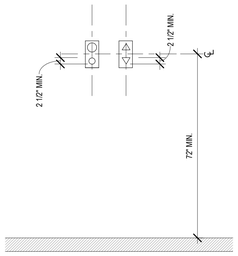
PICTOGRAM FIELD

CHARACHTER SIZE & MOUNTING HEIGHTS

LOCATION & DIMENSIONS | NO SCALE | 6

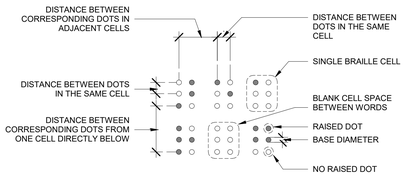


LOCATION OF TACTILE SIGNAGE @ DOOR



VISIBLE HALL SIGNALS

LOCATION OF TACTILE SIGNS | NO SCALE | 3



BRAILLE MEASUREMENT

MEASUREMENT RANGE	MINIMUM (IN INCHES) TO MAXIMUM (IN INCHES)
DOT BASE DIAMETER	0.059 (1.5 MM) TO 0.063 (1.6 MM)
DISTANCE BETWEEN TWO DOTS IN THE SAME CELL	0.090 (2.3 MM) TO 0.100 (2.5 MM)
DISTANCE BETWEEN CORRESPONDING DOTS IN ADJACENT CELLS	0.241 (6.1 MM) TO 0.300 (7.6 MM)
DOT HEIGHT	0.025 (0.6 MM) TO 0.037 (0.9 MM)
DISTANCE BETWEEN CORRESPONDING DOTS FROM ONE CELL DIRECTLY BELOW	0.395 (10 MM) TO 0.400 (10.2 MM)

**** NOTE: BRAILLE SHALL BE POSITIONED BELOW THE CORRESPONDING TEXT. IF TECT IS MULT-LINED, BRAILLE SHALL BE PLACED BELOW THE ENTIRE TEXT. BRAILLE SHALL BE SEPARATED 3/8" MINIMUM FROM ANY OTHER TACTILE CHARACTERS AND 3/6" MMIN. FROM RAISED BORDERS AND DECORATIVE ELEMENTS.**

BRAILLE DIMENSIONS

BRAILLE DIMENSIONS | NO SCALE | 1

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1031 W SYCAMORE RD
FRESNO, TX 77545

ADA/ARCHITECTURAL BARRIER REMOVAL

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CONSTRUCTION

1. FORT BEND COUNTY MUST BE INVITED TO THE PRE-CONSTRUCTION MEETING.
2. CONTRACTOR SHALL NOTIFY FORT BEND COUNTY ENGINEERING DEPARTMENT 48 HOURS PRIOR TO COMMENCING CONSTRUCTION AND 48 HOUR NOTICE TO ANY CONSTRUCTION ACTIVITY WITHIN THE LIMITS OF THE PAVING AT CONSTRUCTION@FBCTX.GOV.
3. CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL PERMITS REQUIRED FROM FORT BEND COUNTY PRIOR TO COMMENCING CONSTRUCTION OF ANY IMPROVEMENTS WITHIN COUNTY ROAD RIGHT OF WAYS.
4. ALL PAVING IMPROVEMENTS SHALL BE CONSTRUCTED IN ACCORDANCE WITH FORT BEND COUNTY "RULES, REGULATIONS AND REQUIREMENTS" RELATING TO THE APPROVAL AND ACCEPTANCE OF IMPROVEMENTS IN SUBDIVISIONS AS CURRENTLY AMENDED.
5. ALL ROAD WIDTHS, CURB RADII AND CURB ALIGNMENT SHOWN INDICATES BACK OF CURB.
6. A CONTINUOUS LONGITUDINAL REINFORCING BAR SHALL BE USED IN THE CURBS.
7. ALL CONCRETE PAVEMENT SHALL BE 5½ SACK CEMENT WITH A MINIMUM COMPRESSIVE STRENGTH OF 3500 PSI AT 28 DAYS. TRANSVERSE EXPANSION JOINTS SHALL BE INSTALLED AT EACH CURB RETURN AND AT A MAXIMUM SPACING OF 60 FEET.
8. ALL WEATHER ACCESS TO ALL EXISTING STREETS AND DRIVEWAYS SHALL BE MAINTAINED AT ALL TIMES.
9. 4" X 12" REINFORCED CONCRETE CURB SHALL BE PLACED IN FRONT OF SINGLE FAMILY LOTS ONLY. ALL OTHER AREAS SHALL BE 6" REINFORCED CONCRETE CURB.
10. CURB HEADERS ARE REQUIRED AT CURB CONNECTIONS TO HANDICAP RAMPS, WITH NO CONSTRUCTION JOINT WITHIN 5' OF RAMPS.
11. GUIDELINES ARE SET FORTH IN THE TEXAS "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES", AS CURRENTLY AMENDED, SHALL BE OBSERVED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ADEQUATE FLAGMEN, SIGNING, STRIPING AND WARNING DEVICES, ETC., DURING CONSTRUCTION - BOTH DAY AND NIGHT.
12. ALL R1-1 STOP SIGNS SHALL BE A MINIMUM OF 36"X36" WITH DIAMOND GRADE SHEETING PER TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.
13. STREET NAME SIGNAGE SHALL BE ON A 9" HIGH SIGN FLAT BLADE W/REFLECTIVE GREEN BACKGROUND. STREET NAMES SHALL BE UPPER AND LOWERCASE LETTERING WITH UPPERCASE LETTERS OF 6" MINIMUM AND LOWERCASE LETTERS OF 4.5" MINIMUM. THE LETTERS SHALL BE REFLECTIVE WHITE. STREET NAME SIGNS SHALL BE MOUNTED ON STOP SIGN POST.
14. A BLUE DOUBLE REFLECTORIZED BUTTON SHALL BE PLACED AT ALL FIRE HYDRANT LOCATIONS. THE BUTTON SHALL BE PLACED 12 INCHES OFF OF THE CENTERLINE OF THE STREET ON THE SAME SIDE AS THE HYDRANT.
15. THE PROJECT AND ALL PARTS THEREOF SHALL BE SUBJECT TO INSPECTION FROM TIME TO TIME BY INSPECTORS DESIGNATED BY FORT BEND COUNTY. NO SUCH INSPECTIONS SHALL RELIEVE THE CONTRACTOR OF ANY OF ITS OBLIGATIONS HEREUNDER. NEITHER FAILURE TO INSPECT NOR FAILURE TO DISCOVER OR REJECT ANY OF THE WORK AS NOT IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS, REQUIREMENTS AND SPECIFICATIONS OF FORT BEND COUNTY OR ANY PROVISION OF THIS PROJECT SHALL BE CONSTRUED TO IMPLY AN ACCEPTANCE OF SUCH WORK OR TO RELIEVE THE CONTRACTOR OF ANY OF ITS OBLIGATIONS HEREUNDER.
16. STABILIZED SUBGRADE: DETERMINE THE THICKNESS OF THE STABILIZED SUBGRADE AFTER CURING AND COMPACTION. IF THE SUBGRADE DEPTH IS GREATER THAN THE PROPOSED THICKNESS BY 20% OR MORE, THE CMT LAB MUST PROVIDE VERIFICATION THE PERCENTAGE OF MATERIAL BEING USED TO STABILIZE THE SUBGRADE MEETS OR EXCEEDS PROJECT REQUIREMENTS. TEST RESULTS REQUIRED.

NOTE: FORT BEND COUNTY NOTES SUPERSEDE ANY CONFLICTING NOTES.

J:\1704\1601\Fort Bend County Standards\Fort Bend County STD\FBC GENERAL NOTES\FORT BEND CO GENERAL NOTES.dwg

NO.	REVISIONS	DATE	NAME
1	ORIGINAL STANDARD ISSUED	2-1-22	RJS

FORT BEND COUNTY
ENGINEERING DEPARTMENT

THE STATE OF TEXAS · FORT BEND COUNTY

PROJECT TITLE:		
DRAWN BY: INIT		FBCED STANDARD
CK'D BY: INIT	SHEET DESCRIPTION: CONSTRUCTION GENERAL NOTES	02
SCALE: NONE		SHEET NO:
DATE: 2-1-22	APPROVED BY:	/

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ARCHITECTS

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PROJECT #: N032023
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REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
031 W SYCAMORE RD
FRESNO, TX 77545

GENERAL NOTES 1 OF 2

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STATE OF TEXAS · AMANDA F. BARBIER · 122357 · LICENSED · PROFESSIONAL ENGINEER
2024-02-28

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GENERAL NOTES

1. WATER LINES AND WASTEWATER COLLECTION SYSTEMS SHALL CONSTRUCTED IN ACCORDANCE WITH THE UNIFORM PLUMBING OR SEPTIC CODE AS APPLICABLE AND THE DETAILS CONTAINED HEREIN.

2. ALL PROPOSED PIPE STUB-OUTS FOR MANHOLES OR INLETS ARE TO BE PLUGGED WITH EIGHT (8) INCH BRICK WALLS UNLESS OTHERWISE NOTED.

3. ADEQUATE DRAINAGE SHALL BE MAINTAINED AT ALL TIMES DURING CONSTRUCTION AND ANY DRAINAGE DITCH OR STRUCTURE DISTURBED DURING CONSTRUCTION SHALL BE RESTORED TO EXISTING CONDITIONS OR BETTER.

4. CONTRACTOR SHALL TAKE NECESSARY PRECAUTIONS TO PROTECT ROOT SYSTEMS OF SHRUBS, PLANTS AND TREES ALONG THE AREA OF EXCAVATION.

5. CONTRACTOR SHALL COMPLY WITH LATEST EDITION OF OSHA REGULATIONS AND THE STATE OF TEXAS LAWS CONCERNING EXCAVATION, TRENCH, AND SHORING.

6. BOUNDARY INFORMATION SUPPLIED BY N/A

7. TOPOGRAPHIC AND ELEVATION SURVEY INFORMATION SUPPLIED BY **CIVIL CORP ENGINEERS AND SURVEYORS.**

8. CONTRACTOR SHALL OBTAIN ALL PERMITS REQUIRED BY ALL GOVERNING AUTHORITIES HAVING JURISDICTION OVER THIS PROJECT PRIOR TO STARTING CONSTRUCTION
(A) CONTRACTOR TO OBTAIN ALL PERMITS REQUIRED BY REGULATION OF FORT BEND COUNTY, TEXAS FOR FLOOD PLAIN MANAGEMENT PRIOR TO STARTING CONSTRUCTION, WHEN APPLICABLE.
(B) CONTRACTOR TO OBTAIN ALL PERMITS REQUIRED BY FORT BEND COUNTY, TEXAS PRIOR TO STARTING UTILITY AND/OR CULVERT CONSTRUCTION IN FORT BEND COUNTY
(C) CONTRACTOR SHALL NOTIFY TxDOT A MINIMUM 72 HRS. PRIOR TO CONSTRUCTING WITHIN TxDOT R.O.W. TO SCHEDULE REQUIRED INSPECTIONS, REFER TO TxDOT DRIVEWAY APPROACH PERMIT FOR DETAILS, WHEN APPLICABLE.

9. NO CONSTRUCTION OR FABRICATION SHALL BEGIN UNTIL THE CONTRACTOR HAS RECEIVED AND THOROUGHLY REVIEWED ALL PLANS AND OTHER DOCUMENTS APPROVED BY ALL OF THE PERMITTING AUTHORITIES.

10. THE CONTRACTOR SHALL VERIFY THE SUITABILITY OF ALL EXISTING AND PROPOSED SITE CONDITIONS INCLUDING GRADES AND DIMENSIONS BEFORE COMMENCEMENT OF CONSTRUCTION. THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES.

11. THE UTILITIES PRESENTED ON THESE DRAWINGS ARE SHOWN BASED ON THE BEST AVAILABLE INFORMATION. CONTRACTOR SHALL VERIFY THE EXACT LOCATIONS IN THE FIELD PRIOR TO COMMENCING CONSTRUCTION. CONTRACTOR SHALL NOTIFY TEXAS ONE CALL AT 713-223-4567/811 OR 800-344-8377 AND LONE STAR NOTIFICATION CENTER AT 800-669-8344 AT LEAST 48 HOURS BEFORE PROCEEDING WITH ANY EXCAVATION. UTILITIES MARKED WITHIN THE PUBLIC RIGHT OF WAY OR IN EASEMENTS SHALL COMPLY WITH TAC TITLE 16, PART 1, CHAPTER 18, RULE §18.6 AND THE AMERICAN PUBLIC WORKS ADMINISTRATION (APWA) UNIFORM COLOR CODE.

12. CONTRACTOR SHALL UNCOVER EXISTING UTILITIES AT ALL PROPOSED "POINTS OF CROSSING" TO DETERMINE IF CONFLICT EXISTS BEFORE COMMENCING ANY CONSTRUCTION. NOTIFY ENGINEER AT 713-953-5054 AT ONCE OF ANY CONFLICTS. THE CONTRACTOR SHALL NOT MAKE ANY FIELD MODIFICATIONS WITHOUT THE PRIOR APPROVAL OF THE ENGINEER. THIS APPROVAL MUST BE OBTAINED BEFORE RESUMING ANY CONSTRUCTION IN THE AFFECTED AREA.

13. THE CONTRACTOR IS RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING UTILITIES DURING THE CONSTRUCTION OF THIS PROJECT.

14. AT LEAST 48 HOURS PRIOR TO EXCAVATING, AND/OR AUGURING IN PUBLIC RIGHT-OF-WAY OR EASEMENTS, CONTRACTOR SHALL NOTIFY "TEXAS ONE-CALL SYSTEM" AT 1-800-245-4545 TO VERIFY DEPTH AND LOCATION OF ALL EXISTING UTILITY LINES.

15. ALL CLEARING, GRUBBING, STRIPPING, EXCAVATION, FILL, COMPACTION, PAVEMENT AND SUBGRADE PREPARATION SHALL BE IN ACCORDANCE WITH THE GEOTECHNICAL REPORT. EARTHWORK FOR ALL BUILDING FOUNDATIONS AND SLABS SHALL BE IN ACCORDANCE WITH THE GEOTECHNICAL RECOMMENDATIONS.

16. DURING CONSTRUCTION, THE OWNER SHALL PROVIDE A QUALIFIED GEOTECHNICAL LAB TO PERFORM MATERIALS TESTING DURING THE CONSTRUCTION.

17. CONTRACTOR IS TO NOTIFY ALL APPLICABLE UTILITY COMPANIES TO VERIFY LOCATION AND DEPTH OF ALL EXISTING UTILITY LINES. ALL EXISTING UTILITIES PRESENTED ON THESE DRAWINGS ARE SHOWN AT THE APPROXIMATE LOCATIONS BASED ON THE BEST AVAILABLE INFORMATION. THE CONTRACTOR SHALL FIELD DETERMINE THE EXACT LOCATIONS PRIOR TO COMMENCING CONSTRUCTION AND SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND MAINTAIN THESE UNDERGROUND UTILITIES.

18. ADEQUATE DRAINAGE SHALL BE MAINTAINED AT ALL TIMES DURING CONSTRUCTION AND ANY DRAINAGE DITCH OR STRUCTURE DISTURBED DURING CONSTRUCTION SHALL BE RESTORED TO THE SATISFACTION OF THE OWNING AUTHORITY.

19. ALL PAVEMENT SHOWN ON THESE PLANS SHALL HAVE 6" CURBING AT EDGES OF PAVEMENT UNLESS OTHERWISE NOTED. WHERE CONCRETE CURB OR WALK IS INDICATED, ELEVATION SHALL BE 6-INCHES ABOVE TOP OF PAVEMENT ELEVATION SHOWN. COORDINATE LOCATIONS WITH ARCHITECTURAL SITE PLAN.

20. THE WORK AREA SHALL BE BARRICADED DURING DARKNESS AND PERIODS OF INACTIVITY WHEN IN AN AREA OF DIRECT PUBLIC ACCESS.

21. CONTRACTOR SHALL PROVIDE SHEETING, SHORING AND BRACING AS NECESSARY TO PROTECT WORKMEN AND EXISTING UTILITIES DURING ALL PHASES OF CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE A TRENCH SAFETY SYSTEM TO MEET APPROPRIATE REQUIREMENTS ESTABLISHED IN OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) SAFETY & HEALTH REGULATIONS, 29 CFR 1926, SUBPART P - EXCAVATIONS, TRENCHING AND SHORING, AND OSHA'S PROPOSED STANDARDS ON TRENCHING, EXCAVATION PUBLISHED IN VOLUME 52, NO. 72 OF THE FEDERAL REGISTER, APRIL 15, 1987, PAGES 12288-12339. SHOULD THE REFERENCED OSHA STANDARDS BE MODIFIED OR AMENDED, THE MORE STRINGENT REQUIREMENTS SHALL APPLY.

22. ALL FINISHED GRADES SHALL VARY UNIFORMLY BETWEEN FINISHED ELEVATIONS SHOWN.

23. CONTRACTOR SHALL PROVIDE AND INSTALL TRAFFIC CONTROL DEVICES, WHEN REQUIRED, IN CONFORMANCE WITH PART VI OF THE "TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" (TEXAS M.U.T.C.D. MOST RECENT EDITION WITH REVISIONS) DURING CONSTRUCTION.

24. OVERHEAD LINES MAY EXIST ON THE PROPERTY. WE HAVE NOT ATTEMPTED TO MARK THOSE LINES SINCE THEY ARE CLEARLY VISIBLE. CONTRACTOR SHALL LOCATE AND IDENTIFY OVERHEAD LINES PRIOR TO BEGINNING ANY CONSTRUCTION. TEXAS LAW, SECTION 752, HEALTH & SAFETY CODE, FORBIDS ALL ACTIVITIES IN WHICH PERSONS OR THINGS MAY COME WITHIN SIX (6) FEET OF LIVE OVERHEAD HIGH VOLTAGE LINES. CONTRACTORS AND OWNERS ARE LEGALLY RESPONSIBLE FOR SAFETY OF CONSTRUCTION WORKERS UNDER THIS LAW. THIS LAW CARRIES BOTH CRIMINAL AND CIVIL LIABILITY. TO ARRANGE FOR LINES TO BE TURNED OFF AND MOVED, CALL CENTERPOINT AT 713-207-7777.

25. ALL EXISTING POWER POLES, LIGHT STANDARDS, SIGNS, TREES, STRUCTURES ETC., WHICH AFFECT THE PROPOSED CONSTRUCTION, SHALL BE REMOVED AND/OR RELOCATED AS REQUIRED WHETHER SHOWN ON DRAWINGS OR NOT.

26. THE FINISHED GRADES SHOWN ON THIS PLAN REPRESENT FINAL ELEVATIONS. CARE SHOULD BE TAKEN BY THE CONTRACTOR NOT TO INCREASE THESE FINISHED GRADES WITH LANDSCAPING OR OTHER ALTERATIONS. THE THICKNESS OF SOD, GRASS AND LANDSCAPING MATERIALS SHOULD BE DEDUCTED FROM THE FINISHED GRADE ELEVATIONS IN THESE PLANS IN ORDER TO DETERMINE THE GROUND ELEVATIONS DURING CONSTRUCTION.

STORM WATER POLLUTION PREVENTION CONSTRUCTION NOTES

1. CONTRACTOR SHALL IMPLEMENT INLET PROTECTION DEVICES AND REINFORCED FILTER FABRIC BARRIER ALONG ROAD SIDE DITCHES AT LOCATIONS SHOWN ON THE TYPICAL STORM WATER POLLUTION PREVENTION (SWPP) PLANS TO KEEP SILT AND/OR EXCAVATED MATERIALS FROM ENTERING INTO THE STORM WATER INLETS AND DITCHES EVENTUALLY POLLUTING THE RECEIVING STORM.

2. DURING EXCAVATION PHASE OF THE PROJECT, CONTRACTOR SHALL SCHEDULE THE WORK IN SHORT SEGMENTS SO THAT EXCAVATED MATERIAL CAN BE QUICKLY HAULED AWAY FROM THE SITE AND TO PREVENT IT FROM STAYING UNCOLLECTED ON THE EXISTING PAVEMENT. ANY LOOSE EXCAVATED MATERIAL WHICH FALLS ON PAVEMENTS OR DRIVEWAYS SHALL BE SWEPT BACK INTO THE EXCAVATED AREA.

3. CONTRACTOR SHALL CLEAN UP THE EXISTING STREET INTERSECTIONS AND DRIVEWAYS DAILY, AS NECESSARY, TO REMOVE ANY EXCESS MUD, SILT OR ROCK TRACKED FROM THE EXCAVATED AREA.

4. CONTRACTOR SHALL FOLLOW GOOD HOUSEKEEPING PRACTICES DURING THE CONSTRUCTION OF THE PROJECT, ALWAYS CLEANING UP DIRT AND LOOSE MATERIALS AS CONSTRUCTION PROGRESSES.

5. CONTRACTOR TO INSPECT AND MAINTAIN THE AREAS LISTED BELOW AT LEAST ONCE EVERY FOURTEEN(14) CALENDAR DAYS AND WITHIN 24 HOURS OF THE END OF A STORM EVENT OF 0.5 INCHES OR GREATER.
- DISTURBED AREAS OF THE CONSTRUCTION SITE THAT HAVE NOT BEEN FINALLY STABILIZED.
- AREAS USED FOR STORAGE OF MATERIALS THAT ARE EXPOSED TO PRECIPITATION.
- STRUCTURAL CONTROL MEASURES.
- LOCATIONS WHERE VEHICLES ENTER OR EXIT THE SITE.

6. CONTRACTOR TO BE RESPONSIBLE TO MAINTAIN EXISTING DITCHES AND/OR CULVERTS FOR UNOBSTRUCTED DRAINAGE AT ALL TIMES. WHERE SODDING IS DISTURBED BY EXCAVATION OR BACKFILLING OPERATIONS, SUCH AREAS SHALL BE REPLACED BY SEEDING OR SODDING. SLOPE 4:1 OR STEEPER SHALL BE REPLACED BY BLOCK SODDING.

STORM SEWER NOTES

1. STORM SEWER CONSTRUCTION SHALL COMMENCE AT THE PROPOSED POINT OF CONNECTION TO THE EXISTING PUBLIC SYSTEM AND PROCEED UPSTREAM.

2. CONTRACTOR TO ALLOW A MINIMUM OF 6-INCHES OF VERTICAL CLEARANCE BETWEEN THE STORM SEWER AND OTHER EXISTING OR PROPOSED UTILITIES.

3. ADJUST EXISTING MANHOLE RIMS TO MATCH NEW GROUND AND/OR NEW PAVEMENT ELEVATIONS. PROPOSED MANHOLES, GRATE INLETS, JUNCTION BOX COVERS, AND CLEANOUTS LOCATED WITHIN PAVED AREAS SHALL BE SET FLUSH WITH PAVEMENT.

4. ALL STORM SEWERS SHALL BE BEDDED AND BACK FILLED IN ACCORDANCE WITH CITY OF HOUSTON REQUIREMENTS OR THE DETAILS CONTAINED IN THESE PLANS.

5. ALL HDPE STORM SEWER PIPE SHALL BE ADS DUAL WALL (SOIL TIGHT) HDPE MEETING AASHTO M294 TYPE S OR APPROVED EQUAL. ALL HDPE WYES, REDUCERS, JOINTS, TEES AND FITTINGS SHALL BE DUAL WALL SOIL TIGHT (ST). ALL RCP STORM SEWER PIPE WHERE INDICATED SHALL CONFORM TO THE REQUIREMENTS OF ASTM C-76 FOR CLASS III WALL THICKNESS WITH RUBBER GASKETS CONFORMING TO ASTM C-443.

6. THE CONTRACTOR SHALL VERIFY ALL EXISTING INVERTS AND RIM ELEVATIONS PRIOR TO CONSTRUCTION.

7. ALL INLETS, MANHOLES, CLEANOUTS, AND JUNCTION BOXES SHALL HAVE A TRAFFIC DUTY GRATE OR COVER UNLESS OTHERWISE NOTED.

WATER NOTES

1. WATER LINES SHALL BE CONSTRUCTED IN ACCORDANCE WITH APPLICABLE REQUIREMENTS OF FORT BEND COUNTY, THE TCEQ, HCMUD 23, THE PROJECT SPECIFICATIONS, AND THE CONSTRUCTION DETAILS OF THIS PLAN SET.

2. WATER LINES HAVING A DIAMETER OF 4" THRU 12" SHALL BE P.V.C. CLASS 235, DR-18, AWWA C-900-07 WITH FITTINGS MEETING AWWA C-900 PVC, DR-14, OR DUCTILE IRON CLASS 50. WATER LINES AND FITTINGS 1" THRU 3" IN DIAMETER SHALL BE CTS CROSS-LINKED POLYETHYLENE TUBING, ATM F876, AWWA C904-06, SDR9. DUCTILE IRON PIPE (D.I.P.) WATER LINES 4" THRU 54" SHALL BE AWWA C151 (ANSI A21.51) AND DOUBLE WRAPPED IN ACCORDANCE WITH ASTM D1785 IN 8-MIL POLYETHYLENE. PIPE SHALL BE LINED IN ACCORDANCE WITH AWWA C104 (ANSI A21.4).

3. CONCRETE THRUST BLOCKS SHALL BE PROVIDED AS NECESSARY TO PREVENT PIPE MOVEMENT FOR ALL TEES, BENDS, AND VALVES, IN ACCORDANCE WITH CITY STANDARDS. IF A CITY STANDARD IS NOT AVAILABLE, USE DETAIL PROVIDED. WHERE THRUST BLOCKING IS NOT POSSIBLE, RESTRAINED JOINTS SHALL BE INSTALLED.

4. ALL WATER LINES UNDER PROPOSED OR FUTURE PAVING AND TO A POINT OF ONE (1) FOOT BACK OF ALL PROPOSED OR FUTURE CURBS SHALL BE ENCASED IN BANK SAND TO 12" OVER PIPE AND BACKFILLED WITH CEMENT STABILIZED SAND TO WITHIN ONE (1) FOOT OF SUBGRADE.

5. ALL WATER VALVES SHALL BE SUPPLIED AND INSTALLED IN ACCORDANCE WITH THE LATEST EDITION OF AWWA C-500 AND SHALL BE OF THE RESILIENT SEAT TYPE.

6. ALL BELOW GRADE VALVES SHALL BE GASKETED, HUB-END GATE VALVES WITH A CAST IRON BOX, EXCEPT WHERE FLANGES ARE CALLED OUT ON THE PLANS.

7. HYDROSTATIC TESTING: ALL WATER PIPE SHALL BE TESTED FOR LEAKAGE IN ACCORDANCE WITH THE LATEST CITY OF HOUSTON STANDARD CONSTRUCTION SPECIFICATIONS. TESTS ARE TO BE PERFORMED ON THE ENTIRE FOOTAGE OF WATER PIPE LINE INCLUDED IN THIS PROJECT.

8. ALL WATER LINES TO HAVE 4' MINIMUM COVER TO FINISHED GRADE AND MINIMUM 12" CLEARANCE TO OTHER UTILITIES AT CROSSING UNLESS OTHERWISE NOTED ON PLANS. ALL WATER LINE INSTALLED OVER 8' DEEP SHALL UTILIZE RESTRAINED JOINT FITTINGS.

9. WATER LINE TO BE CONSTRUCTED TO WITHIN FIVE (5) FEET OF BUILDING BY SITE CONTRACTOR. SEE PLUMBING DRAWINGS FOR CONTINUATION OF SERVICE CONNECTIONS INTO BUILDING.

10. ALL WATER LINES SHALL BE BEDDED AND BACKFILLED AS DETAILED ON THIS DRAWING SET.

11. FOR PRESSURE TAPS, FURNISH, INSTALL AND AIR TEST THE SLEEVE AND VALVE. CONCRETE BLOCKING SHALL BE PLACED BEHIND AND UNDER ALL TAP SLEEVES TWENTY-FOUR (24) HOURS PRIOR TO MAKING THE WET TAP.

12. FURNISH AND INSTALL THE FIRE LINE, DOMESTIC WATER LINE, IRRIGATION LINE AND WASTEWATER COLLECTION SYSTEM AND ALL RELATED APPURTENANCES FROM THE PUBLIC MAIN TO THE BUILDING PAD(S) AS SHOWN ON THE PLANS, INCLUDING BUT NOT LIMITED TO ALL PIPING, FITTINGS, VAULTS, VALVES, METERS, AND MANHOLES REQUIRED.

13. ALL MATERIALS, INSTALLATION, INSPECTION AND TESTING OF WATER METER AND RELATED PIPING AND APPURTENANCES SHALL CONFORM TO UPC STANDARDS, AWWA STANDARDS, TCEQ STANDARDS, AND THE APPLICABLE LOCAL UTILITY COMPANY REGULATIONS. ALL MATERIALS AND INSTALLATIONS REQUIRED FOR FIRE PROTECTION SHALL MEET FACTORY MUTUAL GLOBAL STANDARDS.

14. INSTALLATION OF WATER LINES SHALL BEGIN AT THE TAP TO THE EXISTING OR PUBLIC WATER SYSTEM SHOWN PER THIS PLAN SET AND PROGRESS UPSTREAM. WATER AND WASTEWATER LINES SHALL BE EXTENDED TO SERVICE ENTRANCE INTO BUILDING(S). CONTRACTOR SHALL PROVIDE A WATERTIGHT SLEEVE IN FOUNDATION FOR WATER LINE.

15. TRENCH EXCAVATION SHALL BE PERFORMED AND BACKFILL MATERIAL AND PROCEDURES SHALL BE IN COMPLIANCE WITH THE CITY OF HOUSTON STANDARD SPECIFICATIONS AND/OR THE DETAILS PER THIS PLAN SET. FOR PROJECTS OUTSIDE THE CITY OF HOUSTON'S ETJ, THE TEXAS DEPARTMENT OF TRANSPORTATION 1993 STANDARD SPECIFICATION FOR CONSTRUCTION OF HIGHWAYS, STREETS AND BRIDGES, ITEM 400 - EXCAVATION AND BACKFILL FOR STRUCTURES MAY BE USED IF ENGINEER'S APPROVAL IS OBTAINED.

16. CONTRACTOR SHALL KEEP WATER PIPE CLEAN AND CAP (OR OTHERWISE EFFECTIVELY COVERED) OPEN PIPE ENDS TO EXCLUDE INSECTS, ANIMALS OR OTHER SOURCES OF CONTAMINATION FROM UNFINISHED PIPE LINES AT TIMES WHEN CONSTRUCTION IS NOT IN PROGRESS.

17. CONTRACTOR IS RESPONSIBLE FOR PROVIDING OR COORDINATING TAP AT PUBLIC MAIN AND ALL LINES, FITTINGS, AND APPURTENANCES SHOWN ON PLANS OR REQUIRED BY THE OWNING MUNCIPALITY.

GRADING NOTES

1. BEFORE STARTING CONSTRUCTION, CONTRACTOR SHALL VERIFY BENCHMARK ELEVATION AND NOTIFY ENGINEER IF ANY DISCREPANCY AND/OR CONFLICT IS FOUND.

2. CONTRACTOR SHALL MAINTAIN POSITIVE DRAINAGE AWAY FROM PROPOSED BUILDINGS AND SHALL ENSURE THAT PAVED AREAS SLOPE UNIFORMLY BETWEEN CALLED GRADES. CONTRACTOR SHALL NOTIFY ENGINEER IF ANY GRADING DISCREPANCIES ARE FOUND IN THE EXISTING AND PROPOSED GRADES PRIOR TO PLACEMENT OF PAVEMENT OR UTILITIES.

3. CONTRACTOR SHALL PROTECT ALL MANHOLE COVERS, VALVE COVERS, VAULT LIDS, FIRE HYDRANTS, POWER POLES, GUY WIRES, AND TELEPHONE BOXES THAT ARE TO REMAIN IN-PLACE AND SHALL ENSURE THEY REMAIN UNDISTURBED DURING CONSTRUCTION.

4. ALL EXISTING CONCRETE PAVING, SIDEWALK, AND CURB DEMOLITION DEBRIS SHALL BE REMOVED AND DISPOSED OF BY CONTRACTOR. DISPOSAL SHALL BE AT AN APPROVED OFF-SITE, LAWFUL LOCATION, OR AS DIRECTED BY THE OWNER.

5. CONTRACTOR SHALL ENSURE THAT CONSTRUCTED SLOPES AND ELEVATIONS COMPLY WITH TEXAS DEPARTMENT OF LICENSING AND REGULATION REQUIREMENTS FOR ACCESSIBILITY. GRADES SHOWN HEREON HAVE BEEN CAREFULLY SELECTED TO COMPLY WITH ACCESSIBILITY REQUIREMENTS.

6. THE FINISHED GRADES SHOWN ON THIS PLAN REPRESENT FINAL ELEVATIONS. CARE SHOULD BE TAKEN BY THE CONTRACTOR NOT TO INCREASE THESE FINISHED GRADES WITH LANDSCAPING OR OTHER ALTERATIONS. THE THICKNESS OF SOD, GRASS AND LANDSCAPING MATERIALS SHOULD BE DEDUCTED FROM THE FINISHED GRADE ELEVATIONS IN THESE PLANS IN ORDER TO DETERMINE THE GROUND ELEVATIONS DURING CONSTRUCTION.

7. ALL PROPOSED TOP OF CURB ELEVATIONS SHALL BE 6" ABOVE TOP OF PAVEMENT ELEVATION UNLESS OTHERWISE NOTED.

8. ALL PAVEMENT SHOWN ON THIS PLAN TO HAVE 6" CURBING AT EDGES OF PAVEMENT UNLESS OTHERWISE NOTED.

9. CONTRACTOR SHALL REMOVE TOP 4" OF SOIL COVER FROM PROPOSED AREAS FOR PAVEMENT AND BUILDING. STRIPPED SOIL SHALL BE STOCKPILED OR DISPOSED OF AS DIRECTED BY OWNER.

10. STOCKPILES FOR STRIPPINGS AND FOR SOIL SHALL BE MAINTAINED SEPARATELY AND SHALL CONTAIN NO CONCRETE, LIMBS, PAPER, WOOD, MISCELLANEOUS DEBRIS, OR CONSTRUCTION WASTE IN EITHER STOCKPILE.

11. AREAS INDICATED AS GRADE TO DRAIN SHALL HAVE A MINIMUM SLOPE OF 1% TOWARDS AN INLET OR SWALE.

12. THE GENERAL CONTRACTOR AND ALL SUB CONTRACTORS SHALL VERIFY THE SUITABILITY OF ALL EXISTING AND PROPOSED SITE CONDITIONS INCLUDING GRADES AND DIMENSIONS BEFORE COMMENCEMENT OF CONSTRUCTION. THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY OF ANY DISCREPANCIES. MINOR ADJUSTMENTS TO FINISHED GRADE TO ACCOMPLISH SPOT DRAINAGE IS ACCEPTABLE, IF NECESSARY, WITH PRIOR APPROVAL BY THE ENGINEER. NEW PAVEMENT SHALL MATCH THE SURFACE ELEVATION AND BE FLUSH WITH ANY ABUTTING EXISTING PAVING.

13. ALL PROPOSED CONTOURS WHERE SHOWN ARE APPROXIMATE. PROPOSED SPOT ELEVATIONS AND DESIGNATED SLOPES ARE TO BE USED IN THE EVENT OF ANY DISCREPANCIES.

14. SIDEWALKS ADJACENT TO THE PROPOSED BUILDING SHALL HAVE A CROSS SLOPE OF 2% AWAY FROM THE BUILDING UNLESS INDICATED OTHERWISE ON THE GRADING PLAN.

15. ALL AREAS TO BE FILLED SHALL BE DONE WITH CLEAN SUITABLE MATERIAL COMPACTED IN 8 - INCH LIFTS TO 98% DENSITY AS DETERMINED BY AASHTO T-180 IF GEOTECHNICAL REPORT DOES NOT SPECIFY.

16. ALL FILL MATERIAL PROVIDED SHALL BE IN ACCORDANCE WITH REQUIREMENTS AND RECOMMENDATIONS OUTLINED IN THE GEOTECHNICAL REPORT OR APPROVED IN WRITING BY THE GEOTECHNICAL ENGINEER PRIOR TO PLACING AND COMPACTING.

17. ALL SLOPES STEEPER THAN 3:1 SHALL BE OVERLAID WITH CURLEX BLANKET SYSTEM AND ANCHORED PER MANUFACTURERS RECOMMENDATIONS, OR SHALL BE SODDED IF INDICATED ON GRADING PLAN OR SWPPP.

18. ALL AREAS DISTURBED SHALL BE RESTORED AND GRADED TO DRAIN.

SANITARY SEWER NOTES

1. CONTRACTOR SHALL CONTACT THE PUBLIC UTILITY DISTRICT TO COORDINATE ANY REQUIRED UTILITY INSPECTIONS AND PAY ANY REQUIRED FEES PER UTILITY DISTRICT REQUIREMENTS.

2. ALL MANHOLES ARE TO BE PER CITY OF HOUSTON STANDARD DETAILS DRAWING NUMBERS 02082-01, 02082-02, 02082N-02, 02082-03, AND 02082N-03 UNLESS OTHERWISE NOTED. USE 2010 VERSION AS APPLICABLE.

3. SANITARY SEWER MANHOLES WILL HAVE BEDDING AND BACKFILL PER CITY OF HOUSTON STANDARD DETAILS DRAWING NO. 02317-08 UNLESS OTHERWISE NOTED.

4. SANITARY SEWER PIPE AND FITTINGS 6" AND SMALLER SHALL BE SCHEDULE 40 PVC CONFORMING TO ASTM SPECIFICATION D-1785 AND D-2665. SANITARY SEWER PIPE 8" AND LARGER SHALL BE SDR-26 PVC DWV, OR GREEN C-900 DR-18 PVC. AWWA C-900 DR-18 PVC PIPE USES EITHER AWWA C900 DR-18 PVC FITTINGS OR DIP FITTINGS.

5. ALL SDR-26 PVC PIPE SHALL MEET ASTM SPECIFICATION D3034 AND USE "FULL BODIED" SDR-26 PVC FITTINGS WITH APPROPRIATE ADAPTERS AND SHALL HAVE A CELL CLASSIFICATION OF 12364-B AS DEFINED IN ASTM D-1784 AND SHALL HAVE DIP SIZE OD AND RUBBER GASKET BELL-AND-SPIGOT TYPE JOINT ENDS, UNLESS OTHERWISE NOTED.

8. ALL SANITARY SEWERS SHALL BE BEDDED AND BACK FILLED IN ACCORDANCE WITH FORT BEND COUNTY REQUIREMENTS OR THE DETAILS CONTAINED IN THESE PLANS. ALL SANITARY SEWER LINES UNDER PROPOSED OR FUTURE PAVEMENT AND TO A POINT ONE (1) FOOT BACK OF ALL PROPOSED OR FUTURE CURBS SHALL HAVE BEDDING PER CITY OF HOUSTON STANDARD DETAILS DRAWING NUMBERS 02317-01, 02317-02, OR 02317-03 AS APPLICABLE, WITH 1 ½ SACK CEMENT/CY STABILIZED SAND BACKFILL UP TO THE BOTTOM OF THE PAVEMENT SUBGRADE. 100 PSI PERFORMANCE RESULTS ARE STILL REQUIRED.

9. CONTRACTOR SHALL COORDINATE SANITARY SEWER CONSTRUCTION WITH OTHER UNDERGROUND UTILITIES TO AVOID CONFLICTS.

10. SANITARY SEWER SHALL BE CONSTRUCTED AND TESTED IN ACCORDANCE WITH UTILITY DISTRICT REQUIREMENTS.

11. SANITARY SEWER MANHOLE RIMS OUTSIDE OF PROPOSED PAVING WILL BE SET 3" - 6" ABOVE THE SURROUNDING LEVEL FINISHED GRADE AFTER PAVING WITH SLOPED BACKFILL IS ADDED FOR STORM WATER TO DRAIN AWAY FROM MANHOLE RIM.

12. IN WET STABLE TRENCH AREAS USE BEDDING PER CITY OF HOUSTON STANDARD DETAILS DRAWING NUMBER 02317-02 (2002).

13. SANITARY SEWER TO BE CONSTRUCTED WITHIN FIVE(5) FEET OF BUILDING BY SITE CONTRACTOR. SEE PLUMBING DRAWINGS FOR CONTINUATION OF SERVICE CONNECTIONS INTO BUILDING.

14. "SAN. S. E." INDICATES "SANITARY SEWER EASEMENT"

15. FOR SANITARY MANHOLE (MH) RIMS SET INSIDE OF OR @ CURB & GUTTER PAVEMENT AND/OR BELOW T.C., MH RIMS WILL BE SET FLUSHED WITH AN ABUTTING PAVED SURFACE. THE (VULCAN, NEENAH OR EQUAL) HEAVY DUTY BOLTED SOLID MH COVER SHALL BE PROPERLY (AND SECURELY) ATTACHED AND SEALED TO ITS COMPATIBLE GASKETED FRAME BY USING BOTH A NEOPRENE GASKET AND (AT LEAST) 4 COUNTER-SUNK HEX-HEAD COARSE THREADED ½"-13 UNC STAINLESS STEEL BOLTS. THE HEAVY DUTY FRAME MH COVER SHALL BE SOLID (NO AIR HOLES). SAID FRAME SHALL BE BOTH EMBEDDED INTO THE MH'S TOP ALSO SECURELY ANCHORED TO THE UNDERLYING MH STRUCTURE WITH EITHER SECURELY ATTACHED EMBEDDED ANCHOR BOLTS OR THE CONCRETE MH'S EXPOSED REBARS WELDED TO THE FRAME OR OTHER EQUALLY SECURED METHODS TO PREVENT MH COVER/FRAME BLOW-OFFS/EJECTIONS.

16. USE THE SAME TYPE OF SEWER PIPE [OR PIPE JOINT ENDS] FROM MANHOLE TO MANHOLE WITH NO PIPE TYPE {OR THEIR JOINT ENDS} CHANGE IN BETWEEN EACH SEPARATE PAIR OF MANHOLES. IDENTICAL DIP-SIZED SEWER PIPE BELL & SPIGOT ENDS ARE REQUIRED FOR ALL SEWER PIPE USED FROM MANHOLE TO MANHOLE WHEREVER GREEN C-900 (DR-18) PVC PIPE OR POLYETHYLENE-ENCASED DIP SECTIONS (18'-20'(+)) ARE USED FOR WATER LINE CROSSING(S) AND/OR SEWER AUGERING AND/OR JACKING AND/OR SHALLOW BURIAL.

17. SANITARY SEWER CONSTRUCTION SHALL COMMENCE AT THE PROPOSED POINT OF CONNECTION TO THE EXISTING OR PUBLIC SANITARY SEWER SYSTEM AND PROCEED UPSTREAM.

18. ADJUST EXISTING SANITARY SEWER MANHOLE RIMS TO MATCH PROPOSED PAVEMENT ELEVATIONS SO THAT MANHOLE RIM IS SET FLUSH WITH PAVEMENT.

19. THE CONTRACTOR SHALL VERIFY ALL EXISTING INVERTS AND RIM ELEVATIONS PRIOR TO CONSTRUCTION.

20. ALL CLEANOUTS SHALL HAVE A TRAFFIC-DUTY/TRAFFIC-RATED COVER UNLESS OTHERWISE NOTED.

PAVING AND STRIPING NOTES

1. CONTRACTORS SHOULD REVIEW GEOTECHNICAL ENGINEERING REPORT PREPARED BY ____________, PROJECT NUMBER ___________, DATED ___________ . CONTRACTOR MUST ADHERE TO RECOMMENDATIONS THEREIN FOR MATERIALS AND PRACTICE OF INSTALLATION, AND SHALL VERIFY DETAILS SHOWN HERE ARE CURRENT AND HAVE NOT BEEN MODIFIED. CONTRACTOR MUST RECEIVE WRITTEN CONFIRMATION FOR GEOTECHNICAL CONSULTANT PRIOR TO INSTALLATION.

2. ALL SIGNS, PAVEMENT MARKINGS, AND OTHER TRAFFIC CONTROL DEVICES SHALL CONFORM TO THE "TEXAS" MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" (M.U.T.C.D.) AND CITY OR COUNTY STANDARDS AS APPLICABLE.

3. CONTRACTOR SHALL FURNISH ALL PAVEMENT MARKINGS FOR FIRE LANES, ROADWAY LANES, PARKING STALLS, HANDICAPPED PARKING SYMBOLS, ACCESS AISLES, STOP BARS AND SIGNS, AND MISCELLANEOUS STRIPING WITHIN PARKING LOTS AS SHOWN ON THE PLANS.

4. ALL JOINTS SHALL EXTEND THROUGH THE CURB.

5. THE MINIMUM LENGTH OF OFFSET JOINTS AT RADIUS POINTS SHALL BE 2 FEET.

6. ALL JOINTS, INCLUDING EXPANSION JOINTS WITH REMOVABLE TACK STRIPS, SHALL BE SEALED WITH JOINT SEALANT.

7. THE MATERIALS AND PROPERTIES OF ALL CONCRETE SHALL MEET THE APPLICABLE REQUIREMENTS IN THE A.C.I. (AMERICAN CONCRETE INSTITUTE) MANUAL OF CONCRETE PRACTICE.

8. CONTRACTOR SHALL APPLY A SECOND COATING OVER ALL PAVEMENT MARKINGS PRIOR TO ACCEPTANCE BY OWNER.

9. ANY EXISTING PAVEMENT, CURBS AND/OR SIDEWALKS DAMAGED OR REMOVED WILL BE REPAIRED BY THE CONTRACTOR AT HIS EXPENSE TO THE SATISFACTION OF THE ENGINEER AND OWNER.

10. DO NOT UNLOAD OR USE ANY HEAVY CONSTRUCTION EQUIPMENT ON NEW CONCRETE FOR AT LEAST 7 DAYS AFTER CONCRETE IS POURED.

11. CONTRACTOR IS RESPONSIBLE FOR COORDINATING WORK SUCH THAT UTILITIES ARE INSTALLED PRIOR TO PAVEMENT BASE BEING INSTALLED.

12. ALL CONCRETE PAVING AND FLATWORK SHALL BE CURED IN CONFORMANCE WITH AMERICAN CONCRETE INSTITUTE GUIDELINES.

13. NO VEHICULAR TRAFFIC IS ALLOWED ON CONCRETE REINFORCEMENT UNTIL PAVEMENT IS POURED AND CURED.

14. CONTRACTOR IS RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH THE TEMPORARY CLOSURE OF ANY PUBLIC ROADWAY TO FACILITATE CONSTRUCTION OF NEW PARCEL DRIVEWAY/CURBCUT, INCLUDING BUT NOT LIMITED TO: PERMITTING, TEMPORARY TRAFFIC SIGNS, TRAFFIC BLOCKAGE, COORDINATION/APPROVAL FROM LOCAL TRAFFIC ENGINEER, ETC.

15. CONTRACTOR SHALL VERIFY THAT PROPOSED PAVEMENT WILL MEET ADA, TDLR/TAS REQUIREMENTS PRIOR TO POURING BY ASSESSING SLOPES OF FORM WORK.

16. EXISTING MANHOLES IN AREAS OF PROPOSED PAVEMENT SHALL BE ADJUSTED SO THAT MANHOLE RIM ELEVATION MATCHES PROPOSED PAVEMENT ELEVATION.

ACCESSIBILITY NOTES

1. CONTRACTOR SHALL ENSURE THAT CONSTRUCTED SLOPES AND ELEVATIONS COMPLY WITH TEXAS DEPARTMENT OF LICENSING AND REGULATION (TDLR) REQUIREMENTS FOR ACCESSIBILITY. GRADES SHOWN HEREON HAVE BEEN CAREFULLY SELECTED TO COMPLY WITH TEXAS ACCESSIBILITY STANDARDS.

2. ALL ACCESSIBLE SPACES AND ACCESSIBLE ROUTES SHALL COMPLY WITH THE TEXAS ACCESSIBILITY STANDARDS (T.A.S.) AND CITY REQUIREMENTS.

3. ACCESSIBLE ROUTES SHALL HAVE A MAXIMUM CROSS SLOPE OF 2%.

4. ACCESSIBLE ROUTES MAY HAVE LONGITUDINAL SLOPES UP TO 5% (SEE NOTE 8 FOR SLOPES GREATER THAN 5%)

5. WHERE AN ACCESSIBLE ROUTE CHANGES DIRECTION AND AT ALL POINTS OF BUILDING EGRESS, A 5'x5' MINIMUM LANDING SHALL BE PROVIDED WITH MAXIMUM 2% SLOPE IN ANY DIRECTION.

6. TOP OF WALK OR TOP OF LANDING ELEVATIONS AT BUILDING ENTRANCES/EXITS SHALL BE A MAXIMUM OF 1/4" BELOW FINISHED FLOOR ELEVATION.

7. PARKING SPACES AND ACCESS AISLES SHALL BE LEVEL WITH SURFACE SLOPES NOT EXCEEDING 1:50 (2%) IN ALL DIRECTIONS. CURB RAMPS COMPLYING WITH T.A.S. SECTION 405 SHALL BE PROVIDED AT ALL PASSENGER LOADING ZONES.

8. ALL ACCESSIBLE RAMPS SHALL BE MAXIMUM 1 VERTICAL UNIT FOR EVERY 12 HORIZONTAL UNITS (8.33%). ALL RAMPS MUST HAVE 5'x5' LANDING WITH MAXIMUM 2% SLOPE AT THE TOP AND BOTTOM. RAMP RUNS RISING MORE THAN 6 INCHES VERTICALLY REQUIRE HANDRAILS.

9. SLOPES OF CURB RAMPS SHALL COMPLY WITH T.A.S. SECTION 405.2. TRANSITIONS FROM RAMPS TO WALKS, GUTTERS, OR STREETS SHALL BE FLUSH AND FREE OF ABRUPT CHANGES. MAXIMUM SLOPES OF ADJOINING GUTTERS, ROAD SURFACE IMMEDIATELY ADJACENT TO THE CURB RAMP, OR ACCESSIBLE ROUTE SHALL NOT EXCEED 1:20.

AT&T TEXAS/SWBT FACILITIES

1. THE LOCATIONS OF AT&T TEXAS/SWBT FACILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION BEFORE COMMENCING WORK. HE AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THIS FAILURE TO EXACTLY LOCATE AND PRESERVE THESE UNDERGROUND UTILITIES.

2. THE CONTRACTOR SHALL CALL 1-800-344-8377 A MINIMUM OF 48 HOURS PRIOR TO CONSTRUCTION TO HAVE UNDERGROUND LINES FIELD LOCATED.

3. WHEN EXCAVATING WITHIN EIGHTEEN INCHES (18") OF THE INDICATED LOCATION OF AT&T TEXAS/SWBT FACILITIES, ALL EXCAVATIONS MUST BE ACCOMPLISHED USING NON-MECHANIZED EXCAVATION PROCEDURES. WHEN BORING, THE CONTRACTOR SHALL EXPOSE THE AT&T TEXAS/SWBT FACILITIES.

4. WHEN AT&T TEXAS/SWBT FACILITIES ARE EXPOSED, THE CONTRACTOR WILL PROVIDE SUPPORT TO PREVENT DAMAGE TO THE CONDUIT DUCTS OR CABLES. WHEN EXCAVATING NEAR TELEPHONE POLES THE CONTRACTOR SHALL BRACE THE POLE FOR SUPPORT.

5. THE PRESENCE OR ABSENCE OF AT&T TEXAS/SWBT UNDERGROUND CONDUIT FACILITIES OR BURIED CABLE FACILITIES SHOWN ON THESE PLAN DOES NOT MEAN THAT THERE ARE NO DIRECT BURIED CABLES OR OTHER CABLES IN CONDUIT IN THE AREA.

6. PLEASE CONTACT THE AT&T TEXAS DAMAGE PREVENTION MANAGER MR. ROOSEVELT LEE JR. AT (713)567-4552 OR E-MAIL HIM AT RL7259@ATT.COM, IF THERE ARE QUESTIONS ABOUT BORING OR EXCAVATING NEAR OUR AT&T TEXAS/SWBT FACILITIES.

CAUTION: UNDERGROUND GAS FACILITIES

THE CONTRACTOR SHALL CONTACT THE UTILITY COORDINATING COMMITTEE AT 1-800-545-6005 OR 811 A MINIMUM OF 48 HOURS PRIOR TO CONSTRUCTION TO HAVE MAIN AND SERVICE LINES FIELD LOCATED.
- WHEN CENTERPOINT ENERGY PIPE LINE MARKINGS ARE NOT VISIBLE, CALL (713) 207-5463 OR (713- 945-8037 (7:00 A.M. TO 4:30 P.M.) FOR STATUS OF LINE LOCATION REQUEST BEFORE EXCAVATION BEGINS.
- WHEN EXCAVATING WITHIN EIGHTEEN INCHES (18") OF THE INDICATED LOCATION OF CENTERPOINT ENERGY FACILITIES, ALL EXCAVATION MUST BE ACCOMPLISHED USING NON-MECHANIZEDEXCAVATION PROCEDURES.
- WHEN CENTERPOINT ENERGY FACILITIES ARE EXPOSED, SUFFICIENT SUPPORT MUST BE PROVIDED TO THE FACILITIES TO PREVENT EXCESSIVE STRESS ON THE PIPING.
- FOR EMERGENCIES REGARDING GAS LINES CALL (713) 659-3552 OR (713) 207-4200. THE CONTRACTOR IS FULLY RESPONSIBLE FOR ANY DAMAGES CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE THESE UNDERGROUND FACILITIES.

CAUTION: OVERHEAD ELECTRICAL LINES

OVERHEAD LINES MAY EXIST ON THE PROPERTY. THE LOCATION OF THE OVERHEAD LINES HAS NOT BEEN SHOWN ON THESE DRAWINGS AS THE LINES ARE CLEARLY VISIBLE, BUT YOU SHOULD LOCATE THEM PRIOR TO BEGINNING ANY CONSTRUCTION. TEXAS LAW, SECTION 752, HEALTH AND SAFETY CODE FORBIDS ACTIVITIES THAT OCCUR IN CLOSE PROXIMITY TO HIGH VOLTAGE LINES, SPECIFICALLY:

- ANY ACTIVITY WHERE PERSON OR THINGS MAY COME WITHIN SIX(6) FEET OF LIVE OVERHEAD HIGH VOLTAGE LINES; AND
- OPERATING A CRANE, DERRICK, POWER SHOVEL, DRILLING RIG, PILE DRIVER, HOISTING EQUIPMENT, OR SIMILAR APPARATUS WITHIN 10 FEET OF LIVE OVERHEAD HIGH VOLTAGE LINES.

PARTIES RESPONSIBLE FOR THE WORK, INCLUDING CONTRACTORS ARE LEGALLY RESPONSIBLE FOR THE SAFETY OF CONSTRUCTION WORKERS UNDER THIS LAW. THIS LAW CARRIES BOTH CRIMINAL AND CIVIL LIABILITY. TO ARRANGE FOR LINES TO BE TURNED OFF OR REMOVED CALL CENTERPOINT ENERGY AT (713) 207-2222.

ACTIVITIES ON OR ACROSS CENTERPOINT ENERGY FEE OR EASEMENT PROPERTY.
NO APPROVAL TO USE, CROSS OR OCCUPY CENTERPOINT FEE OR EASEMENT PROPERTY IS GIVEN. IF YOU NEED TO USE CENTERPOINT PROPERTY, PLEASE CONTACT OUR SURVEYING & RIGHT OF WAY DIVISION AT (713) 207-6248 OR (713) 207-5769.

SMITH&COMPANY
ARCHITECTS

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CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., SUITE 260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE
647 RICHMOND AVE., SUITE 220
HOUSTON, TX 77057
TBPE FIRM REG:#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:
NO. DATE DESCRIPTION

FRESNO BOYS & GIRLS CLUB
ˉ031 W SYCAMORE RD
FRESNO, TX 77545

GENERAL NOTES 2 OF 2

100% Construction Document
02.29.2024

STATE OF TEXAS
AMANDA F. BARBIER
122357
LICENSED
PROFESSIONAL ENGINEER
2024-02-28

C0.02

FOR REFERENCE ONLY

STATE OF TEXAS
COUNTY OF FORT BEND

WE, FORT BEND COUNTY, TEXAS, A POLITICAL SUBDIVISION OF THE STATE OF TEXAS, ACTING BY AND THROUGH KP GEORGE, COUNTY JUDGE, BEING AN OFFICER OF FORT BEND COUNTY, TEXAS, A POLITICAL SUBDIVISION OF THE STATE OF TEXAS, OWNER HEREINAFTER REFERRED TO AS OWNERS OF THE 4.635 ACRES TRACT DESCRIBED IN THE ABOVE AND FOREGOING MAP OF FRESNO BOYS & GIRLS CLUB, DO HEREBY MAKE AND ESTABLISH SAID SUBDIVISION AND DEVELOPMENT PLAN OF SAID PROPERTY ACCORDING TO ALL LINES, DEDICATIONS, RESTRICTIONS AND NOTATIONS ON SAID MAPS OR PLAT AND HEREBY DEDICATE TO THE USE OF THE PUBLIC FOREVER, ALL STREETS (EXCEPT THOSE STREETS DESIGNATED AS PRIVATE STREETS, OR PERMANENT ACCESS EASEMENTS), ALLEYS, PARKS, WATER COURSES, DRAINS, EASEMENTS AND PUBLIC PLACES SHOWN THEREON FOR THE PURPOSES AND CONSIDERATIONS THEREIN EXPRESSED; AND DO HEREBY BIND OURSELVES, OUR HEIRS, SUCCESSORS AND ASSIGNS TO WARRANT AND FOREVER DEFEND THE TITLE ON THE LAND SO DEDICATED.

FURTHER, OWNERS HAVE DEDICATED AND BY THESE PRESENTS DO DEDICATE TO THE USE OF THE PUBLIC FOR PUBLIC UTILITY PURPOSE FOREVER UNOBSTRUCTED AERIAL EASEMENTS. THE AERIAL EASEMENTS SHALL EXTEND HORIZONTALLY AN ADDITIONAL ELEVEN FEET, SIX INCHES (11' 6") FOR TEN FEET (10' 0") PERIMETER GROUND EASEMENTS OR SEVEN FEET, SIX INCHES (7' 6") FOR FOURTEEN FEET (14' 0") PERIMETER GROUND EASEMENTS OR FIVE FEET, SIX INCHES (5' 6") FOR SIXTEEN FEET (16' 0") PERIMETER GROUND EASEMENTS, FROM A PLANE SIXTEEN FEET (16' 0") ABOVE THE GROUND LEVEL UPWARD, LOCATED ADJACENT TO AND ADJOINING SAID PUBLIC UTILITY EASEMENTS THAT ARE DESIGNATED WITH AERIAL EASEMENTS (U.E. AND A.E.) AS INDICATED AND DEPICTED, HEREON, WHEREBY THE AERIAL EASEMENT TOTALS TWENTY ONE FEET, SIX INCHES (21' 6") IN WIDTH.

FURTHER, OWNERS HAVE DEDICATED AND BY THESE PRESENTS DO DEDICATE TO THE USE OF THE PUBLIC FOR PUBLIC UTILITY PURPOSE FOREVER UNOBSTRUCTED AERIAL EASEMENTS. THE AERIAL EASEMENTS SHALL EXTEND HORIZONTALLY AN ADDITIONAL TEN FEET (10' 0") FOR TEN FEET (10' 0") BACK-TO-BACK GROUND EASEMENTS, OR EIGHT FEET (8' 0") FOR FOURTEEN FEET (14' 0") BACK-TO-BACK GROUND EASEMENTS OR SEVEN FEET (7' 0") FOR SIXTEEN FEET (16' 0") BACK-TO-BACK GROUND EASEMENTS, FROM A PLANE SIXTEEN FEET (16' 0") ABOVE GROUND LEVEL UPWARD, LOCATED ADJACENT TO BOTH SIDES AND ADJOINING SAID PUBLIC UTILITY EASEMENTS THAT ARE DESIGNATED WITH AERIAL EASEMENTS (U.E. AND A.E.) AS INDICATED AND DEPICTED HEREON, WHEREBY THE AERIAL EASEMENT TOTALS THIRTY FEET (30' 0") IN WIDTH.

FURTHER, OWNERS DO HEREBY COVENANT AND AGREE THAT ALL OF THE PROPERTY WITHIN THE BOUNDARIES OF THIS PLAT IS HEREBY RESTRICTED TO PREVENT THE DRAINAGE OF ANY SEPTIC TANKS INTO ANY PUBLIC OR PRIVATE STREET, PERMANENT ACCESS EASEMENT, ROAD OR ALLEY, OR ANY DRAINAGE DITCH, EITHER DIRECTLY OR INDIRECTLY.

FURTHER, OWNERS DO HEREBY DEDICATE TO THE PUBLIC A STRIP OF LAND TWENTY (20' 0") FEET WIDE ON EACH SIDE OF THE CENTER LINE OF ANY AND ALL BAYOUS, CREEKS, GULLIES, RAVINES, DRAWS AND DRAINAGE DITCHES LOCATED IN SAID SUBDIVISION, AS EASEMENTS FOR DRAINAGE PURPOSES, FORT BEND COUNTY OR ANY OTHER GOVERNMENTAL AGENCY SHALL HAVE THE RIGHT TO ENTER UPON SAID EASEMENT AT ANY AND ALL TIMES FOR THE PURPOSES OF CONSTRUCTION AND MAINTENANCE OF DRAINAGE FACILITIES AND STRUCTURES.

FURTHER, OWNERS DO HEREBY COVENANT AND AGREE THAT ALL OF THE PROPERTY WITHIN THE BOUNDARIES OF THIS SUBDIVISION AND ADJACENT TO ANY DRAINAGE EASEMENT, DITCH, GULLY, CREEK OR NATURAL DRAINAGE WAY SHALL HEREBY BE RESTRICTED TO KEEP SUCH DRAINAGE WAYS AND EASEMENTS CLEAR OF FENCES, BUILDINGS, EXCESSIVE VEGETATION AND OTHER OBSTRUCTIONS TO THE OPERATIONS AND MAINTENANCE OF THE DRAINAGE FACILITY AND THAT SUCH ABUTTING PROPERTY SHALL NOT BE PERMITTED TO DRAIN DIRECTLY INTO THIS EASEMENT EXCEPT BY MEANS OF AN APPROVED DRAINAGE STRUCTURE.

FURTHER, OWNERS HEREBY CERTIFY THAT THIS REPLAT DOES NOT ATTEMPT TO ALTER, AMEND, OR REMOVE ANY COVENANTS OR RESTRICTIONS; WE FURTHER CERTIFY THAT NO PORTION OF THE PRECEDING PLAT WAS LIMITED BY DEED RESTRICTION TO RESIDENTIAL USE FOR MORE THAN TWO (2) RESIDENTIAL UNITS PER LOT.

FURTHER, OWNERS DO HEREBY ACKNOWLEDGE THE RECEIPT OF THE "ORDERS FOR REGULATION OF OUTDOOR LIGHTING IN THE UNINCORPORATED AREAS OF FORT BEND COUNTY, TEXAS", AND DO HEREBY COVENANT AND AGREE AND SHALL COMPLY WITH THIS ORDER AS ADOPTED BY FORT BEND COUNTY COMMISSIONERS' COURT ON MARCH 23, 2004, AND ANY SUBSEQUENT AMENDMENTS.

IN TESTIMONY WHEREOF, THE FORT BEND COUNTY, TEXAS, A POLITICAL SUBDIVISION OF THE STATE OF TEXAS, HAS CAUSED THESE PRESENTS TO BE SIGNED BY KP GEORGE, ITS COUNTY JUDGE, THEREUNTO AUTHORIZED,

THIS _____ DAY OF _____, 2023.

FORT BEND COUNTY, TEXAS
A POLITICAL SUBDIVISION OF THE STATE OF TEXAS

BY: _____
KP GEORGE, COUNTY JUDGE

STATE OF TEXAS
COUNTY OF FORT BEND

BEFORE ME, THE UNDERSIGNED AUTHORITY, ON THIS DAY PERSONALLY APPEARED KP GEORGE, COUNTY JUDGE OF FORT BEND COUNTY, TEXAS, A POLITICAL SUBDIVISION OF THE STATE OF TEXAS, KNOWN TO ME TO BE THE PERSON WHOSE NAME IS SUBSCRIBED TO THE FOREGOING INSTRUMENT AND ACKNOWLEDGED TO ME THAT HE EXECUTED THE SAME FOR THE PURPOSES AND CONSIDERATIONS THEREIN EXPRESSED.

GIVEN UNDER MY HAND AND SEAL OF OFFICE,

THIS _____ DAY OF _____, 2023.

_____
NOTARY PUBLIC IN AND FOR THE STATE OF TEXAS

MY COMMISSION EXPIRES: _____

I, BRANDON M. ABSHER, AM REGISTERED UNDER THE LAWS OF THE STATE OF TEXAS TO PRACTICE THE PROFESSION OF SURVEYING AND HEREBY CERTIFY THAT THE ABOVE SUBDIVISION IS TRUE AND ACCURATE; WAS PREPARED FROM AN ACTUAL SURVEY OF THE PROPERTY MADE UNDER MY SUPERVISION ON THE GROUND; THAT, EXCEPT AS SHOWN ALL BOUNDARY CORNERS, ANGLE POINTS, POINTS OF CURVATURE AND OTHER POINTS OF REFERENCE HAVE BEEN MARKED WITH IRON (OR OTHER OBJECTS OF A PERMANENT NATURE) PIPES OR RODS HAVING AN OUTSIDE DIAMETER OF NOT LESS THAN FIVE EIGHTHS (5/8) INCH AND A LENGTH OF NOT LESS THAN THREE (3) FEET (SEE NOTE 10); AND THAT THE PLAT BOUNDARY CORNERS HAVE BEEN TIED TO THE TEXAS COORDINATE SYSTEM OF 1983, SOUTH CENTRAL ZONE.

_____
BRANDON M. ABSHER, R.P.L.S.
REGISTERED PROFESSIONAL LAND SURVEYOR
TEXAS REGISTRATION NO. 6654

I, AMANDA BARBIER, P.E., A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF TEXAS DO HEREBY CERTIFY THAT THIS PLAT MEETS ALL REQUIREMENTS OF FORT BEND COUNTY TO THE BEST OF MY KNOWLEDGE.

_____
AMANDA BARBIER, P.E.
LICENSED PROFESSIONAL ENGINEER
TEXAS LICENSE NO. 122357

THIS IS TO CERTIFY THAT THE PLANNING COMMISSION OF THE CITY OF HOUSTON, TEXAS, HAS APPROVED THIS PLAT AND SUBDIVISION OF FRESNO BOYS & GIRLS CLUB IN CONFORMANCE WITH THE LAWS OF THE STATE OF TEXAS AND THE ORDINANCES OF THE CITY OF HOUSTON AS SHOWN HEREON AND AUTHORIZED THE RECORDING OF THIS PLAT

THIS _____, DAY OF _____, 2023.

BY: _____
MARTHA L. STEIN, CHAIR
OR M. SONNY GARZA, VICE-CHAIR

BY: _____
MARGARET WALLACE BROWN, AICP, CNU-A, SECRETARY

NOTES:

1. UNLESS OTHERWISE INDICATED, THE BUILDING LINES (B.L.), WHETHER ONE OR MORE, SHOWN ON THIS SUBDIVISION PLAT ARE ESTABLISHED TO EVIDENCE COMPLIANCE WITH THE APPLICABLE PROVISIONS OF CHAPTER 42, CODE OF ORDINANCES, CITY OF HOUSTON, TEXAS, IN EFFECT AT THE TIME THIS PLAT WAS APPROVED, WHICH MAY BE AMENDED FROM TIME TO TIME.
2. THE COORDINATES SHOWN HEREON ARE TEXAS SOUTH CENTRAL ZONE NO. 4204 TEXAS COORDINATE SYSTEM (NAD83) AND MAY BE BROUGHT TO SURFACE BY APPLYING THE FOLLOWING COMBINED SCALE: 1.000130.
3. BENCHMARK:
   NGS BENCHMARK DR8228, AN ALUMINUM ROD WITH DATUM TIP IN SLEEVE, LOCATED EAST OF A DETENTION POND IN THE HILL AT SIMS GREENWAY.

   PUBLISHED ELEVATION = 40.6 FEET NAVD88, 2011 ADJUSTMENT, GEOID18

   HELD ELEVATION = 41.01 FEET NAVD 88, 2011 ADJUSTMENT, GEOID18

   SITE TBM CP-4
   5/8" IRON ROD W/RED PLASTIC CAP STAMPED "CONTROL POINT", LOCATED ON THE WEST SIDE OF SOUTH POST OAK BOULEVARD (UNDEVELOPED) AND AT THE SOUTH EAST CORNER OF A DETENTION POND.

   ELEVATION = 68.31 FEET NAVD 88, 2011 ADJUSTMENT, GEOID18

   SITE TBM CP-5
   5/8" IRON ROD W/RED PLASTIC CAP STAMPED "CONTROL POINT", LOCATED AT THE NORTHWEST CORNER OF THE INTERSECTION OF SOUTH POST OAK BOULEVARD AND WEST SYCAMORE ROAD.

   ELEVATION = 67.50 FEET NAVD 88, 2011 ADJUSTMENT, GEOID18
4. THE TOP OF ALL FLOOR SLABS SHALL BE A MINIMUM OF 68.8 FEET ABOVE MEAN SEA LEVEL (NAVD 88 DATUM). IN ADDITION, NO TOP OF SLAB ELEVATION SHALL BE LESS THAN 24 INCHES ABOVE THE LOWEST TOP OF CURB ADJACENT TO THE LOT IN WHICH IT LIES. IN THE ABSENCE OF A CURB, THE TOP OF THE SLAB ELEVATION SHALL BE NO LESS THAN 24 INCHES ABOVE THE HIGHEST NATURAL GROUND ALONG THE PERIMETER OF THE BUILDING FOUNDATION AND 12 INCHES ABOVE ANY DOWN GRADIENT ROADWAY OR DRAINAGE RESTRAIN, WHICHEVER IS HIGHER.
5. THIS PLAT WAS PREPARED TO MEET FORT BEND COUNTY REQUIREMENTS.
6. THIS PLAT WAS PREPARED FROM INFORMATION FURNISHED BY CHARTER TITLE COMPANY, EFFECTIVE DATE OF OCTOBER 17, 2023 AND ISSUED ON OCTOBER 23, 2023. THE SURVEYOR HAS NOT ABSTRACTED THE ABOVE PROPERTY.
7. THIS PLAT LIES PARTIALLY WITHIN FORT BEND COUNTY ASSISTANCE DISTRICT NO. 4, AND WHOLLY WITHIN FORT BEND COUNTY EMERGENCY SERVICES DISTRICT NO. 7, FORT BEND COUNTY SUBSIDENCE DISTRICT, FORT BEND INDEPENDENT SCHOOL DISTRICT, THE ETJ OF THE CITY OF HOUSTON AND FORT BEND COUNTY.
8. BY GRAPHICAL PLOTTING, THE SUBJECT TRACT LIES WITHIN ZONE "X" (UNSHADED) AS SHOWN ON WITH THE FEDERAL EMERGENCY MANAGEMENT AGENCY FLOOD INSURANCE RATE MAP NOS. 48157C0315L, APRIL 2, 2014.
9. THERE ARE NO PIPELINES OR PIPELINE EASEMENTS WITHIN THE PLATTED AREA SHOWN HEREON.
10. FIVE-EIGHTHS (5/8) INCH IRON RODS WITH PLASTIC CAP MARKED "CIVILCORP" AND THREE (3) FEET IN LENGTH ARE SET ON ALL PERIMETER BOUNDARY CORNERS UNLESS OTHERWISE INDICATED.
11. THE DRAINAGE SYSTEM FOR THIS SUBDIVISION IS DESIGNED IN ACCORDANCE WITH THE FORT BEND COUNTY DRAINAGE CRITERIA MANUAL WHICH ALLOWS STREET PONDING DURING INTENSE RAINFALL EVENTS.
12. ALL DRAINAGE EASEMENTS TO BE KEPT CLEAR OF FENCES, BUILDINGS, VEGETATION AND OTHER OBSTRUCTIONS TO THE OPERATION AND MAINTENANCE OF THE DRAINAGE FACILITY.
13. ALL PROPERTY TO DRAIN INTO THE DRAINAGE EASEMENT ONLY THROUGH AN APPROVED DRAINAGE STRUCTURE.
14. SIDEWALKS SHALL BE BUILT OR CAUSED TO BE BUILT NOT LESS THAN 5 FEET IN WIDTH ON BOTH SIDES OF ALL DEDICATED RIGHTS-OF-WAY WITHIN SAID PLAT AND ON THE CONTIGUOUS RIGHT-OF-WAY OF ALL PERIMETER ROADS SURROUNDING SAID PLAT, IN ACCORDANCE WITH A.D.A. REQUIREMENTS.
15. SITE PLANS SHALL BE SUBMITTED TO FORT BEND COUNTY AND ANY OTHER APPLICABLE JURISDICTION FOR REVIEW AND APPROVAL TO OBTAIN A DEVELOPMENT PERMIT. DEVELOPMENT PERMITS AND ALL OTHER APPLICABLE PERMITS SHALL BE OBTAINED FROM FORT BEND COUNTY PRIOR TO BEGINNING CONSTRUCTION.
16. THIS PLAT LIES WITHIN LIGHT ZONE 2 OF THE FORT BEND COUNTY LIGHTING ORDINANCE.
17. ABSENT WRITTEN AUTHORIZATION BY THE AFFECTED UTILITIES, ALL UTILITY AND AERIAL EASEMENTS MUST BE KEPT UNOBSTRUCTED FROM ANY NON-UTILITY IMPROVEMENTS OR OBSTRUCTIONS BY THE PROPERTY OWNER. ANY UNAUTHORIZED IMPROVEMENTS OR OBSTRUCTIONS MAY BE REMOVED BY ANY PUBLIC UTILITY AT THE PROPERTY OWNER'S EXPENSE. WHILE WOODEN POSTS AND PANELED WOODEN FENCES ALONG THE PERIMETER AND BACK TO BACK EASEMENTS AND ALONGSIDE REAR LOTS LINES ARE PERMITTED, THEY TOO MAY BE REMOVED BY PUBLIC UTILITIES AT THE PROPERTY OWNER'S EXPENSE SHOULD THEY BE AN OBSTRUCTION. PUBLIC UTILITIES MAY PUT SAID WOODEN POSTS AND PANELED WOODEN FENCES BACK UP, BUT GENERALLY WILL NOT REPLACE WITH NEW FENCING.
18. THIS PROPERTY IS SUBJECT TO A RIGHT-OF-ENTRY AGREEMENT AS REFLECTED IN CLERK'S FILE NUMBER 2021146222, OFFICIAL PUBLIC RECORDS FORT BEND COUNTY, TEXAS.

VICINITY MAP
SCALE: 1" = 2640'

KEY MAP NO. 651C

I, J. STACY SKAWINSKI, FORT BEND COUNTY ENGINEER, DO HEREBY CERTIFY THAT THE PLAT OF THIS SUBDIVISION COMPLIES WITH ALL OF THE EXISTING RULES AND REGULATIONS OF THIS OFFICE AS ADOPTED BY THE FORT BEND COUNTY COMMISSIONERS' COURT. HOWEVER, NO CERTIFICATION IS HEREBY GIVEN AS TO THE EFFECT OF DRAINAGE FROM THIS SUBDIVISION ON THE INTERCEPTING DRAINAGE ARTERY OR PARENT STREAM OR ON ANY OTHER AREA OR SUBDIVISION WITHIN THE WATERSHED.

_____
J. STACY SKAWINSKI, P.E.
FORT BEND COUNTY ENGINEER

APPROVED BY THE COMMISSIONERS' COURT OF FORT BEND COUNTY, TEXAS,

THIS _____ DAY OF _____, 2023.

_____
VINCENT M. MORALES, JR.
PRECINCT 1, COUNTY COMMISSIONER

_____
GRADY PRESTAGE
PRECINCT 2, COUNTY COMMISSIONER

_____
KP GEORGE
COUNTY JUDGE

_____
W.A. (ANDY) MEYERS
PRECINCT 3, COUNTY COMMISSIONER

_____
DEXTER L. McCOY
PRECINCT 4, COUNTY COMMISSIONER

I, LAURA RICHARD, COUNTY CLERK IN AND FOR FORT BEND COUNTY, HEREBY CERTIFY THAT THE FOREGOING INSTRUMENT WITH ITS CERTIFICATE OF AUTHENTICATION WAS FILED FOR RECORDATION IN MY OFFICE ON _____ , 2023 AT _____ O'CLOCK _____M. IN PLAT NUMBER _____ OF THE PLAT RECORDS OF FORT BEND COUNTY, TEXAS.

WITNESS MY HAND AND SEAL OF OFFICE, AT RICHMOND, TEXAS. THE DAY AND DATE LAST ABOVE WRITTEN.

_____
LAURA RICHARD, COUNTY CLERK
FORT BEND COUNTY, TEXAS

BY: _____
DEPUTY

FRESNO BOYS & GIRLS CLUB

A SUBDIVISION OF 4.635 ACRES OF LAND SITUATED IN THE MANUEL ESCALERA SURVEY, ABSTRACT 170, FORT BEND COUNTY, TEXAS; ALSO BEING A PARTIAL REPLAT OF LOT 753 OF MAGNOLIA PLACE, AS RECORDED IN VOLUME 2, PAGE 23, OF THE FORT BEND COUNTY PLAT RECORDS.

1 RESERVE (4.349 ACRES) 1 BLOCK

OCTOBER 31, 2023 JOB NO. 1704-2301

REASON FOR REPLAT: TO CREATE ONE RESERVE IN ONE BLOCK.

OWNERS:
FORT BEND COUNTY
301 JACKSON ST., RICHMOND, TEXAS 77469

SURVEYOR:
CIVILCORP
4611 AIRLINE ROAD, SUITE 300
VICTORIA, TEXAS 77904
TBPLS No. 100576-00

ENGINEER:
LJA Engineering, Inc.
1904 W. Grand Parkway North
Suite 100
Katy, Texas 77449
Phone 713.953.5200
Fax 713.953.5026
FRN-F-1386

SHEET 1 OF 2

MYLAR CHECK: COORD_____ DIR_____

Date\Time : 10th_31_Oct_2023_at_8:32:07a
Path\Name : J:\Projects\2021\2104_Plats\Fresno Boys & Girls Club.dwg

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

STRUCTURAL ENGINEER
STANLEY SPURLING & HAMILTON INC.
3301 EDLOE ST.
HOUSTON, TX 77027

CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., SUITE 200
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE
647 RICHMOND AVE., SUITE 220
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

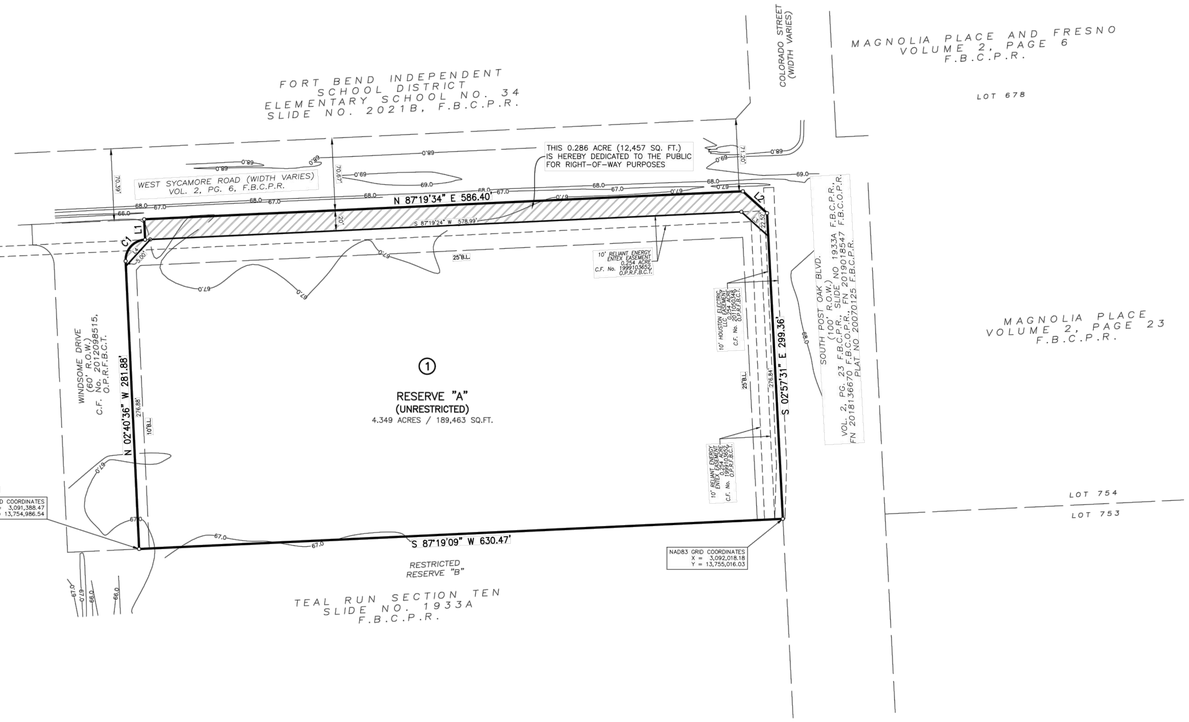
FRESNO BOYS & GIRLS CLUB
031 W SYCAMORE RD
FRESNO, TX 77545

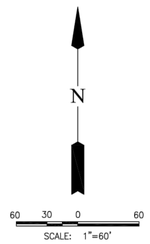
PRELIMINARY PLAT 1 OF 2

100% Construction Document
02.29.2024

C0.03

FOR REFERENCE ONLY





VICINITY MAP
SCALE: 1" = 2640'

KEY MAP NO. 651C

LEGEND

B.L.	INDICATES BUILDING LINE
D.E.	INDICATES DRAINAGE EASEMENT
F.B.C.P.R.	INDICATES FORT BEND COUNTY PLAT RECORDS
O.P.R.F.B.C.T.	INDICATES OFFICIAL PUBLIC RECORDS FORT BEND COUNTY, TEXAS
F.B.C.D.R.	INDICATES FORT BEND COUNTY DEED RECORDS
C.F. NO.	INDICATES CLERK'S FILE NUMBER
FND	INDICATES FOUND
I.P.	INDICATES IRON PIPE
I.R.	INDICATES IRON ROD
STM.S.E.	INDICATES STORM SEWER EASEMENT
R.O.W.	INDICATES RIGHT OF WAY
VOL.	INDICATES VOLUME
PG.	INDICATES PAGE

LINE TABLE		
LINE	BEARING	DISTANCE
L1	N 02°40'36" W	20.00'
L2	S 47°51'45" E	31.85'
L3	N 47°49'03" W	35.44'
L4	S 42°19'24" W	35.36'

CURVE TABLE					
CURVE	RADIUS	DELTA	ARC	CHORD BEARING	CHORD
C1	20.00'	90°00'00"	31.42'	N 42°19'24" E	28.28'

FRESNO BOYS & GIRLS CLUB

A SUBDIVISION OF 4.635 ACRES OF LAND SITUATED IN THE MANUEL ESCALERA SURVEY, ABSTRACT 170, FORT BEND COUNTY, TEXAS; ALSO BEING A PARTIAL REPLAT OF LOT 753 OF MAGNOLIA PLACE, AS RECORDED IN VOLUME 2, PAGE 23, OF THE FORT BEND COUNTY PLAT RECORDS.

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VICTORIA, TEXAS 77904
TBPLS No. 100576-00

ENGINEER:
LJA Engineering, Inc.
1904 W. Grand Parkway North
Suite 100
Katy, Texas 77449
Phone 713.953.5200
Fax 713.953.5026
FRN-F-1386

SHEET 2 OF 2

MYLAR CHECK: COORD._____ DIR._____

Date\Time - Tue, 31 Oct 2023 - 8:32am
Path\Name - I:\Projdat\1PLATTING\1704\04_Plats\Fresno Boys & Girls Club.dwg

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

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647 RICHMOND AVE., SUITE 220
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TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

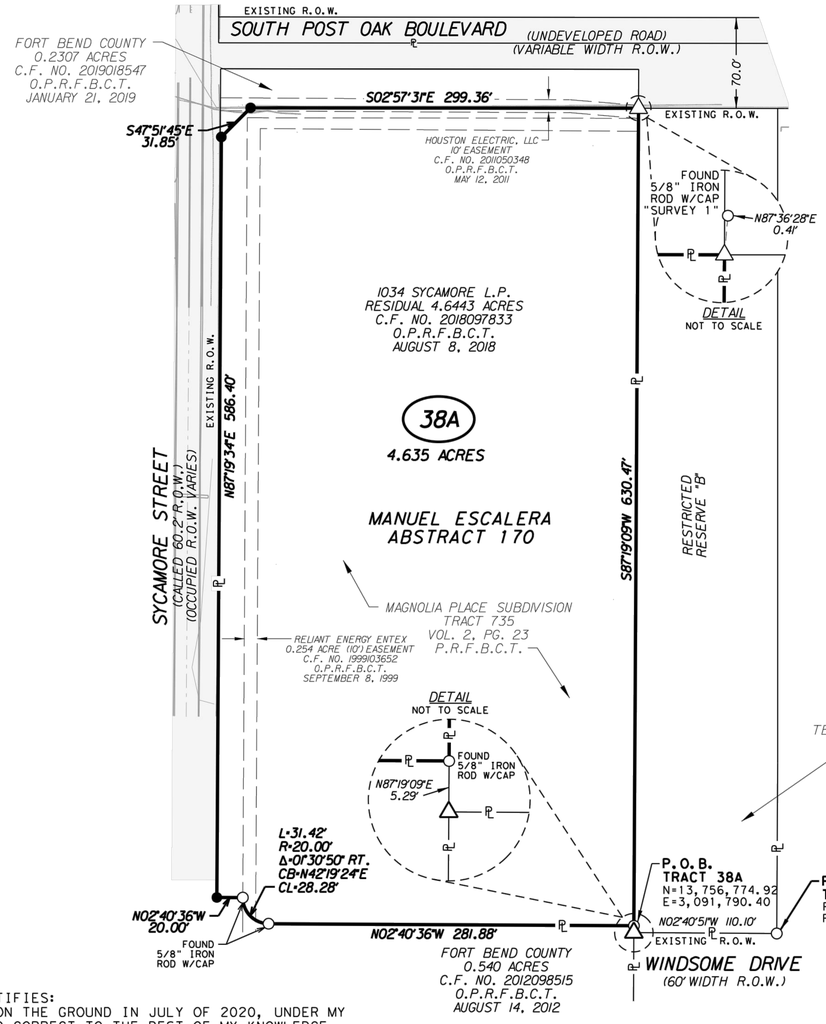
FRESNO BOYS & GIRLS CLUB
031 W SYCAMORE RD
FRESNO, TX 77545

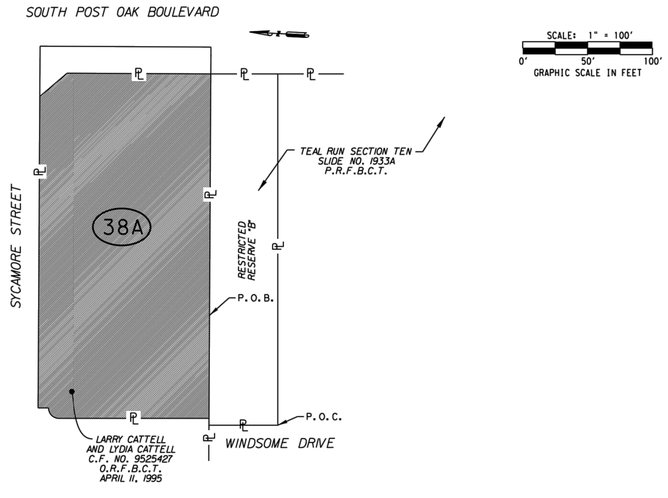
PRELIMINARY PLAT 2 OF 2

100% Construction Document
02.29.2024

C0.04

FOR REFERENCE ONLY





PROPERTY SKETCH
NOT TO SCALE

SCALE: 1" = 100'
0' 50' 100'
GRAPHIC SCALE IN FEET

LEGEND

(N)	TRACT NUMBER
●	SET 5/8" IRON ROD WITH YELLOW PLASTIC CAP STAMPED "CIVILCORP"
○	FOUND MONUMENT (AS NOTED)
△	CALCULATED POINT
R.O.W.	RIGHT-OF-WAY
℄	PROPERTY LINE
℔	SURVEY/ABSTRACT LINE
	FEE HOOK
F.B.C.T.	FORT BEND COUNTY, TEXAS
P.R.F.B.C.T.	PLAT RECORDS FORT BEND COUNTY, TEXAS
O.R.F.B.C.T.	OFFICIAL RECORDS FORT BEND COUNTY, TEXAS
D.R.F.B.C.T.	DEED RECORDS FORT BEND COUNTY, TEXAS
O.P.R.F.B.C.T.	OFFICIAL PUBLIC RECORDS FORT BEND COUNTY, TEXAS
C.F. NO.	CLERK FILE NUMBER
P.O.C.	POINT OF COMMENCING
P.O.B.	POINT OF BEGINNING
(NXX°XX'XX"E XXX.XX')	RECORD BEARING & DISTANCE

NOTES:
1. ALL BEARINGS AND COORDINATES SHOWN HEREON ARE BASED ON THE TEXAS COORDINATE SYSTEM, SOUTH CENTRAL ZONE (4204), NAD83. ALL COORDINATES AND DISTANCES SHOWN HEREON ARE SURFACE AND MAY BE CONVERTED TO GRID BY DIVIDING BY A COMBINED ADJUSTMENT FACTOR OF 1.000130 (FORT BEND COUNTY).

2. A PROPERTY DESCRIPTION OF EVEN DATE WAS PREPARED IN CONJUNCTION WITH THIS PLAT.

3. ACCORDING TO THE FLOOD INSURANCE RATE MAP (FIRM) FOR THE CITY OF FRESNO, FORT BEND COUNTY, TEXAS, COMMUNITY PANEL NUMBER 48157C 0315 L, MAP REVISED APRIL 2, 2014, THE SUBJECT PROPERTY IS LOCATED IN ZONE X WHICH IN THIS CASE IS NOT A SPECIAL FLOOD HAZARD AREA.

STATE OF TEXAS
REGISTERED
BRANDON M. ABSHER
6654
PROFESSIONAL
LAND SURVEYOR

07/24/2020

THE UNDERSIGNED HEREBY CERTIFIES:
THAT THIS SURVEY WAS MADE ON THE GROUND IN JULY OF 2020, UNDER MY SUPERVISION AND IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

SIGNED: _____
BRANDON M. ABSHER
REGISTERED PROFESSIONAL LAND SURVEYOR
TEXAS No. 6654

CivilCorp
ENGINEERS • SURVEYORS
4611 AIRLINE ROAD, SUITE 300, VICTORIA, TEXAS 77904
TBPE REGISTRATION #F-10283 TBPLS REGISTRATION #100576-00

TRACT 38A
SOUTH POST OAK BOULEVARD
FORT BEND COUNTY

SCALE:	JOB NUMBER:	DATE:	DRAWING:
1" = 40'	1520100	7/24/2020	1 OF 1

DATE: 7/24/2020 4:59:16 PM
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SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

STRUCTURAL ENGINEER
STANLEY SPURLING & HAMILTON INC.
3301 EDLOE ST.
HOUSTON, TX 77027

CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., SUITE 260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE
647 RICHMOND AVE., SUITE 220
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:
NO. DATE DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

BOUNDARY SURVEY

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02.29.2024

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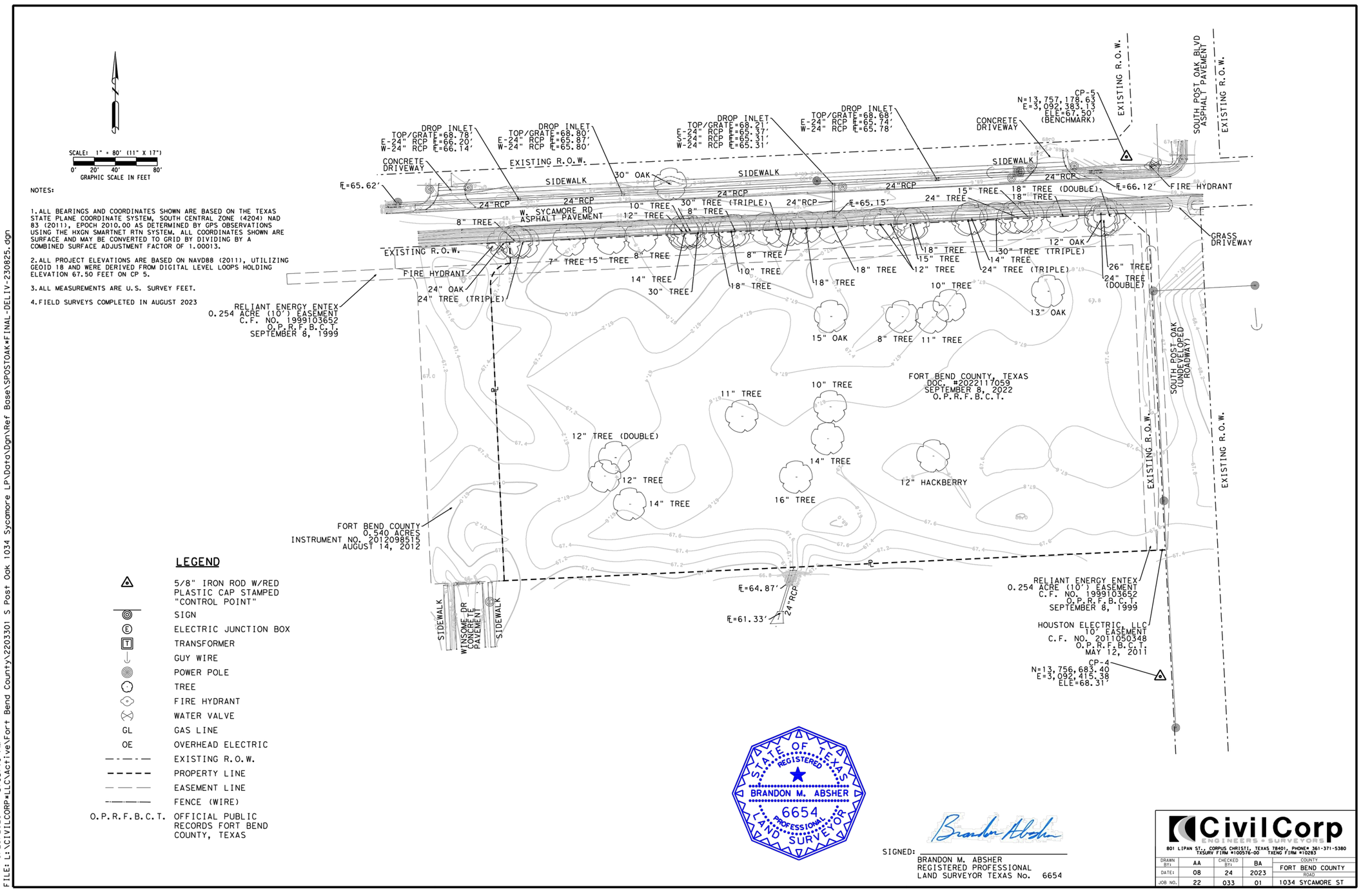
FOR REFERENCE ONLY



NOTES:

1. ALL BEARINGS AND COORDINATES SHOWN ARE BASED ON THE TEXAS STATE PLANE COORDINATE SYSTEM, SOUTH CENTRAL ZONE (4204) NAD 83 (2011), EPOCH 2010.00 AS DETERMINED BY GPS OBSERVATIONS USING THE HXGN SMARTNET RTN SYSTEM. ALL COORDINATES SHOWN ARE SURFACE AND MAY BE CONVERTED TO GRID BY DIVIDING BY A COMBINED SURFACE ADJUSTMENT FACTOR OF 1.00013.

2. ALL PROJECT ELEVATIONS ARE BASED ON NAVD88 (2011), UTILIZING GEOID 18 AND WERE DERIVED FROM DIGITAL LEVEL LOOPS HOLDING ELEVATION 67.50 FEET ON CP 5.

3. ALL MEASUREMENTS ARE U.S. SURVEY FEET.

4. FIELD SURVEYS COMPLETED IN AUGUST 2023

LEGEND

▲	5/8" IRON ROD W/RED PLASTIC CAP STAMPED "CONTROL POINT"
	SIGN
E	ELECTRIC JUNCTION BOX
T	TRANSFORMER
	GUY WIRE
	POWER POLE
	TREE
	FIRE HYDRANT
	WATER VALVE
GL	GAS LINE
OE	OVERHEAD ELECTRIC
— - — - —	EXISTING R.O.W.
- - - - -	PROPERTY LINE
— — —	EASEMENT LINE
--—--—--	FENCE (WIRE)
O.P.R.F.B.C.T.	OFFICIAL PUBLIC RECORDS FORT BEND COUNTY, TEXAS

STATE OF TEXAS REGISTERED BRANDON M. ABSHER 6654 PROFESSIONAL LAND SURVEYOR

SIGNED: _____
BRANDON M. ABSHER
REGISTERED PROFESSIONAL
LAND SURVEYOR TEXAS No. 6654

CivilCorp ENGINEERS • SURVEYORS
801 LIPAN ST., CORPUS CHRISTI, TEXAS 78401; PHONE# 361-371-5380
TXSURV FIRM #100576-00 TXENG FIRM #10283

DRAWN BY:	AA	CHECKED BY:	BA	COUNTY
DATE:	08	24	2023	FORT BEND COUNTY
JOB NO.	22	033	01	ROAD 1034 SYCAMORE ST

DATE: 8/29/2023 3:05:10 PM
FILE: L:\CIVILCORP#LLC\Active\Fort Bend County\2203301 S Post Oak 1034 Sycamore LP\Data\Dgn\Ref Base\SPOSTOAK#FINAL-DELIV-230825.dgn

SMITH&COMPANY ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

STRUCTURAL ENGINEER
STANLEY SPURLING & HAMILTON INC.
3301 EDLOE ST.
HOUSTON, TX 77027

CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., SUITE 260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE
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TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

TOPOGRAPHIC SURVEY

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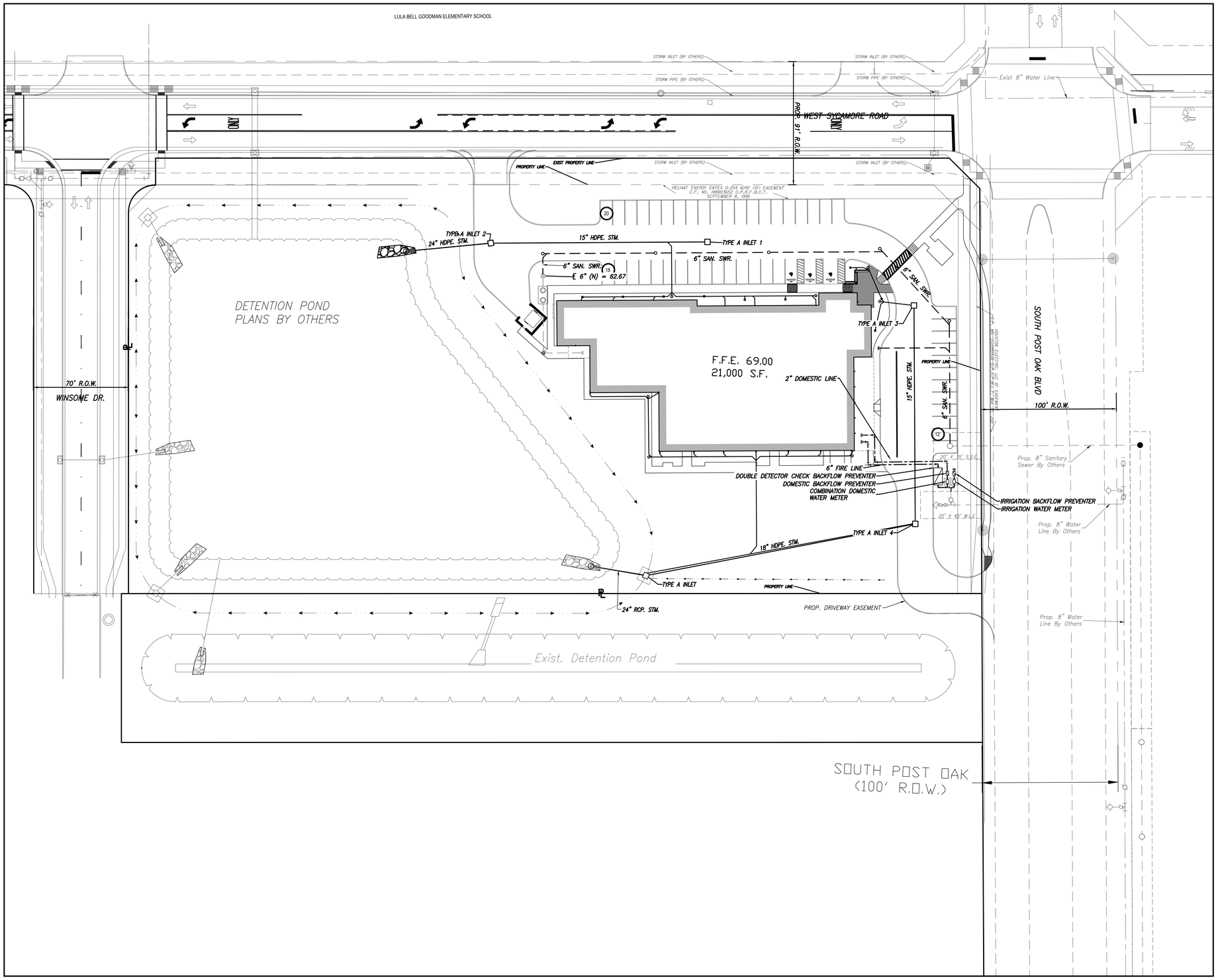

GRAPHIC SCALE
30 0 15 30
(IN FEET)
1 inch = 30 ft.

LEGEND

- PROPOSED WATER LINE AND GATE VALVE AND BOX
- PROPOSED WATER LINE W/BENDS
- PROPOSED WATER LINE W/TEE
- PROPOSED WATER LINE W/FLUSHING VALVE UNIT
  A. LINE SIZE X 6" TEE
  B. 6" GATE VALVE AND BOX
  C. FLUSHING VALVE
- 2" BLOW-OFF ASSEMBLY W/PLUG AND CLAMP
- EXISTING WATER LINE SYSTEM
- PROPOSED SANITARY SEWER AND MANHOLE
- EXISTING SANITARY SEWER AND MANHOLE
- PROPOSED STORM SEWER
- PUBLIC STORM SEWER
- 10 — INDICATES SHEET REFERENCE NUMBER
- W.L.E. — INDICATES WATER LINE EASEMENT
- STM.S.E. — INDICATES STORM SEWER EASEMENT
- S.S.E. — INDICATES SANITARY SEWER EASEMENT

SMITH&COMPANY ARCHITECTS

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STUDIO AVID
6046 FM 2920 RD., SUITE 260
SPRING, TX 77379

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PROJECT #: N032023
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REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
031 W SYCAMORE RD
FRESNO, TX 77545

OVERALL LAYOUT

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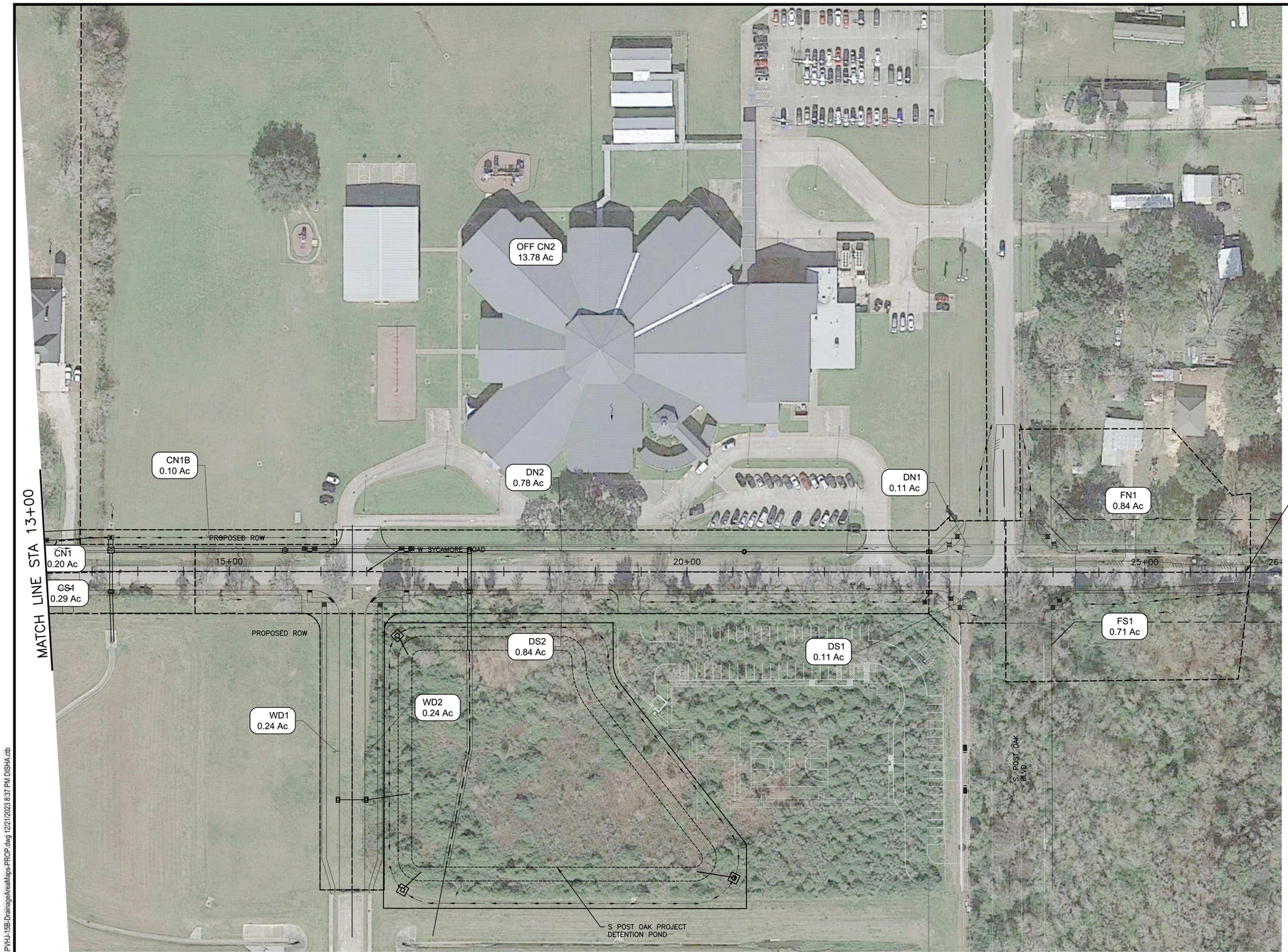
02.29.2024

STATE OF TEXAS
AMANDA F. BARBER
122357
LICENSED
PROFESSIONAL ENGINEER
2024-02-28

C0.07



NO.	DATE	REVISION	APPROVED

INTERIM REVIEW ONLY

Not to be used for construction, bidding, permit or regulatory approval purposes.This document is released for the purpose of interim review under the authority of:

HARISH C. JAJOO

62217
Registration Number

12/21/2023
Date

4771 Sweetwater Blvd Suite 254
Sugar Land, Texas, 77479
(832) 338-3202 C (832) 553-3103 F
TBPE FIRM F-15945

FORT BEND COUNTY
ENGINEERING DEPARTMENT

WEST SYCAMORE ROAD
FROM EAGLEWOOD TO S. POST OAK

PROPOSED
DRAINAGE AREA MAP
SHEET 2 OF 2

PROJECT NUMBER
17122x
DRAWING SCALE
1"=100'

SHEET NO. 48 OF 102

95% SUBMITTAL

2004PVNJ-15B-DrainageAreaMaps-PROP.dwg 12/21/2023 8:37 PM DISHA.ctb

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

STRUCTURAL ENGINEER
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TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

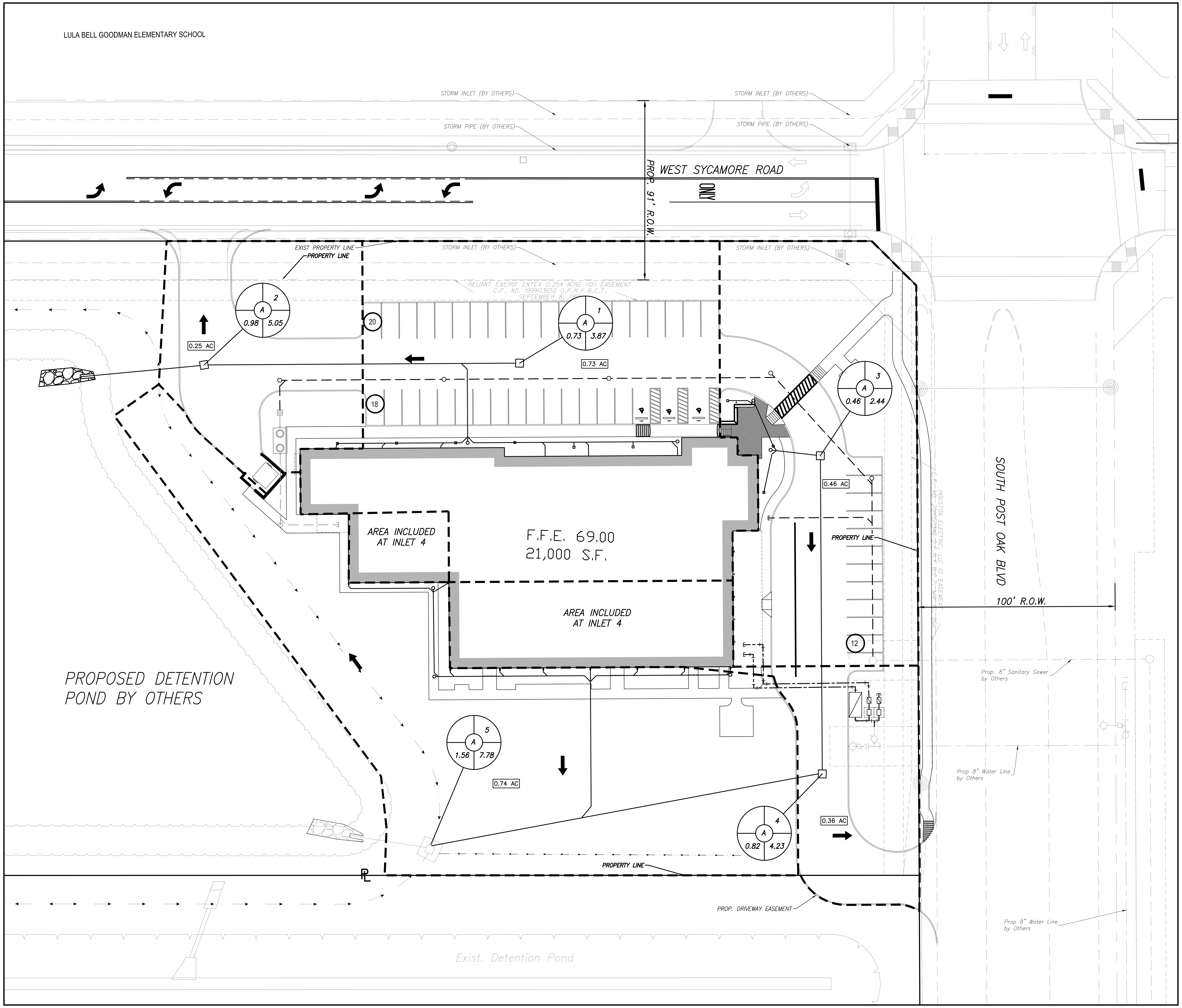
NO.	DATE	DESCRIPTION

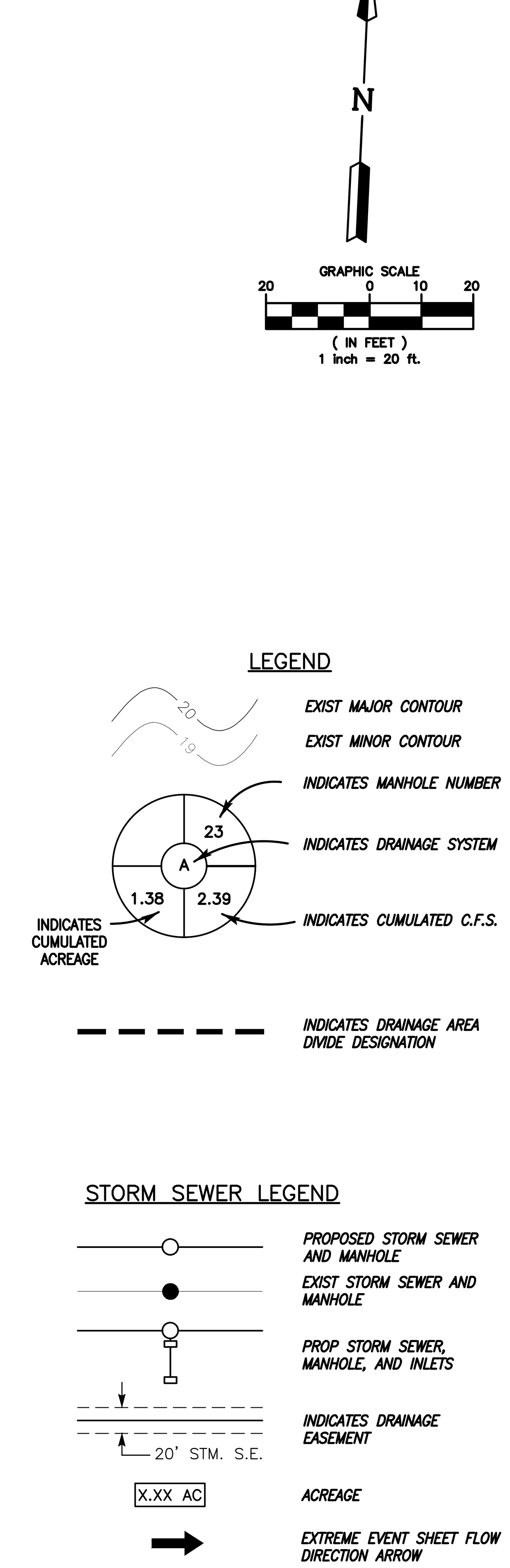
FRESNO BOYS & GIRLS CLUB
DETENTION SERVICE AREA - 031 W SYCAMORE RD
FRESNO, TX 77545
MAP

100% Construction Document
02.29.2024

C0.08

INCLUDED FOR REFERENCE ONLY


LULA BELL GOODMAN ELEMENTARY SCHOOL
STORM INLET (BY OTHERS)
STORM PIPE (BY OTHERS)
WEST SYCAMORE ROAD
PROP. 91' R.O.W.
ONLY
EXIST PROPERTY LINE
PROPERTY LINE
RELIANT ENERGY ENTEX 0.254 ACRE (10') EASEMENT
0.25 AC
0.73 AC
0.46 AC
0.74 AC
0.36 AC
AREA INCLUDED AT INLET 4
F.F.E. 69.00
21,000 S.F.
SOUTH POST OAK BLVD
100' R.O.W.
PROPOSED DETENTION POND BY OTHERS
Prop. 8" Sanitary Sewer by Others
Prop 8" Water Line by Others
PROP. DRIVEWAY EASEMENT
Exist. Detention Pond


N
GRAPHIC SCALE
20 0 10 20
(IN FEET)
1 inch = 20 ft.
LEGEND
EXIST MAJOR CONTOUR
EXIST MINOR CONTOUR
INDICATES MANHOLE NUMBER
INDICATES DRAINAGE SYSTEM
INDICATES CUMULATED C.F.S.
INDICATES CUMULATED ACREAGE
INDICATES DRAINAGE AREA DIVIDE DESIGNATION
STORM SEWER LEGEND
PROPOSED STORM SEWER AND MANHOLE
EXIST STORM SEWER AND MANHOLE
PROP STORM SEWER, MANHOLE, AND INLETS
INDICATES DRAINAGE EASEMENT
20' STM. S.E.
ACREAGE
EXTREME EVENT SHEET FLOW DIRECTION ARROW

SMITH&COMPANY ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
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HOUSTON, TX 77024

STRUCTURAL ENGINEER
STANLEY SPURLING & HAMILTON INC.
3301 EDLOE ST.
HOUSTON, TX 77027

CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., SUITE 260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE
647 RICHMOND AVE., SUITE 220
HOUSTON, TX 77057
TBPE FIRM REG:#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
`031 W SYCAMORE RD
FRESNO, TX 77545

DRAINAGE AREA MAP

100% Construction Document
02.29.2024

STATE OF TEXAS
AMANDA F. BARBER
122357
LICENSED
PROFESSIONAL ENGINEER
2024-02-28

C0.09

Design Frequency: 3 years

E	0.7063
B	48.73
D	8.37

NOTE	INLET From	INLET To	BASIN AREA ac	TOTAL AREA ac	TC minute	Avg C	Freq Factor	Cf	i	Ci	CUM Q cfs	Manning's n	REACH ft	LINE SIZE in	LINE SLOPE %	DESIGN Q cfs	DESIGN V fps	FLOWLINE UP-STREAM	FLOWLINE DOWN-STREAM	ACT.V fps	SLOPE HYD. GRAD. (%)	delta H ft	ELEV. HYD. GRAD. UP-STREAM	ELEV. HYD. GRAD. DOWN-STREAM	TC @ INLET UPSTR	HG DIST BELOW TC ft
On-Site Private																										
Sys 1	1	2	0.73	0.73	10.00	0.85	1.00	0.85	6.24	5.30	3.87	0.011	161	15	0.33	4.40	3.58	63.46	62.92	3.15	0.255	0.411	64.58	64.17	67.15	2.57
	2	5	0.25	0.98	10.75	0.85	1.00	0.85	6.06	5.15	5.05	0.011	63	24	0.18	11.39	3.62	62.17	62.06	1.61	0.035	0.022	64.08	64.06	67.50	3.42
	3	4	0.46	0.46	10.00	0.85	1.00	0.85	6.24	5.30	2.44	0.011	161	15	0.33	4.40	3.58	64.06	63.53	1.98	0.101	0.163	64.94	64.78	67.25	2.31
	4	5	0.36	0.82	10.75	0.85	1.00	0.85	6.06	5.15	4.23	0.011	199	18	0.26	6.36	3.59	63.28	62.76	2.39	0.115	0.229	64.49	64.26	66.45	1.96
	5	OUT	0.74	1.56	11.67	0.85	1.00	0.85	5.86	4.98	7.78	0.013	39	24	0.18	9.64	3.06	62.26	62.19	2.47	0.117	0.046	64.24	64.19	66.45	2.21

Design Frequency: 100 years

E	0.5274
B	42.99
D	1.08

NOTE	INLET From	INLET To	BASIN AREA ac	TOTAL AREA ac	TC minute	Avg C	Freq Factor	Cf	i	Ci	CUM Q cfs	Manning's n	REACH ft	LINE SIZE in	LINE SLOPE %	DESIGN Q cfs	DESIGN V fps	FLOWLINE UP-STREAM	FLOWLINE DOWN-STREAM	ACT.V fps	SLOPE HYD. GRAD. (%)	delta H ft	ELEV. HYD. GRAD. UP-STREAM	ELEV. HYD. GRAD. DOWN-STREAM	TC @ INLET UPSTR	HG DIST BELOW TC ft
On-Site Private																										
Sys 1	1	2	0.73	0.73	10.00	0.85	1.25	1.00	12.09	12.09	8.83	0.011	161	15	0.33	4.40	3.58	63.46	62.92	7.18	1.326	2.141	66.36	64.22	67.15	0.79
	2	OUT 1	0.25	0.98	10.75	0.85	1.25	1.00	11.68	11.68	11.45	0.013	63	24	0.18	9.64	3.06	62.17	62.06	3.64	0.254	0.160	64.22	64.06	67.50	3.28
	3	4	0.46	0.46	10.00	0.85	1.25	1.00	12.09	12.09	5.56	0.011	161	15	0.33	4.40	3.58	64.06	63.53	4.53	0.527	0.848	66.44	65.60	67.25	0.81
	4	5	0.36	0.82	10.75	0.85	1.25	1.00	11.68	11.68	9.58	0.011	199	18	0.26	6.36	3.59	63.28	62.76	5.41	0.591	1.175	65.60	64.42	66.45	0.85
	5	OUT 2	0.74	1.56	11.67	0.85	1.25	1.00	11.23	11.23	17.51	0.013	39	24	0.18	9.64	3.06	62.26	62.19	5.57	0.595	0.232	64.42	64.19	66.45	2.03

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

STRUCTURAL ENGINEER
STANLEY SPURLING & HAMILTON INC.
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LJA ENGINEERING
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LANDSCAPE ARCHITECT
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MEP ENGINEER
INFRASTRUCTURE
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TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023

DATE ISSUED: 02.29.2024

TDLR #: TABS2024011699

REVISIONS:

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FRESNO BOYS & GIRLS CLUB
DRAINAGE CALCULATIONS - 031 W SYCAMORE RD
FRESNO, TX 77545

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STATE OF TEXAS
AMANDA F. BARBER
122357
LICENSED
PROFESSIONAL ENGINEER
2024-02-28

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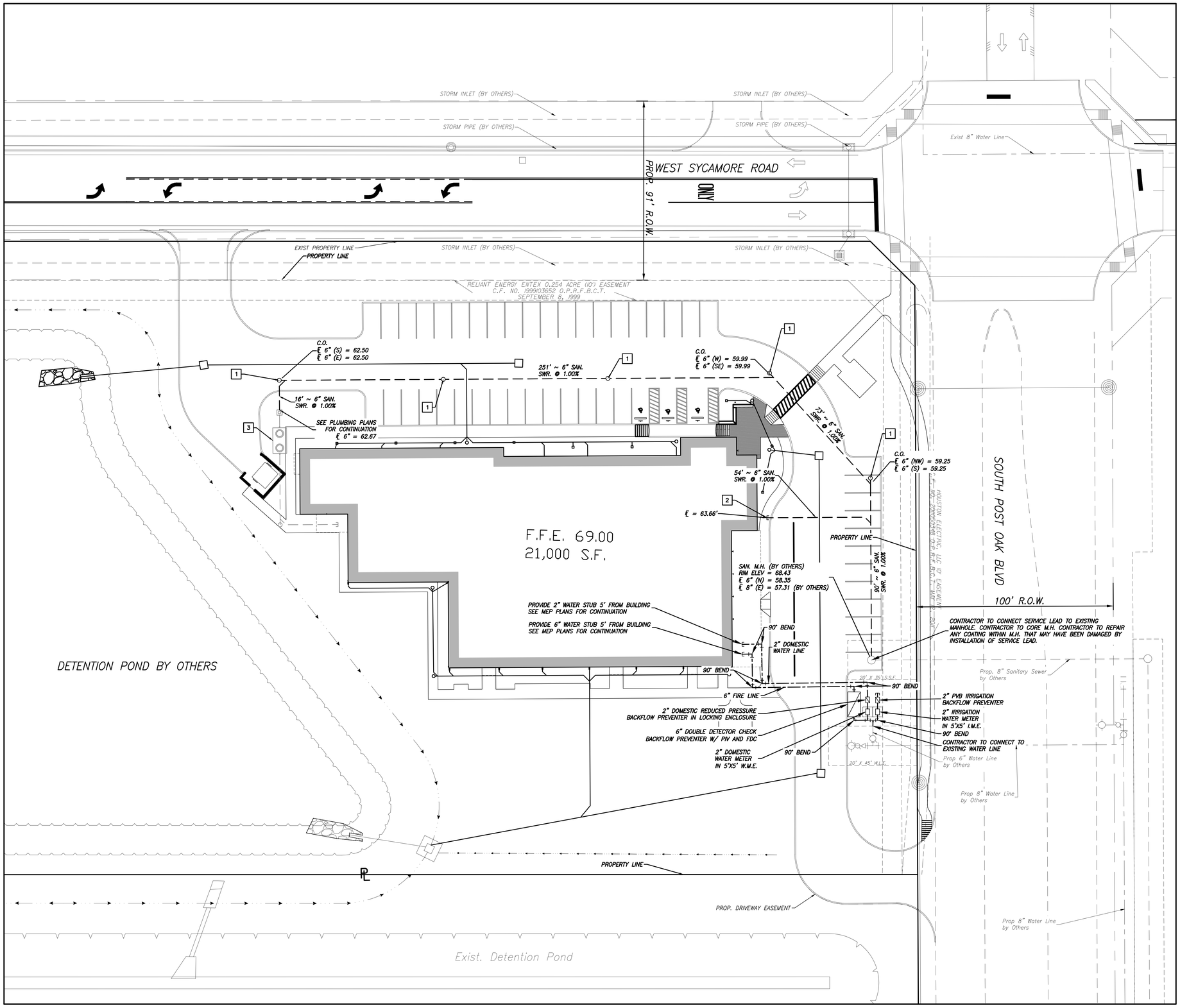
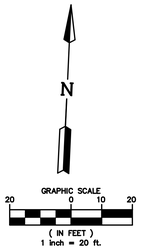




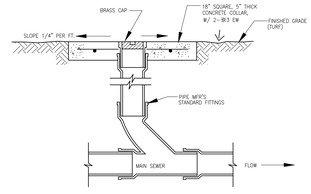
LEGEND

- PROPOSED WATER LINE AND GATE VALVE AND BOX
- PROPOSED WATER LINE W/BENDS
- PROPOSED WATER LINE W/TEE
- PROPOSED WATER LINE W/FLUSHING VALVE UNIT
  A. LINE SIZE X 6" TEE
  B. 6" GATE VALVE AND BOX
  C. FLUSHING VALVE
- EXISTING WATER LINE SYSTEM
- PROPOSED SANITARY SEWER AND MANHOLE
- EXISTING SANITARY SEWER AND MANHOLE
- 10 — INDICATES SHEET REFERENCE NUMBER
- W.L.E. — INDICATES WATER LINE EASEMENT
- STM.S.E. — INDICATES STORM SEWER EASEMENT
- S.S.E. — INDICATES SANITARY SEWER EASEMENT

PIPING MATERIAL SCHEDULE	
WATER LINES (MIN. 4' COVER)	
PIPE DIAMETER	MATERIAL
2" AND SMALLER	SCHEDULE 40 PVC
4"–12"	AWWA C-900-07 PVC DR-18
SANITARY SEWER	
PIPE DIAMETER	MATERIAL
UP TO 6"	SCH 40 (ASTM D1765)
8" AND LARGER	SDR-26 (ASTM D3034)
STORM SEWER	
PIPE DIAMETER	MATERIAL
LESS THAN 10"	SDR 35 PVC OR ENGINEER APPROVED EQUAL
10" – 42"	HANCOR DUAL WALL (SOIL TIGHT-ST) HDPE OR ENGINEER APPROVED EQUAL

SEWER KEY NOTES:

1. CONTRACTOR TO INSTALL CLEANOUT TO GRADE. ALL CLEANOUTS IN PAVEMENT TO HAVE TRAFFIC DUTY CLEANOUT BOX.
2. STUB 5' FROM BUILDING. SEE PLUMBING PLANS FOR CONTINUATION. VERIFY EXACT LOCATION.
3. PROPOSED GREASE TRAP, SHOWN FOR LOCATION APPROVAL PURPOSES ONLY (SEE MEP PLANS FOR DETAIL)



INSTALL IN FLOW DIRECTION OR AS INDICATED ON THE PLANS. CLEANOUT IN PAVEMENT SIMILAR.

SANITARY SEWER CLEANOUT DETAIL

SMITH&COMPANY
ARCHITECTS

ARCHITECT
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TBPE FIRM REG.#F-4506

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TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
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PROJECT #: N032023
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FRESNO BOYS & GIRLS CLUB
031 W SYCAMORE RD
FRESNO, TX 77545

WATER AND SANITARY SEWER LAYOUT

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STATE OF TEXAS
AMANDA F. BARBER
122357
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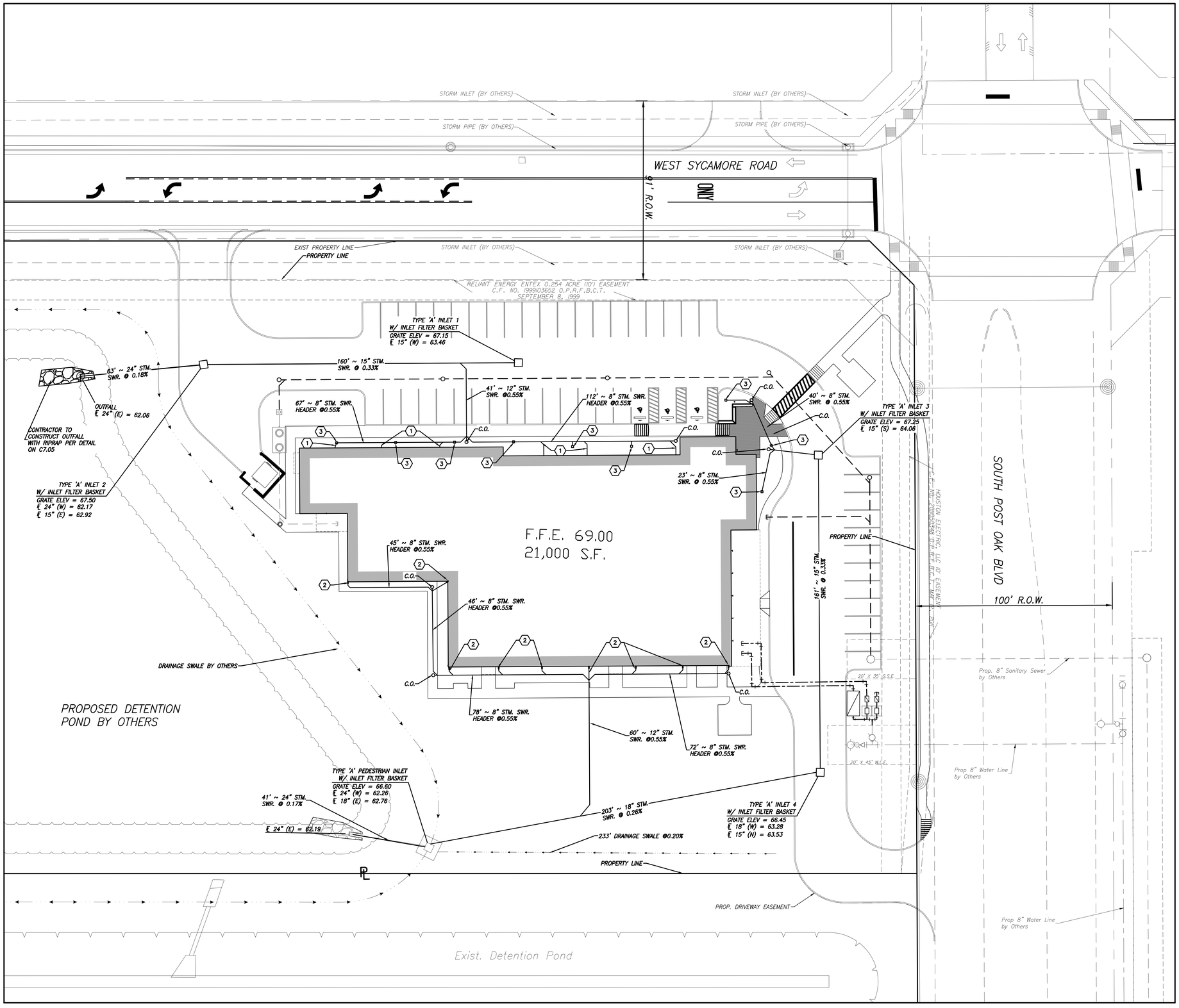
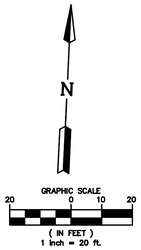
PROFESSIONAL ENGINEER
2024-02-28

C1.00





LEGEND

- PROP. LIGHT POLE (SEE ELECTRICAL PLANS)
- STORM SEWER W/ MANHOLE
- TYPE 'A' INLET
- TYPE 'E' INLET
- 'H-2' INLET
- JUNCTION BOX
- NYLOPLAST INLET
- PUBLIC STORM SEWER
- PUBLIC WATER
- PUBLIC SANITARY SEWER

PIPING MATERIAL SCHEDULE	
WATER LINES (MIN. 4' COVER)	
PIPE DIAMETER	MATERIAL
2" AND SMALLER	SCHEDULE 40 PVC
4"–12"	AWWA C-900-07 PVC DR-18
SANITARY SEWER	
PIPE DIAMETER	MATERIAL
UP TO 6"	SCH 40 (ASTM D1765)
8" AND LARGER	SDR-26 (ASTM D3034)
STORM SEWER	
PIPE DIAMETER	MATERIAL
LESS THAN 10"	SDR 35 PVC OR ENGINEER APPROVED EQUAL
10" – 42"	HANCOR DUAL WALL (SOIL TIGHT-ST) HDPE OR ENGINEER APPROVED EQUAL

STORM SEWER NOTES:

1. ALL TYPE A INLETS WILL BE INSTALLED WITH AN INLET FILTER BASKET

STORM SEWER KEY NOTES:

1. 8" STM. SWR. INTERNAL ROOF DRAIN LEAD
2. 8" STM. SWR. DOWNSPOUT LEAD
3. LANDSCAPE DRAINS

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LANDSCAPE ARCHITECT
STUDIO AVID
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SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE
647 RICHMOND AVE., SUITE 220
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

STORM SEWER LAYOUT

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02.29.2024

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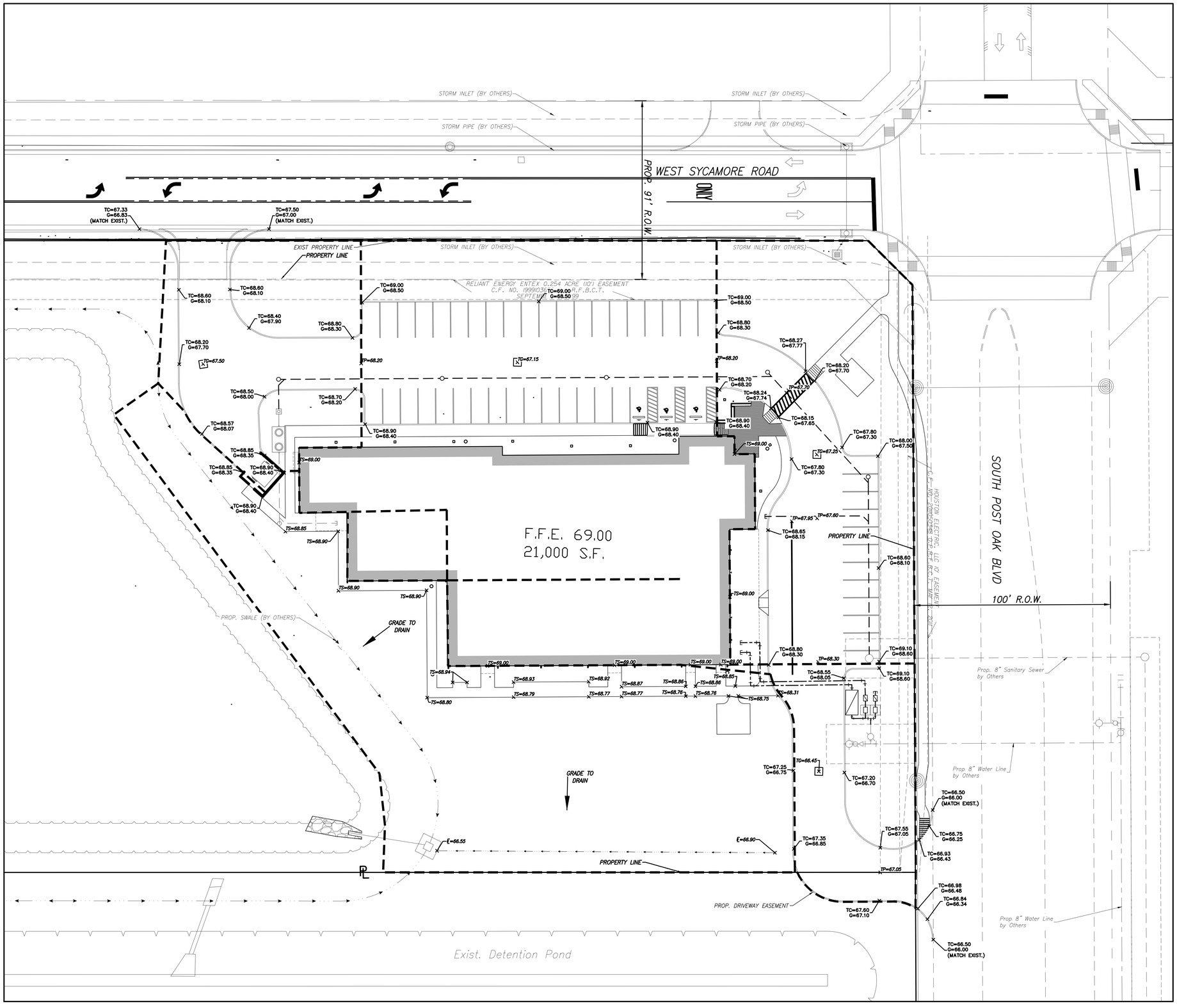

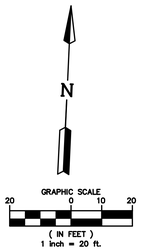

LEGEND

- EXIST MAJOR CONTOUR
- EXIST MINOR CONTOUR
- BLOCK NUMBER
- INDICATES PAVING SUMMIT
- PROPOSED ELEVATION
- DRAINAGE AREA DIVIDE

TC	TOP OF CURB
FG	FINISHED GRADE
G	GUTTER
TG	TOP OF GRATE
TS	TOP OF SIDEWALK
℄	FLOWLINE

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GRADING LAYOUT

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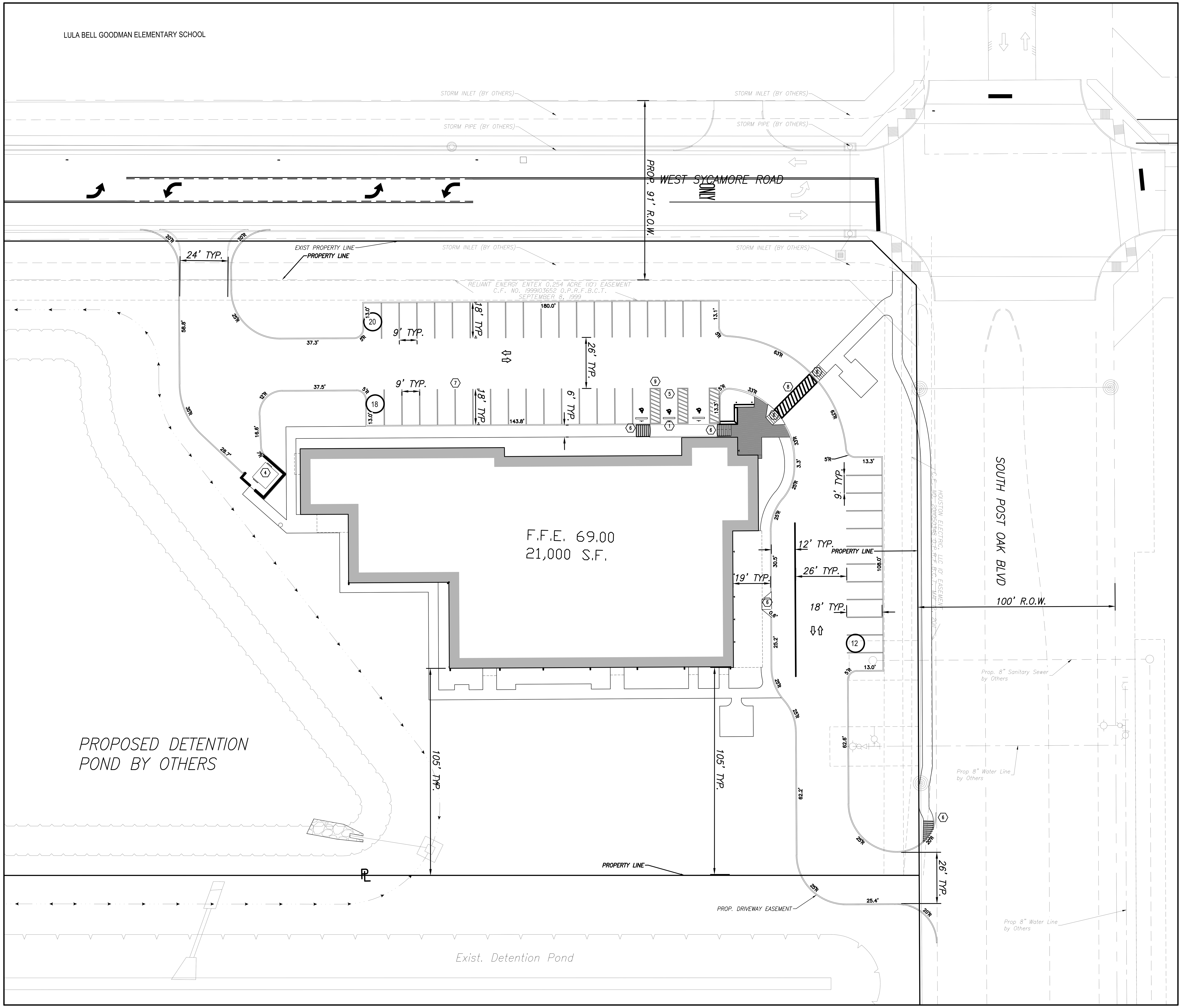

N

GRAPHIC SCALE

20 0 10 20

(IN FEET)
1 inch = 20 ft.

SITE DETAILS

1. ADA HANDICAP/VAN ACCESSIBLE SIGN SEE DETAIL SHEET C7.11
2. R1–1 STOP SIGN
3. PROPOSED TRAFFIC DIRECTION
4. DUMPSTER ENCLOSURE RE: ARCHITECTURAL PLANS
5. HANDICAP ACCESSIBLE PARKING SPOT, SEE DETAIL SHEET C7.11
6. ADA ACCESS & PEDESTRIAN RAMP SEE DETAIL SHEET C7.10
7. INSTALL 4" PARKING STRIPE. CONTRACTOR TO COORDINATE COLOR WITH ARCHITECTURAL PLANS.
8. PEDESTRIAN CROSSWALK
9. ADA STRIPING SEE DETAIL ON SHEET C7.11

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DIMENSION CONTROL LAYOUT

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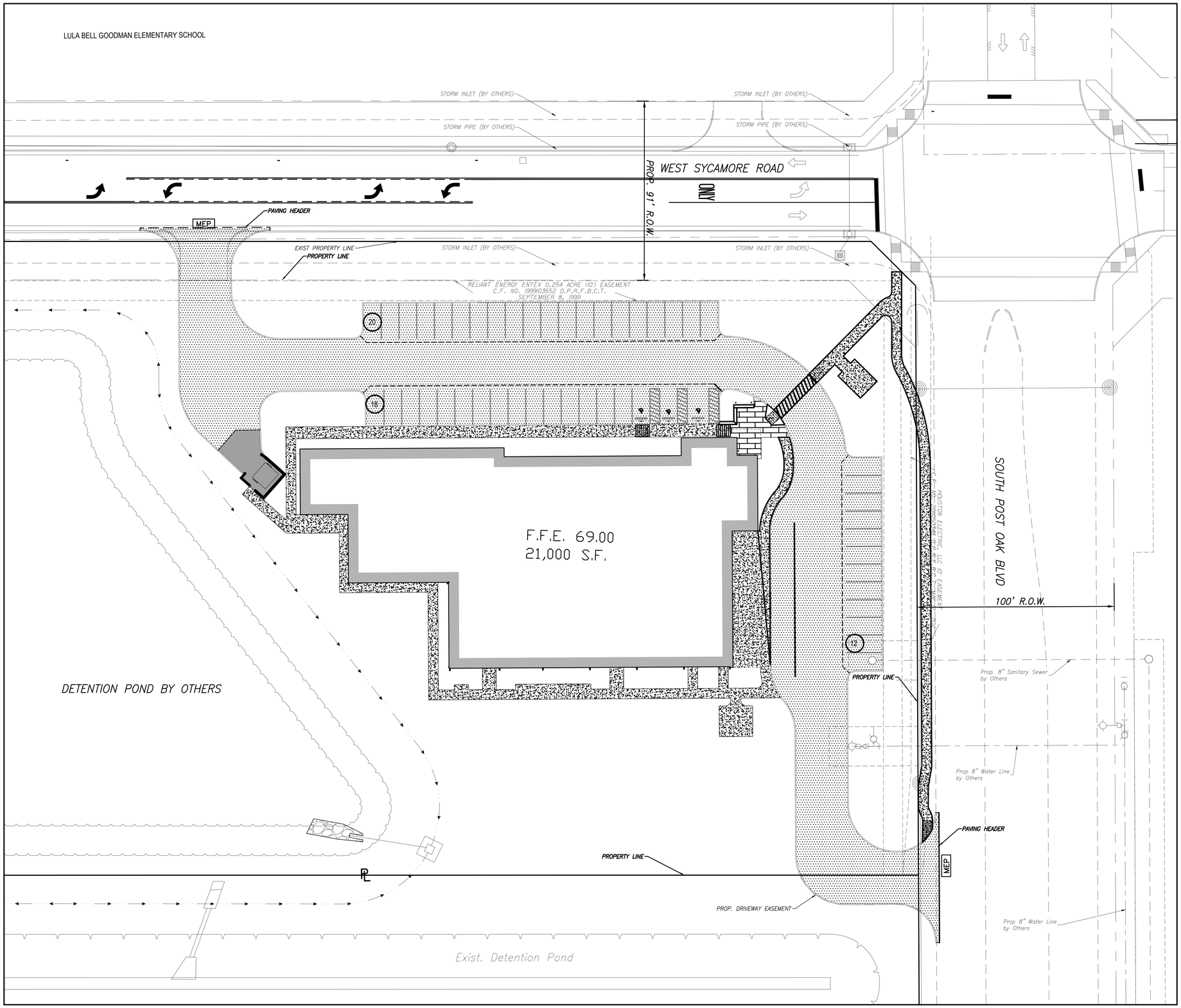

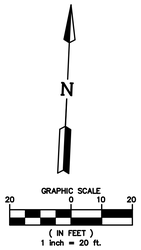

PAVEMENT LEGEND

- 6" CONCRETE PAVEMENT (DI-3)
- 7" CONCRETE PAVEMENT (DI-3)
- 4.5" SIDEWALK
- BRICK PAVER PATIO
- EXPANSION JOINT
- MEP — MATCH EXISTING PAVEMENT (SEE CONCRETE-TO CONCRETE TIE-IN DETAIL)

PAVING NOTES:
THE FOLLOWING PAVEMENT RECOMMENDATIONS ARE ADOPTED FROM THE GEOTECHINCAL ENGINEERING REPORT BY ASSOCIATED TESTING LABORATORIES ENTITLED GEOTECHNICAL GEOTECHNICAL INVESTIGATION, PROPSED FORT BEND COUNTY FRESNO COMMUNITY CENTER DATED JULY 18, 2023, PROJECT NUMBER G23-161. CONTRACTOR SHALL ADHERE TO ALL RECOMMENDATIONS OF THE GEOTECHNICAL REPORT. WHERE A RECOMMENDATION CONTAINED IN THIS DRAWING SET DIFFERS FROM THOSE OUTLINED IN THE GEOTECHNICAL REPORT, THE RECOMMENDATIONS OF THE GEOTECHNICAL REPORT SHALL GOVERN.

SUBGRADE:
THE PAVEMENT SUBGRADE SHOULD BE PLACED IN LOOSE LIFTS NOT EXCEEDING 8-INCHES AND SHOULD BE UNIFORMLY COMPACTED TO A MINIMUM OF 95 PERCENT MAXIMUM DRY DENSITY (PER ASTM D-698) AND WITHIN +/-2 PERCENT OF THE OPTIMUM MOISTURE CONTENT. THE SUBGRADE SHALL BE SCARIFIED AND TREATED WITH 6 TO 8% LIME BY WEIGHT WITH AN APPLICATION DEPTH OF EIGHT (8) INCHES LIME STABILIZATION SHOULD BE PERFORMED IN ACCORDANCE WITH TXDOT STANDARD SPECIFICATIONS, ITEM 260, "LIME STABILIZED SUBGRADE" OR LOCAL EQUIVALENT.

PAVEMENT THICKNESS:
PAVEMENT THICKNESSES SHALL BE 6-INCHES OR 7-INCHES (SEE PLAN).

PAVEMENT:
THE PAVEMENT SHALL BE PORTLAND CEMENT CONCRETE PAVEMENT. THE MATERIALS AND PROPERTIES OF A PORTLAND CEMENT CONCRETE PAVEMENT SHALL MEET APPLICABLE REQUIREMENTS IN THE ACI MANUAL OF CONCRETE PRACTICE. THE PORTLAND CEMENT CONCRETE MIX SHOULD HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 4,000 PSI.

REINFORCING STEEL:
GRADE 60 REINFORCING STEEL SHOULD BE UTILIZED IN THE TRANSVERSE AND LONGITUDINAL DIRECTIONS. THE FOLLOWING PAVEMENT REINFORCEMENTS ARE RECOMMENDED:
SIX-INCH (6") CONCRETE PAVEMENT SHALL BE REINFORCED USING #3 BARS SPACED AT 18 INCHES ON CENTER, EACH WAY.
SEVEN-INCH (7") CONCRETE PAVEMENT SHALL BE REINFORCED USING #3 BARS SPACES AT 18 INCHES ON CENTER, EACH WAY.

JOINT SPACING:
CONTRACTION JOINTS SHOULD BE SPACED AT ABOUT 24 TIMES THE PAVEMENT THICKNESS UP TO A MAXIMUM OF 15 FEET IN ANY DIRECTION. SAW CUT CONTROL JOINTS SHOULD BE CUT WITHIN 6 TO 12 HOURS OF CONCRETE PLACEMENT.

EXPANSION JOINTS SHOULD BE SPACED A MAXIMUM OF 60-FEET APART IN ANY DIRECTION AND SHOULD BE PLACED WHERE THE PAVEMENT ABUTS ANY STRUCTURE. DOWELS SHOULD HAVE A DIAMETER EQUAL TO 1/8 THE SLAB THICKNESS, BE SPACED ON 12-INCH INTERVALS, AND BE EMBEDDED AT LEAST 9-INCHES. WHERE NOT SPECIFIED HEREIN, CONCRETE PAVEMENT SHOULD COMPLY WITH TEXAS DEPARTMENT OF TRANSPORTATION (TXDOT) STANDARD SPECIFICATIONS, ITEM 360, "CONCRETE PAVEMENT", OR LOCAL EQUIVALENT.

CONSTRUCTION JOINTS:
WHEN CONCRETE IS PLANNED TO BE PLACED AT DIFFERENT TIMES, CONTRACTOR SHALL USE A CONSTRUCTION JOINT BETWEEN PAVING AREAS. THE CONSTRUCTION JOINT SHOULD CONSIST OF A BUTT JOINT (NOT A KEYWAY JOINT).

DOWELS AT EXPANSION JOINTS:
THE DOWELS AT EXPANSION JOINTS SHOULD BE SPACED AT 12-INCH CENTERS AND CONSIST OF THE FOLLOWING:
5-INCH PAVEMENT: 5/8-INCH DIAMETER, 18 INCHES LONG WITH 9-INCH EMBEDMENT
6-INCH PAVEMENT: 3/4-INCH DIAMETER, 18 INCHES LONG WITH 9-INCH EMBEDMENT
7-INCH PAVEMENT: 7/8-INCH DIAMETER, 18 INCHES LONG WITH 9-INCH EMBEDMENT

JOINT SEALANT:
TRANSPORTATION (TXDOT) STANDARD SPECIFICATIONS, ITEM 360, "CONCRETE PAVEMENT", OR LOCAL EQUIVALENT. APPROPRIATE JOINT SEALANT IS RECOMMENDED TO KEEP WATER FROM SATURATING THE PAVEMENT SUBGRADE AND TO PREVENT THE INTRODUCTION OF INCOMPRESSIBLE MATERIAL INTO THE JOINTS. ROUTINE MONITORING AND MAINTENANCE OF JOINT SEALANTS ARE RECOMMENDED.

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031 W SYCAMORE RD
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PAVING LAYOUT

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02.29.2024

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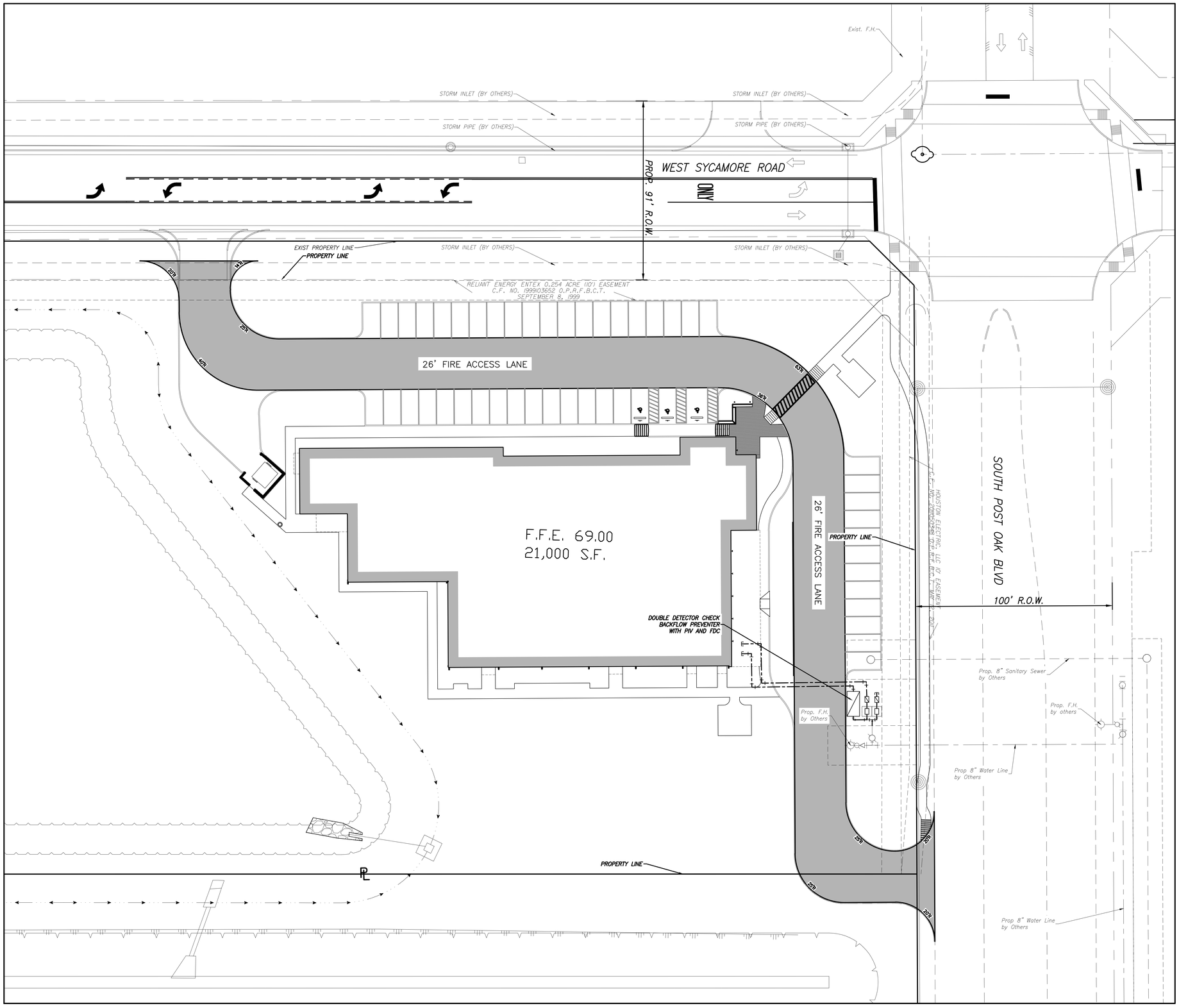

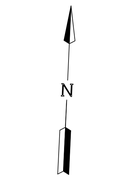

LEGEND

- FIRE LANE
- FH — FIRE HYDRANT
- FIRE DEPARTMENT CONNECTION
- POST INDICATOR VALVE

FIRE CODE NOTES:

1. CURBS LOCATED ON EITHER SIDE OF A FIRE LANE SHALL BE PAINTED RED OR A RED STRIPE SHALL BE PLACED ALONG THE PAVEMENT WHERE THERE IS NO CURB.

2. WHERE A FIRE LANE PASSES BETWEEN HEAD-IN PARKING SPACES, THE RED STRIPE SHOULD BE PLACED ALONG THE REAR OF THESE SPACES CLEARLY DEFINING THE FIRE LANE.

3. BOTH SIDES OF THE FIRE APPARATUS ACCESS ROADS SHALL BE CONTINUOUSLY MARKED BY PAINTED LINES OF RED TRAFFIC PAINT SIX INCHES (6") IN WIDTH WITH WHITE LETTERING FOUR INCHES (4") HIGH AND AT LEAST ONE HALF-INCH (1/2") STROKE, STATING "NO PARKING FIRE LANE – TOW AWAY ZONE". WORDING MAY NOT BE SPACED MORE THAN TWENTY FIVE FEET (25') APART. FIRE LANES SHALL BE MARKED ON BOTH SIDES OF ACCESS ROADS SO AS TO ASSURE A MINIMUM 26' CLEAR WIDTH IN THE MIDDLE OF SAID ACCESS ROADS.

4. WHERE FIRE LANES ARE CLEARLY DEFINED BY CURB/PAVEMENT STRIPING, FIRE LANE SIGNS ARE NOT REQUIRED.

5. WHERE SIGNS ARE REQUIRED – SIGNS SHALL READ "NO PARKING FIRE LANE" OR "FIRE LANE NO PARKING" AND SHALL BE 12" WIDE AND 18" HIGH. SIGNS SHALL BE PAINTED ON A WHITE BACKGROUND WITH LETTERS AND BORDERS IN RED, USING NOT LESS THAN 2" LETTERING. SIGNS SHALL BE PERMANENTLY AFFIXED TO A STATIONARY POST AND THE BOTTOM OF THE SIGN SHALL BE SIX FEET, SIX INCHES (6'6") ABOVE GRADE. SIGNS SHALL BE SPACED NOT MORE THAN FIFTY FEET (50') APART ALONG BOTH SIDES OF THE FIRE LANE. SIGNS MAY BE INSTALLED ON PERMANENT BUILDINGS OR WALLS OR AS APPROVED BY THE FIRE MARSHAL.

5. FIRE LANES SHALL HAVE A TURNING RADIUS OF A MINIMUM TWENTY-FIVE (25) FEET FOR TURNS INSIDE THE PROPERTY.

6. FIRE LANES SHALL HAVE AN UNOBSTRUCTED VERTICAL CLEARANCE OF AT LEAST THIRTEEN AND ONE-HALF (13.5) FEET.

7. FIRE LANES SHALL BE AT LEAST TWENTY-SIX (26) FEET IN WIDTH IN THE IMMEDIATE VICINITY OF ANY BUILDING EXCEEDING THIRTY (30) FEET IN HEIGHT.

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FIRE ACCESS LAYOUT

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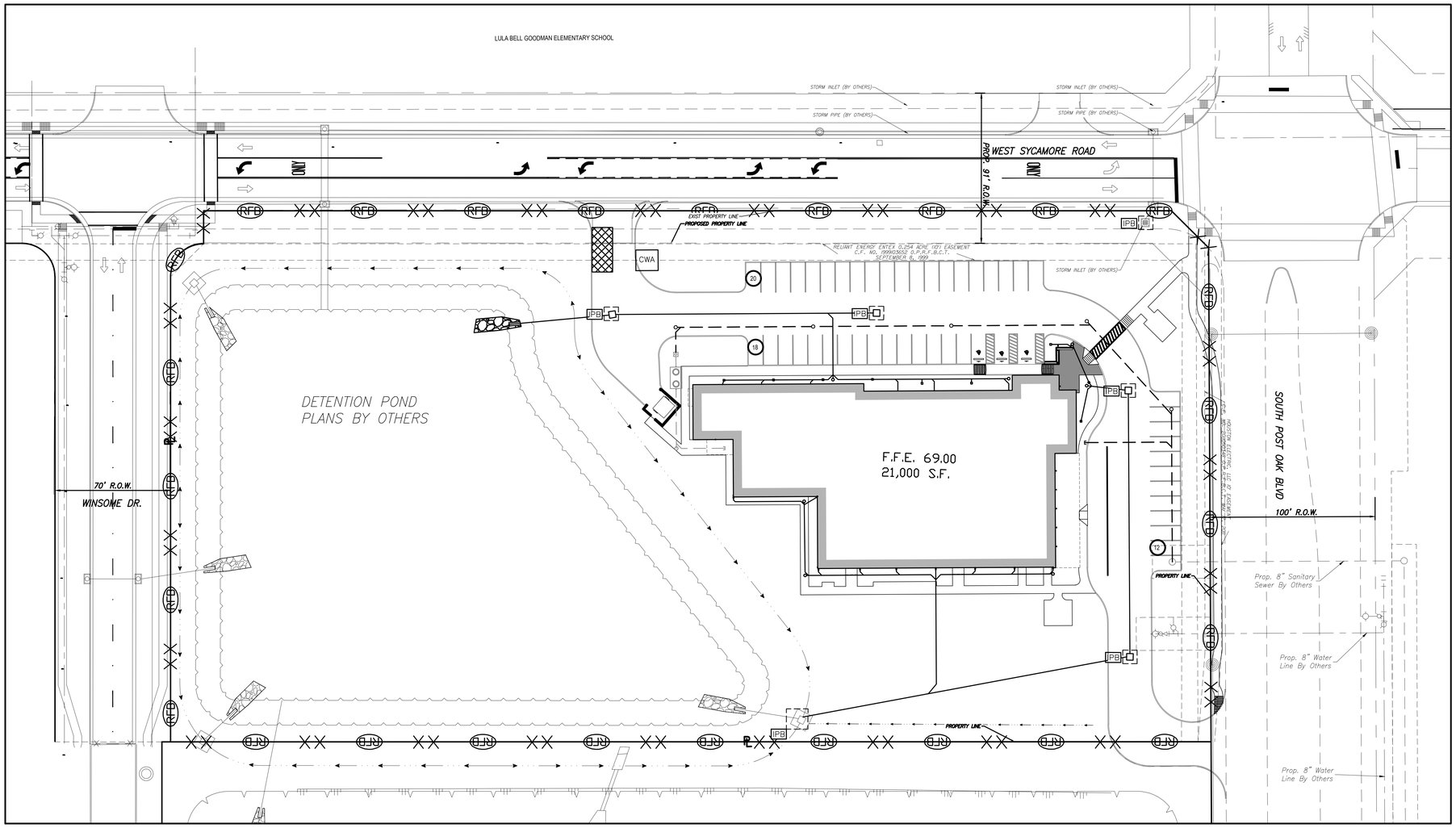

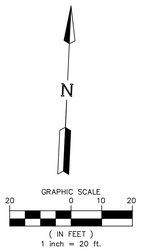

LEGEND

- TEMPORARY STONE CONSTRUCTION ENTRANCE EXIT (SEE DETAILS SHEET C9.9)
- REINFORCED FILTER FABRIC SILT BARRIER FENCE
- CWA — INDICATES CONCRETE WASH OUT AREA
- IPB — INLET PROTECTION BARRIER

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SWPPP LAYOUT

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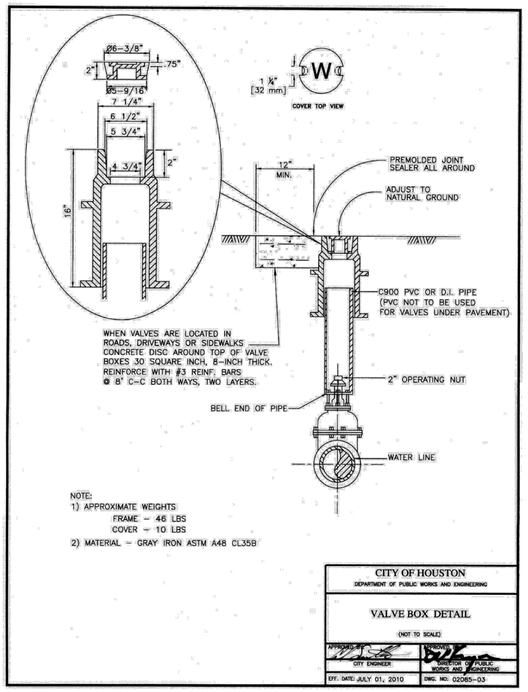


NOTE:
1) APPROXIMATE WEIGHTS
FRAME – 46 LBS
COVER – 10 LBS
2) MATERIAL – GRAY IRON ASTM A48 CL35B

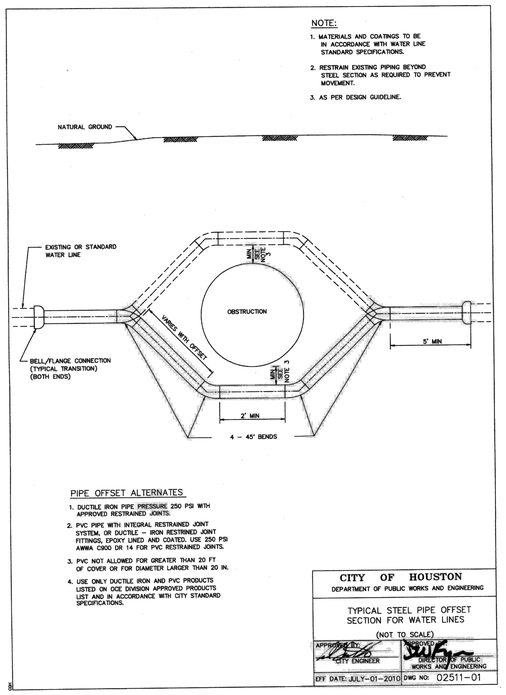
CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

VALVE BOX DETAIL

(NOT TO SCALE)

APPROVED BY: CITY ENGINEER | APPROVED: DIRECTOR OF PUBLIC WORKS AND ENGINEERING
EFF. DATE: JULY 01, 2010 | DWG. NO.: 02065-03

VALVE BOX DETAIL



PIPE OFFSET ALTERNATES

1. DUCTILE IRON PIPE PRESSURE 250 PSI WITH APPROVED RESTRAINED JOINTS.
2. PVC PIPE WITH INTEGRAL RESTRAINED JOINT SYSTEM, OR DUCTILE – IRON RESTRINED JOINT FITTINGS, EPOXY LINED AND COATED. USE 250 PSI AWWA C900 OR 14 FOR PVC RESTRAINED JOINTS.
3. PVC NOT ALLOWED FOR GREATER THAN 20 FT OF COVER OR FOR DIAMETER LARGER THAN 20 IN.
4. USE ONLY DUCTILE IRON AND PVC PRODUCTS LISTED ON OCE DIVISION APPROVED PRODUCTS LIST AND IN ACCORDANCE WITH CITY STANDARD SPECIFICATIONS.

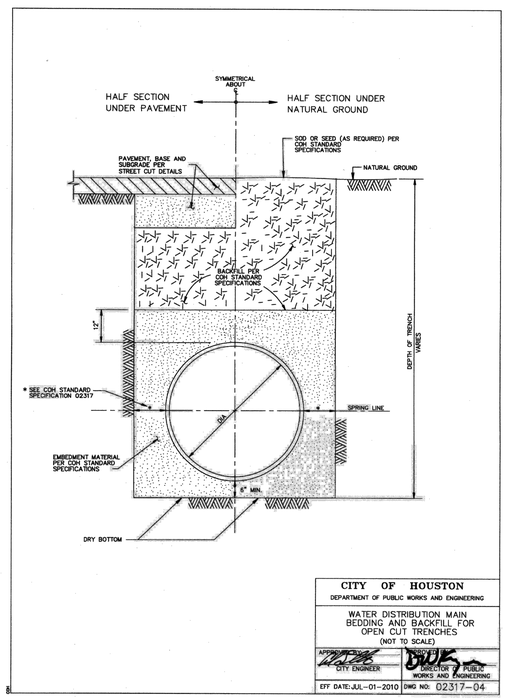
CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

TYPICAL STEEL PIPE OFFSET SECTION FOR WATER LINES

(NOT TO SCALE)

APPROVED BY: CITY ENGINEER | APPROVED: DIRECTOR OF PUBLIC WORKS AND ENGINEERING
EFF DATE: JULY-01-2010 | DWG NO: 02511-01

WATER LINE OFFSET DETAIL



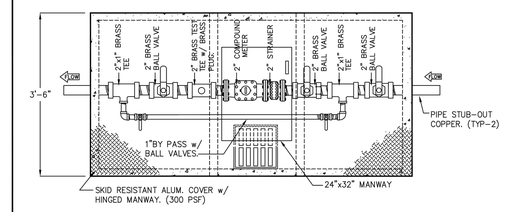
CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

WATER DISTRIBUTION MAIN BEDDING AND BACKFILL FOR OPEN CUT TRENCHES

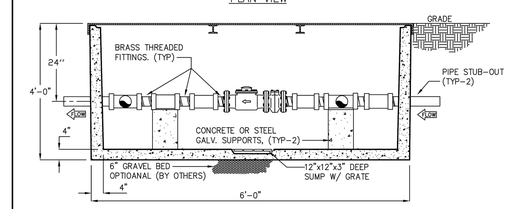
(NOT TO SCALE)

APPROVED BY: CITY ENGINEER | APPROVED: DIRECTOR OF PUBLIC WORKS AND ENGINEERING
EFF DATE: JUL-01-2010 | DWG NO: 02317-04

WATERLINE BEDDING DETAIL



PLAN VIEW



ELEVATION

Specifications

CONCRETE: Class I/II concrete with design strength of 4500 PSI at 28 days. Unit is of monolithic construction at floor and first stage of wall with sectional riser to required depth. Gross empty weight of approximately 5,000 pounds.

REINFORCEMENT: Grade 60 reinforced. Steel rebar conforming to ASTM A615 on required centers or equal.

ALUM. COVER: 1/4" aluminum skid-resistant floor plate welded to angle frame & hinged manway.

Engineering Data

Field excavation and preparation shall be completed prior to delivery of assembly. Use dimensional data as shown. Pipe, valves and fittings of the assembly are approved by one or more of the following associations:

AWWA | UL | NSF

PROJECT:	
CUSTOMER:	
ENGINEER:	
ORDER #:	
PROJ #:	
DATE:	

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DESIGN FOR WATER

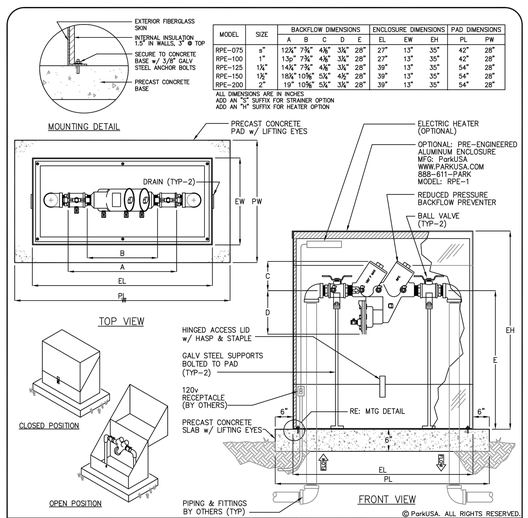
2" WATER METER ASSEMBLY

PM	DRN	ENG	DWG. NO.	REV.
DATE 08/2017			DMC-2	A

DOMESTIC WATER COMPOUND METER ASSEMBLY 2"

MODEL	SIZE	BACKFLOW DIMENSIONS A	B	C	D	E	ENCLOSURE DIMENSIONS EL	EW	EH	PAD DIMENSIONS PL	PW
RPE-075	¾"	12⅞"	7⅞"	4⅜"	3⅜"	28"	27"	13"	35"	42"	28"
RPE-100	1"	13⅜"	7⅞"	4⅜"	3⅜"	28"	27"	13"	35"	42"	28"
RPE-125	1¼"	14⅜"	7⅞"	4⅜"	3⅜"	28"	39"	13"	35"	54"	28"
RPE-150	1½"	16⅛"	10⅜"	5⅜"	4⅜"	28"	39"	13"	35"	54"	28"
RPE-200	2"	18"	10⅜"	5⅜"	3⅜"	28"	39"	13"	35"	54"	28"

ALL DIMENSIONS ARE IN INCHES
ADD AN "S" SUFFIX FOR STRAINER OPTION
ADD AN "H" SUFFIX FOR HEATER OPTION



Specifications

CONCRETE: Class I/II concrete with design strength of 4500 PSI at 28 days.

REINFORCEMENT: Grade 60 reinforced. Steel rebar conforming to ASTM A615 on required centers or equal.

Typical Applications

RP devices are used to protect against high hazard (toxic) fluids in water services to industrial plants, hospital facilities, morgues, mortuaries, and chemical plants. They are also used in irrigation systems, boiler feed, water lines and other installations requiring maximum protection.

Engineering Data

The backflow assembly shall be factory assembled on pad & hydrostatically tested prior to delivery. Field excavation & preparation shall be complete prior to delivery. Pipe, valves and fittings of the assembly shall be approved by one or more of the following associations:

FM | AWWA | UL | NSF | IAPMO | IPCP CERTIFIED PLANT

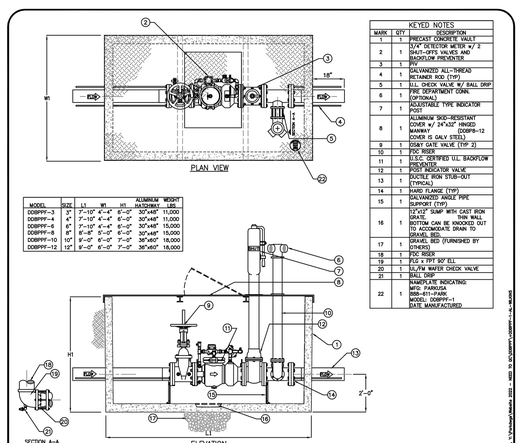
PROJECT:	
CUSTOMER:	
ENGINEER:	
ORDER #:	
PROJ #:	
DATE:	

888.611.PARK
www.parkusa.com
PARK USA
DESIGN FOR WATER

REDUCED PRESSURE BACKFLOW PREVENTER w/ INSULATED ENCLOSURE MODEL RPE – 3/4" THRU 2"

PM	DRN	ENG	DWG. NO.	REV.
DATE 2018			RPE-1	A

3/4" - 2" BACKFLOW PREVENTER



KEYED NOTES MARK	QTY	DESCRIPTION
1	1	PRECAST CONCRETE VAULT
2	1	3/4" DETECTOR METER w/ 2 SHUT-OFFS VALVES AND BACKFLOW PREVENTER
3	1	TEE
4	1	GALVANIZED ALL-THREAD RETAINER ROD (TYP)
5	1	3/4 CHECK VALVE w/ BALL DRIP
6	1	FIRE DEPARTMENT CONN. (OPTIONAL)
7	1	POST TABLE TYPE INDICATOR POST
8	1	ALUMINUM SKID-RESISTANT COVER w/ 24"x32" HINGED MANWAY (DDBPS-12 COVER IS GALV STEEL)
9	1	DSBY GATE VALVE (TYP 2)
10	1	PDC RISER
11	1	U.S.C. CERTIFIED U.L. BACKFLOW PREVENTER
12	1	POST INDICATOR VALVE
13	1	DUCTILE IRON STUB-OUT (TYPICAL)
14	1	HARD FLANGE (TYP)
15	1	GALVANIZED ANGLE PIPE SUPPORT (TYP)
16	1	12"x12" SUMP WITH CAST IRON GRATE. THIN WALL SECTION CAN BE KNOCKED OUT TO ACCOMODATE DRAIN TO GRAVEL BED.
17	1	GRAVEL BED (FURNISHED BY OTHERS)
18	1	PDC RISER
19	1	FLG x FPT 90° ELL
20	1	UL/FM WATER CHECK VALVE
21	1	BALL DRIP
22	1	NAMEPLATE INDICATING: MFG: PARKUSA 888-611-PARK MODEL: DDBPPF-1 DATE MANUFACTURED

MODEL	SIZE	L1	W1	H1	ALUMINUM WEIGHT (MATERIAL)	LBS.
DDBPPF-3	3"	7'-10"	4'-4"	6'-0"	30"x48"	11,000
DDBPPF-4	4"	7'-10"	4'-4"	6'-0"	30"x48"	11,000
DDBPPF-6	6"	7'-10"	4'-4"	6'-0"	30"x48"	15,000
DDBPPF-8	8"	8'-8"	5'-0"	6'-0"	30"x48"	15,000
DDBPPF-10	10"	9'-0"	6'-0"	7'-0"	36"x60"	18,000
DDBPPF-12	12"	9'-0"	6'-0"	7'-0"	36"x60"	18,000

SPECIFICATIONS

CONCRETE: CLASS I/II CONCRETE WITH DESIGN STRENGTH OF 4500 PSI AT 28 DAYS. UNIT IS OF MONOLITHIC CONSTRUCTION AT FLOOR AND FIRST STAGE OF WALL WITH SECTIONAL RISER TO REQUIRED DEPTH.

REINFORCEMENT: GRADE 60 REINFORCED. STEEL REBAR CONFORMING TO ASTM A615 ON REQUIRED CENTERS OR EQUAL.

HATCHWAY: 1/4" ALUMINUM DIAMOND PLATE COVER WITH EXTRUDED ALUMINUM FRAME. HATCH TO BE FURNISHED WITH 316 STAINLESS STEEL SNAP LOCK & BRASS HINGES.

ENGINEERING DATA

FIELD EXCAVATION AND PREPARATION SHALL BE COMPLETED PRIOR TO DELIVERY OF ASSEMBLY. USE DIMENSIONAL DATA AS SHOWN. PIPE, VALVES AND FITTINGS OF THE ASSEMBLY ARE APPROVED BY ONE OR MORE OF THE FOLLOWING ASSOCIATIONS:

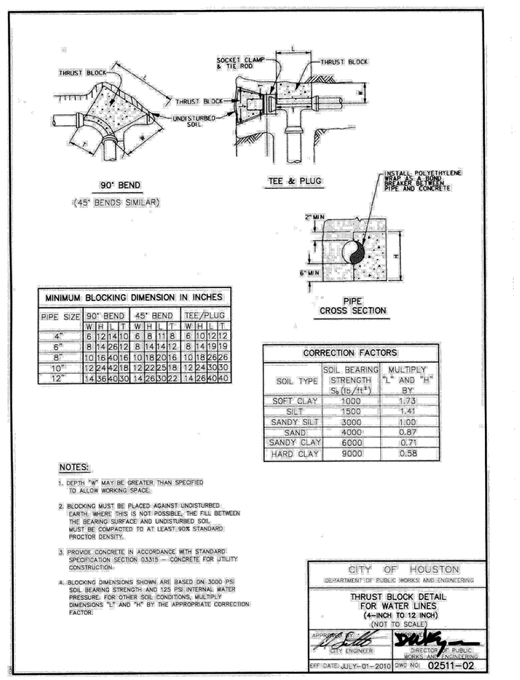
FM | AWWA | UL | NSF | IAPMO | IPCP CERTIFIED PLANT

PARK USA
A Northwest Pipe Company

3" THRU 12" DOUBLE DETECTOR BACKFLOW PREVENTER ASSEMBLY w/ PIV & FDC

PM	PC	DRN	END	DWG. NO.	REV.
DATE 03/2023			CC	DDBPPF-1	A

3"-12" BACKFLOW PREVENTER W/PIV & FDC



MINIMUM BLOCKING DIMENSION IN INCHES												
PIPE SIZE	90° BEND				45° BEND				TEE/PLUG			
	W	R	L	T	W	R	L	T	W	H	L	T
4"	6	12	14	10	6	8	11	8	6	10	12	12
6"	8	14	26	12	8	14	14	12	8	14	19	19
8"	10	16	40	16	10	18	20	16	10	18	26	26
10"	12	24	42	18	12	22	25	18	12	24	30	30
12"	14	36	40	30	14	26	30	22	14	26	40	40

CORRECTION FACTORS SOIL TYPE	SOIL BEARING STRENGTH S_b (lb/ft²)	MULTIPLY "L" AND "H" BY
SOFT CLAY	1000	1.73
SILT	1500	1.41
SANDY SILT	3000	1.00
SAND	4000	0.87
SANDY CLAY	6000	0.71
HARD CLAY	9000	0.58

NOTES:

1. DEPTH "H" MAY BE GREATER THAN SPECIFIED TO ALLOW WORKING SPACE.
2. BLOCKING MUST BE PLACED AGAINST UNDISTURBED EARTH. WHERE THIS IS NOT POSSIBLE, THE FILL BETWEEN THE BEARING SURFACE AND UNDISTURBED SOIL MUST BE COMPACTED TO AT LEAST 90% STANDARD PROCTOR DENSITY.
3. PROVIDE CONCRETE IN ACCORDANCE WITH STANDARD SPECIFICATION SECTION 03315 – CONCRETE FOR UTILITY CONSTRUCTION.
4. BLOCKING DIMENSIONS SHOWN ARE BASED ON 3000 PSF SOIL BEARING STRENGTH AND 125 PSI INTERNAL WATER PRESSURE. FOR OTHER SOIL CONDITIONS, MULTIPLY DIMENSIONS "L" AND "H" BY THE APPROPRIATE CORRECTION FACTOR.

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

THRUST BLOCK DETAIL FOR WATER LINES (4-INCH TO 12 INCH)

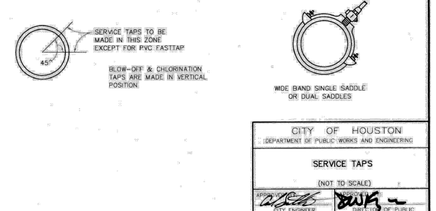
(NOT TO SCALE)

APPROVED BY: CITY ENGINEER | APPROVED: DIRECTOR OF PUBLIC WORKS AND ENGINEERING
EFF DATE: JULY-01-2010 | DWG NO: 02511-02

THRUST BLOCK DETAIL FOR WATER LINES

PIPE TAPPING SCHEDULE WATER MAIN TYPE AND DIAMETER	SERVICE SIZE 3/4"	1"	1 1/2"	2"
4" CAST IRON OR DUCTILE IRON	DSS, WSS	DSS, WSS	DSS, WSS	DSS, WSS
4" ASBESTOS (EXISTING) CEMENT	WSS	WSS	DSS, WSS	DSS, WSS
4" PVC (AWWA-C900)	DSS, WSS	DSS, WSS	DSS, WSS	DSS, WSS
6" AND 8" CAST IRON OR DUCTILE IRON	DSS, WSS	DSS, WSS	DSS, WSS	DSS, WSS
6" AND 8" ASBESTOS (EXISTING) CEMENT	DSS, WSS	DSS, WSS	DSS, WSS	DSS, WSS
6" AND 8" CAST IRON OR DUCTILE IRON	DSS, WSS	DSS, WSS	DSS, WSS	DSS, WSS
6" AND 8" PVC (AWWA C900)	DSS, WSS	DSS, WSS	DSS, WSS	DSS, WSS
12" CAST IRON OR DUCTILE IRON	DSS, WSS	DSS, WSS	DSS, WSS	DSS, WSS
12" ASBESTOS (EXISTING) CEMENT	DSS, WSS	DSS, WSS	DSS, WSS	DSS, WSS
12" PVC (AWWA C900)	DSS, WSS	DSS, WSS	DSS, WSS	DSS, WSS
16" AND UP CAST IRON OR DUCTILE IRON	DWSS	DWSS	DWSS	DWSS
16" AND UP ASBESTOS (EXISTING) CEMENT	DWSS	DWSS	DWSS	DWSS
16" AND UP PVC (AWWA C900)	DWSS	DWSS	DWSS	DWSS

DSS – DUAL STRAP SADDLES
WSS – WIDE BAND STRAP SADDLES
DWSS – DUAL WIDE BAND STRAP SADDLES



CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

SERVICE TAPS

(NOT TO SCALE)

APPROVED BY: CITY ENGINEER | APPROVED: DIRECTOR OF PUBLIC WORKS AND ENGINEERING
EFF DATE: JUL-01-2010 | DWG NO: 02512-02

SERVICE TAPS DETAIL

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

STRUCTURAL ENGINEER
STANLEY SPURLING & HAMILTON INC.
3301 EDLOE ST.
HOUSTON, TX 77027

CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., SUITE 260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE
647 RICHMOND AVE., SUITE 220
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

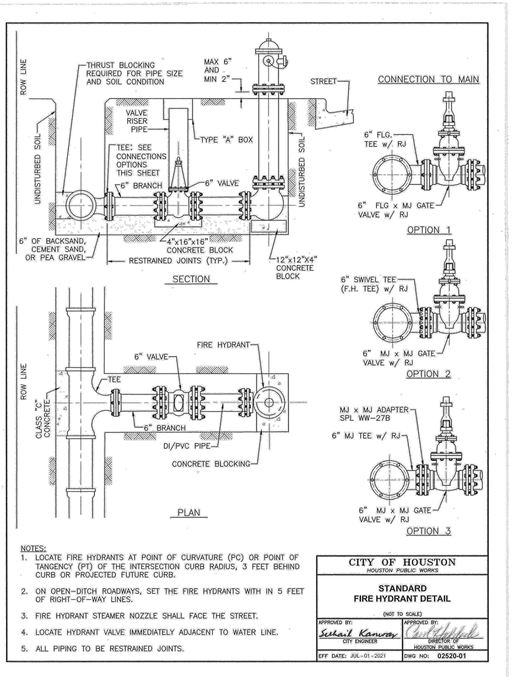
FRESNO BOYS & GIRLS CLUB
031 W SYCAMORE RD
FRESNO, TX 77545

WATERLINE DETAILS 1 OF 2

100% Construction Document
02.29.2024

STATE OF TEXAS
AMANDA F. BARBER
122357
LICENSED
PROFESSIONAL ENGINEER
2024-02-28

C7.01



NOTES:

1. LOCATE FIRE HYDRANTS AT POINT OF CURVATURE (PC) OR POINT OF TANGENCY (PT) OF THE INTERSECTION CURB RADIUS, 3 FEET BEHIND CURB OR PROJECTED FUTURE CURB.
2. ON OPEN-DITCH ROADWAYS, SET THE FIRE HYDRANTS WITH IN 5 FEET OF RIGHT-OF-WAY LINES.
3. FIRE HYDRANT STEAMER NOZZLE SHALL FACE THE STREET.
4. LOCATE HYDRANT VALVE IMMEDIATELY ADJACENT TO WATER LINE.
5. ALL PIPING TO BE RESTRAINED JOINTS.

CITY OF HOUSTON
HOUSTON PUBLIC WORKS

STANDARD FIRE HYDRANT DETAIL

(NOT TO SCALE)

APPROVED BY:	APPROVED BY:
Sekail Kanwar, CITY ENGINEER	DIRECTOR OF HOUSTON PUBLIC WORKS
EFF DATE: JUL-01-2021	DWG NO: 02520-01

FIRE HYDRANT DETAIL

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

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STANLEY SPURLING & HAMILTON INC.
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CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
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SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE
647 RICHMOND AVE., SUITE 220
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
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REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
031 W SYCAMORE RD
FRESNO, TX 77545

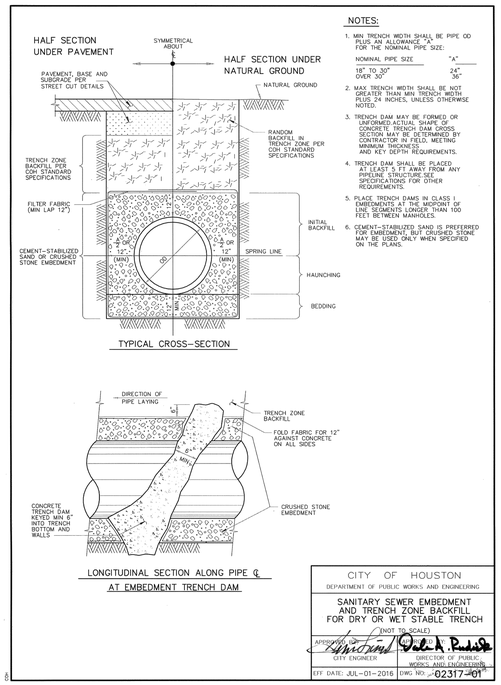
WATERLINE DETAILS 2 OF 2

100% Construction Document
02.29.2024

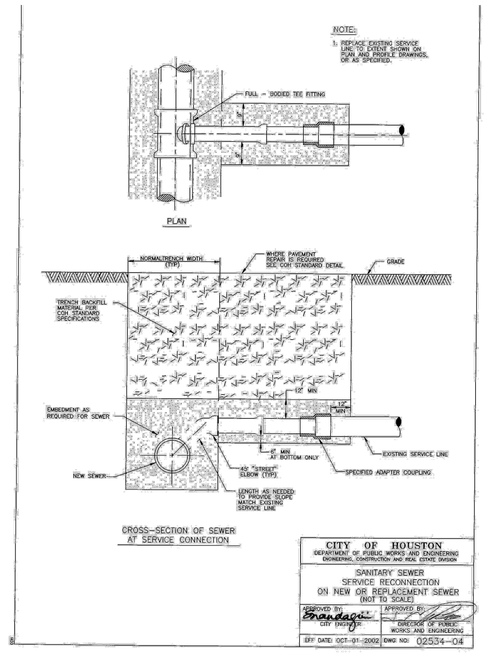
STATE OF TEXAS
AMANDA F. BARBER
122357
LICENSED
PROFESSIONAL ENGINEER

2024-02-28

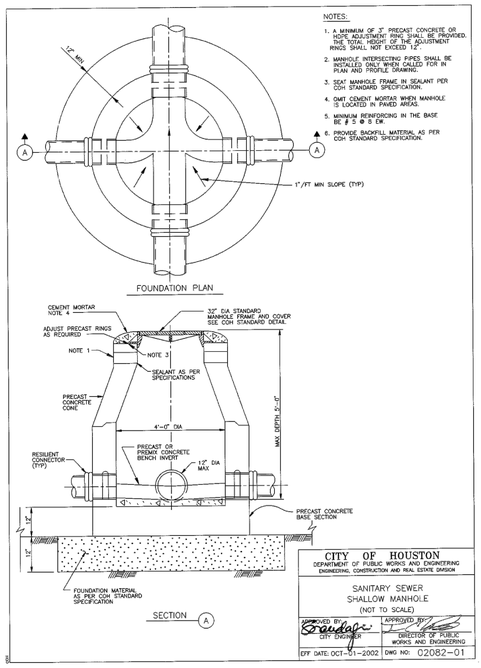
C7.02



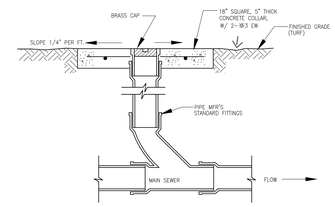
SANITARY SEWER BEDDING AND BACKFILL DETAIL



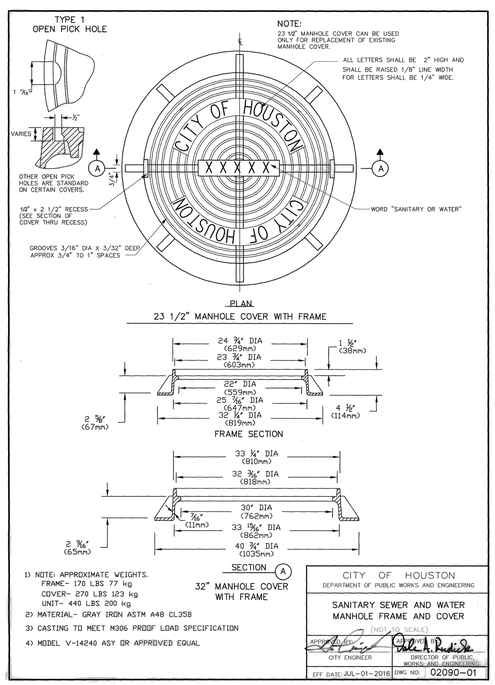
SANITARY SEWER SERVICE RECONNECTION



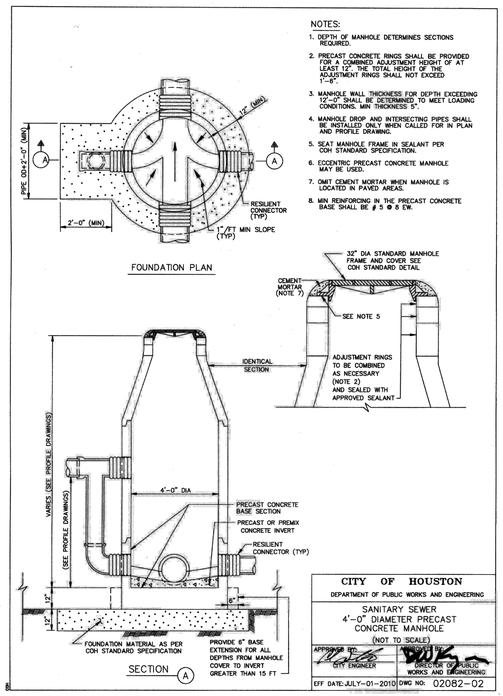
SHALLOW SANITARY SEWER MANHOLE DETAIL



SANITARY SEWER CLEANOUT DETAIL



SANITARY SEWER AND WATER MANHOLE FRAME AND COVER



SANITARY MANHOLE DETAIL

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

STRUCTURAL ENGINEER
STANLEY SPURLING & HAMILTON INC.
3301 EDLOE ST.
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CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
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SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE
647 RICHMOND AVE., SUITE 220
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:
NO. DATE DESCRIPTION

FRESNO BOYS & GIRLS CLUB
SANITARY SEWER DETAILS - 031 W SYCAMORE RD
FRESNO, TX 77545

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02.29.2024

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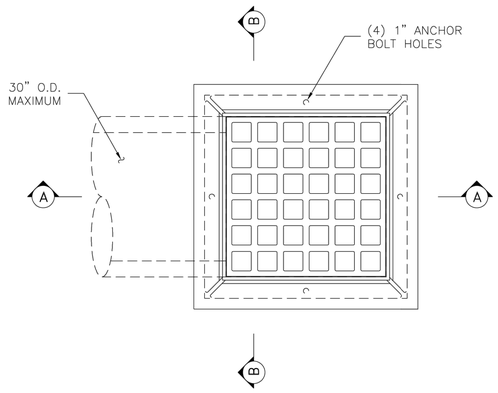
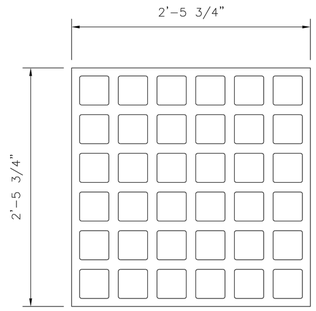
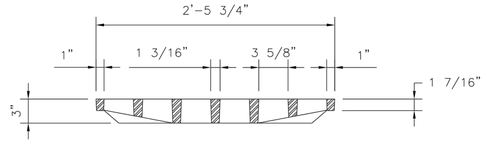


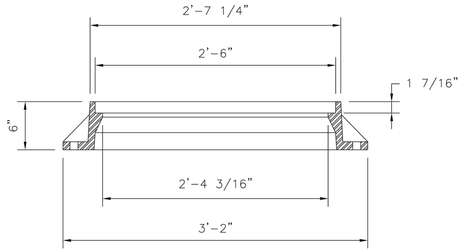
PLAN VIEW



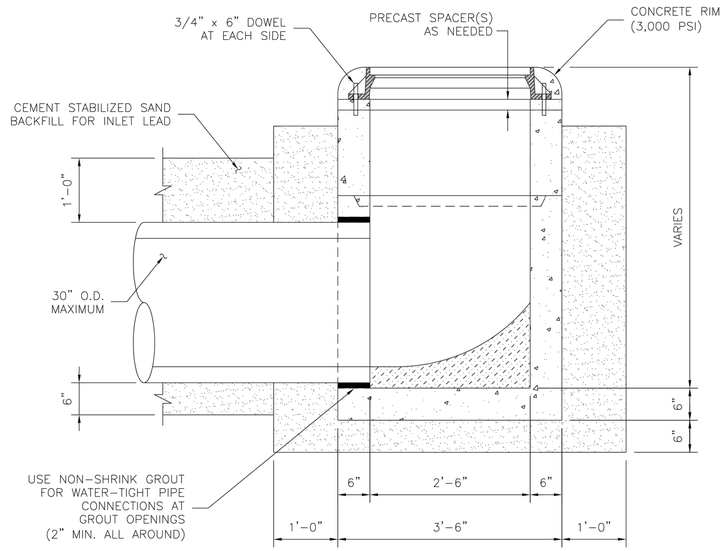
GRATE PLAN VIEW



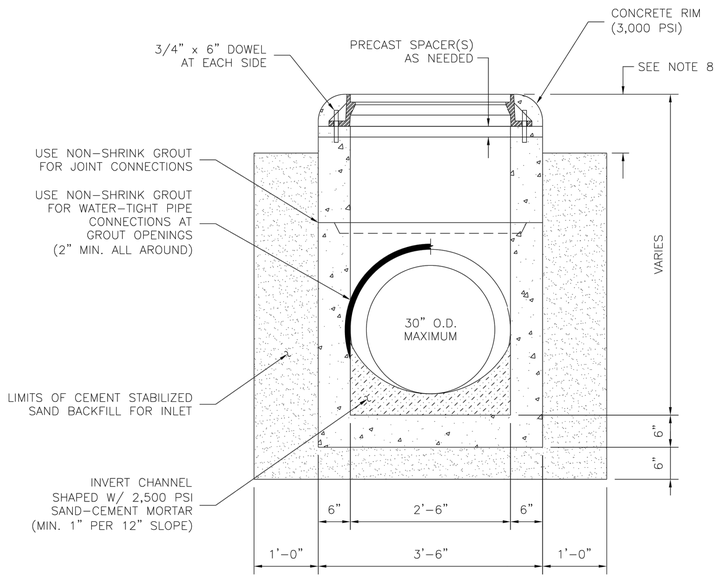
GRATE SECTION A-A



FRAME SECTION A-A



SECTION A-A



SECTION B-B

GENERAL NOTES:

1. CONSTRUCTION AND MATERIALS SHALL MEET REQUIREMENTS OF ITEM 472 "INLETS".
2. CONCRETE FOR INLET: MINIMUM 4,000 PSI IN 28 DAYS
3. PRECAST STRUCTURE TO MEET ASTM C913
4. FRAME AND GRATE SHALL BE EAST JORDAN IRON WORKS MODEL V-4880-1 (OPEN AREA 473 SQ. IN.) OR APPROVED EQUAL.
5. IF THE ENGINEER OF RECORD SPECIFIES A CAST-IN-PLACE INLET, HE/SHE SHALL INCORPORATE A DETAILED DRAWING INTO THE CONTRACT DOCUMENTS. HOWEVER, IF THE CONTRACTOR ELECTS TO CONSTRUCT A CAST-IN-PLACE INLET, THE CONTRACTOR WILL BE RESPONSIBLE FOR PROVIDING A DETAILED DRAWING, SIGNED AND SEALED BY A REGISTERED PROFESSIONAL ENGINEER LICENSED TO PRACTICE IN THE STATE OF TEXAS.
6. SHOP DRAWINGS SHALL BE REQUIRED FOR PRECAST CONSTRUCTION OF INLET.
7. KNOCK-OUTS ARE NOT PERMISSIBLE FOR PRECAST CONSTRUCTION OF INLET.
8. CEMENT STABILIZED SAND SHALL EXTEND TO THE BOTTOM OF PAVEMENT OR SLOPE PAVING, OR 12 INCHES BELOW THE SURFACE IF INLET IS LOCATED IN AN UNPAVED AREA.

NO.	REVISIONS	DATE	NAME
1	ORIGINAL STANDARD ISSUED	2-1-22	RJS

FORT BEND COUNTY
ENGINEERING DEPARTMENT

THE STATE OF TEXAS · FORT BEND COUNTY

PROJECT TITLE:		
DRAWN BY: INIT		FBCED STANDARD
CK'D BY: INIT	SHEET DESCRIPTION: TYPE "A" INLET DETAILS	22
SCALE: 1"=1'-0"	FOR MAXIMUM 30" O.D. PIPE	SHEET NO:
DATE: 2-1-22	APPROVED BY:	/

J:\1704\1601\Fort Bend County Standards\Fort Bend County STD\DONE\FBC TYPE A INLET DETAILS\TYPE_A_INLET_DETAILS.dwg

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

STRUCTURAL ENGINEER
STANLEY SPURLING & HAMILTON INC.
3301 EDLOE ST.
HOUSTON, TX 77027

CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., SUITE 260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE
647 RICHMOND AVE., SUITE 220
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

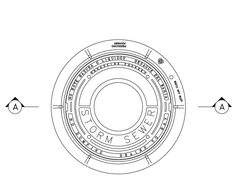
FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

STORM SEWER DETAILS
1 OF 3

100% Construction Document
02.29.2024

THE STATE OF TEXAS · AMANDA F. BARBIER · 122357 · LICENSED PROFESSIONAL ENGINEER
2024-02-28

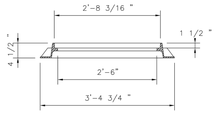
C7.04



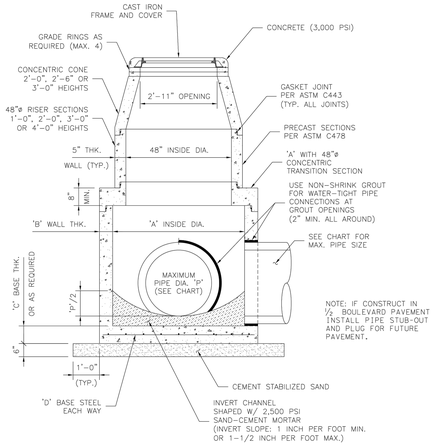
PLAN VIEW
FRAME AND COVER
SCALE: 1" = 1'-0"

NOTE: IF PROJECT IS WITHIN A CITY ETJ OR CITY LIMITS, USE CITY'S STD MANHOLE COVER

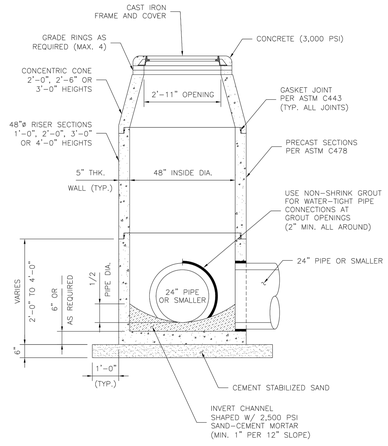
COVER SECTION A-A
SCALE: 1" = 1'-0"



FRAME SECTION A-A
SCALE: 1" = 1'-0"



PRECAST CONCENTRIC MANHOLE
FOR PIPE SIZES GREATER THAN 24"
SCALE: 1" = 1'-0"



48"ø PRECAST CONCENTRIC MANHOLE
FOR PIPE SIZES 24" OR SMALLER
SCALE: 1" = 1'-0"

MAXIMUM PIPE DIA. 'P'	INSIDE DIA. 'A'	WALL THICKNESS 'B'	BASE THICKNESS 'C'	BASE STEEL 'D'
30"	5'-0"	6"	8"	#5 @ 8"
42"	6'-0"	7"	8"	#5 @ 8"
54"	7'-0"	8"	10"	#6 @ 12" (2 LAYERS)
60"	8'-0"	9"	10"	#6 @ 12" (2 LAYERS)

GENERAL NOTES:

1. CONSTRUCTION AND MATERIALS SHALL MEET REQUIREMENTS OF ITEM 471 "PRECAST CONCRETE MANHOLES".
2. CONCRETE FOR MANHOLE: MINIMUM 4,000 PSI IN 28 DAYS
3. HS-20 LOADING, MANHOLE DESIGN SHALL MEET OR EXCEED ASTM C478 REQUIREMENTS.
4. GASKET JOINT: PER ASTM C443
5. FRAME AND COVER SHALL BE EAST JORDAN IRON WORKS MODEL V-1420 OR APPROVED EQUAL.
6. SHOP DRAWINGS WITH MANUFACTURER'S CERTIFICATION SHALL BE SUBMITTED FOR ENGINEER'S APPROVAL.

NO.	REVISIONS	DATE	NAME
1	ORIGINAL STANDARD ISSUED	2-1-22	RJS
2			
3			
4			
5			

FORT BEND COUNTY
ENGINEERING DEPARTMENT

STATE OF TEXAS — REGISTERED PROFESSIONAL ENGINEER

PROJECT TITLE:	
DRAWN BY: INIT	FBCED STANDARD
CK'D BY: INIT	SHEET DESCRIPTION: PRECAST CONCRETE STORM SEWER — 20
SCALE: AS NOTED	MANHOLE DETAILS — SHEET NO: /
DATE: 2-1-22	APPROVED BY:

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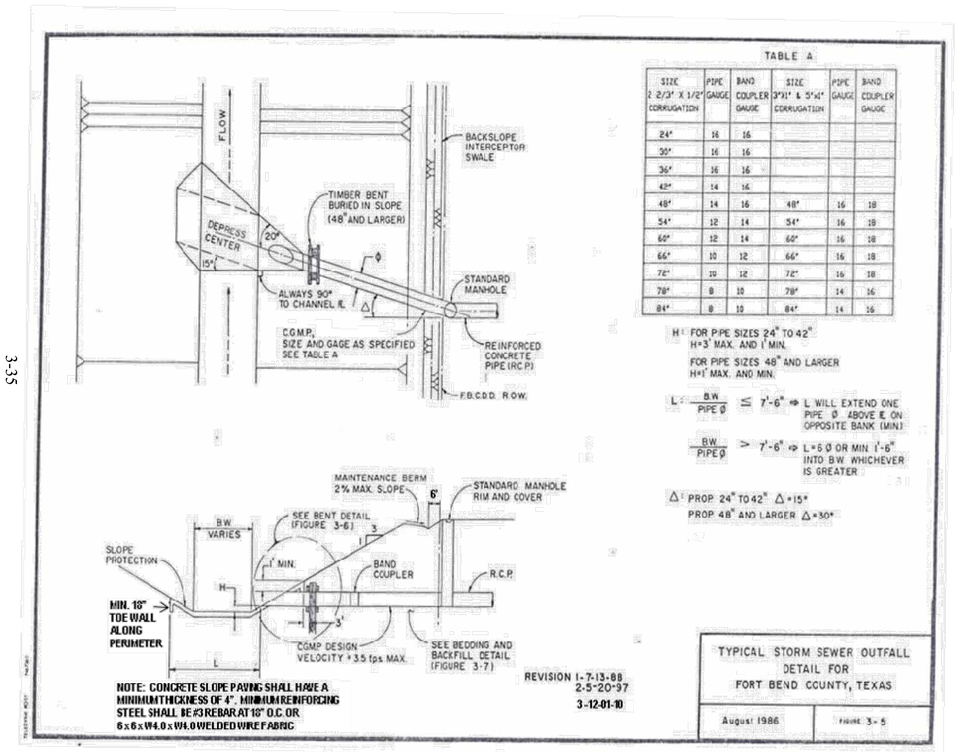

TABLE A

SIZE 2 2/3" X 1/2" CORRUGATION	PIPE GAUGE	BAND COUPLER GAUGE	SIZE 3"X1" & 5"X1" CORRUGATION	PIPE GAUGE	BAND COUPLER GAUGE
24"	16	16			
30"	16	16			
36"	16	16			
42"	14	16			
48"	14	16	48"	16	18
54"	12	14	54"	16	18
60"	12	14	60"	16	18
66"	10	12	66"	16	18
72"	10	12	72"	16	18
78"	8	10	78"	14	16
84"	8	10	84"	14	16

H = FOR PIPE SIZES 24" TO 42" H=3' MAX. AND 1' MIN.
FOR PIPE SIZES 48" AND LARGER H=1' MAX. AND MIN.

$L = \frac{B.W.}{PIPE\ \emptyset} \leq 7'-6"$ ⇒ L WILL EXTEND ONE PIPE ø ABOVE ℄ ON OPPOSITE BANK (MIN)

$\frac{B.W.}{PIPE\ \emptyset} > 7'-6"$ ⇒ L=6 ø OR MIN 1'-6" INTO B.W. WHICHEVER IS GREATER

Δ = PROP 24" TO 42" Δ=15°
PROP 48" AND LARGER Δ=30°

TYPICAL STORM SEWER OUTFALL DETAIL FOR FORT BEND COUNTY, TEXAS

August 1986 — FIGURE 3-5

3-35

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TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

STORM SEWER DETAILS
2 OF 3

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122357
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2024-02-28

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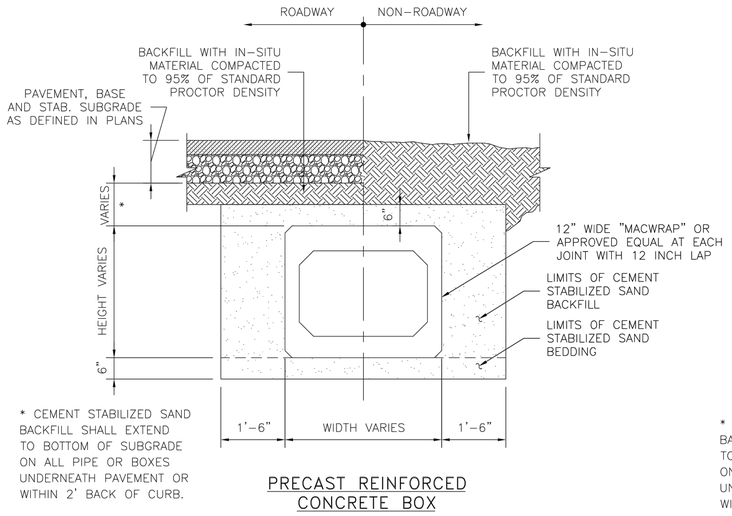
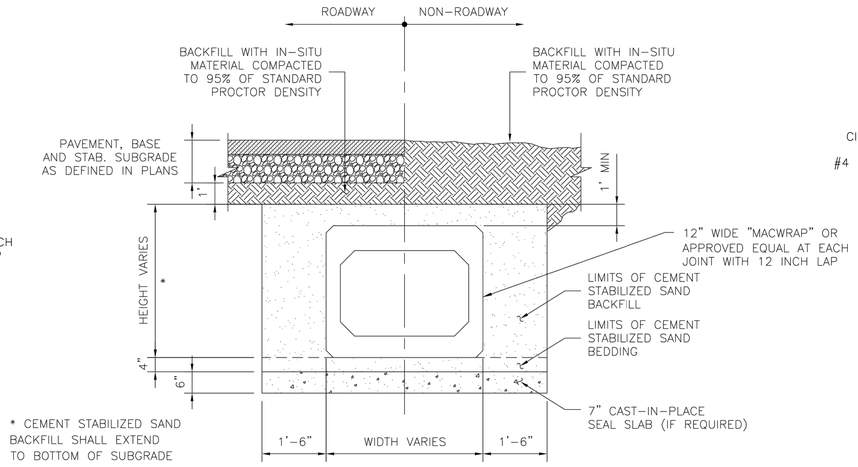


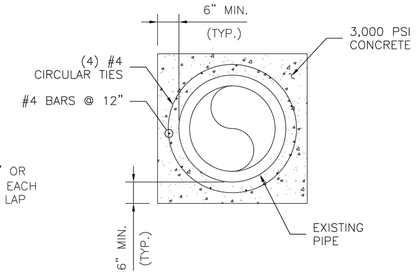
* CEMENT STABILIZED SAND BACKFILL SHALL EXTEND TO BOTTOM OF SUBGRADE ON ALL PIPE OR BOXES UNDERNEATH PAVEMENT OR WITHIN 2' BACK OF CURB.

PRECAST REINFORCED CONCRETE BOX

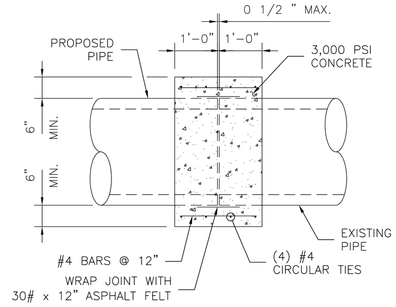


* CEMENT STABILIZED SAND BACKFILL SHALL EXTEND TO BOTTOM OF SUBGRADE ON ALL PIPE OR BOXES UNDERNEATH PAVEMENT OR WITHIN 2' BACK OF CURB.

PRECAST REINFORCED CONCRETE BOX WITH SEAL SLAB

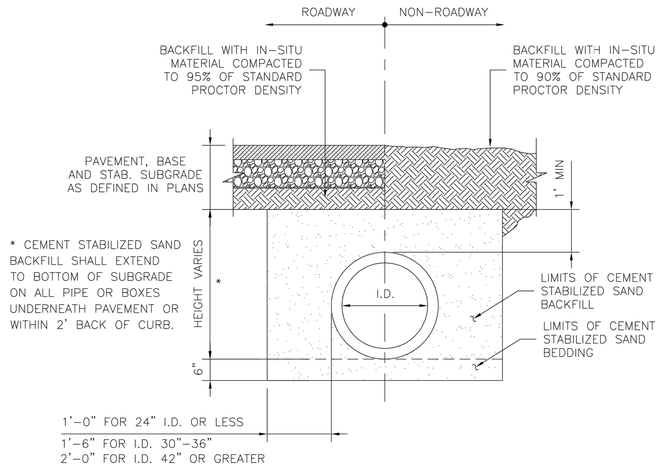


SECTION VIEW

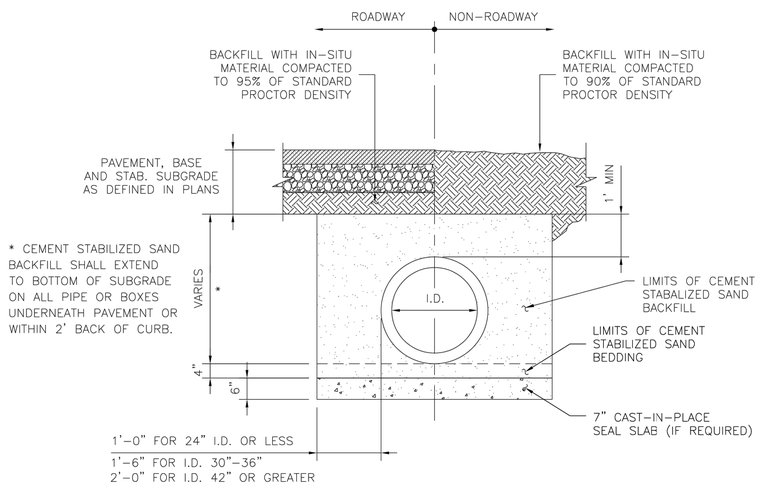


ELEVATION VIEW

TYPICAL CONCRETE COLLAR FOR 36" & SMALLER RCP



REINFORCED CONCRETE PIPE



REINFORCED CONCRETE PIPE WITH SEAL SLAB

GENERAL NOTES:

1. FOR RCP LARGER THAN 36" DIAMETER, CONCRETE COLLARS MUST BE DESIGNED BY THE ENGINEER OF RECORD.
2. ALL TRENCHES IN ROW SHALL BE BACKFILLED WITH 1.5 SACK CEMENT STABILIZED SAND TO WITHIN 1' OF SUBGRADE. COMPACTED TO 95% STANDARD PROCTOR DENSITY

NO.	REVISIONS	DATE	NAME
1	ORIGINAL STANDARD ISSUED	2-1-22	RJS
2			
3			
4			
5			

FORT BEND COUNTY
ENGINEERING DEPARTMENT

THE STATE OF TEXAS · FORT BEND COUNTY

PROJECT TITLE:		
DRAWN BY: INIT		FBCED STANDARD
CK'D BY: INIT	SHEET DESCRIPTION: STORM SEWER CONSTRUCTION DETAILS	18
SCALE: 1"=1'-6"		SHEET NO: /
DATE: 2-1-22	APPROVED BY:	

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TECHNOLOGY CONSULTANT
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WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

STORM SEWER DETAILS
3 OF 3

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02.29.2024

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2024-02-28

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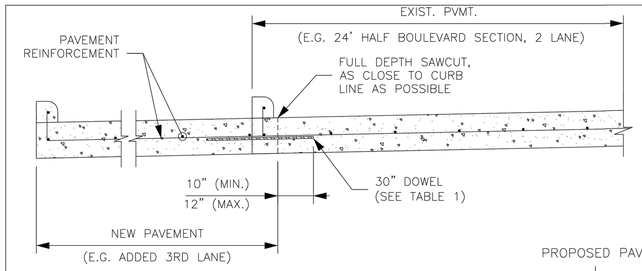


TYPICAL CONCRETE ROADWAY WIDENING DETAIL

SCALE: 1" = 1'-6"

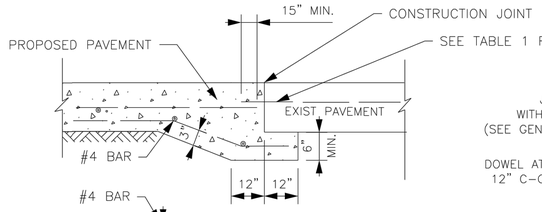
TABLE 1
(CONSTRUCTION JOINT DOWELS)

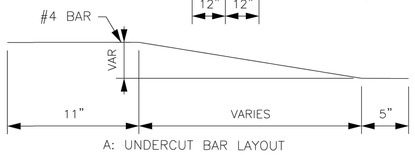
DOWEL SIZE	PAVEMENT DEPTH
#4 BAR	< 6"
#5 BAR	6" ≤ D < 9"
#6 BAR	≥9"

DOWEL SHALL BE DRILLED INTO EXISTING PAVEMENT (MIN. 10", MAX. 12") AND EPOXIED. (SEE ITEM 361.3)

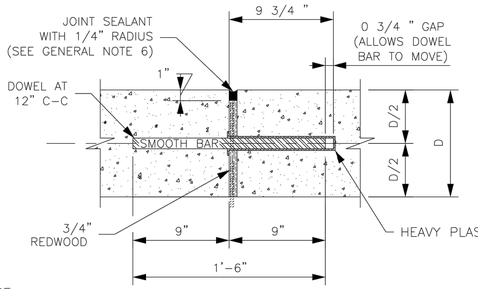
EXPANSION JOINT DOWELS 12" O.C.

PAVEMENT THICKNESS (D)	DOWEL DIA.
6"	3/4"
7"	1"
8"	1"
9" & 10"	1 1/4"





A: UNDERCUT BAR LAYOUT

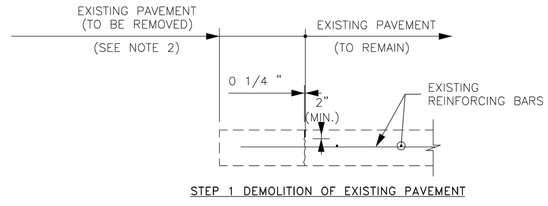


DOWEL TYPE EXPANSION JOINT

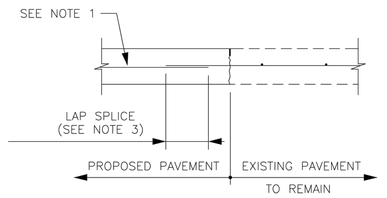
SCALE: 1" = 6"

NOTES FOR DOWEL EXPANSION JOINT:

1. EXPANSION JOINT SHALL BE PLACED AT THE END OF EACH CURB RADIUS AND SPACED AT A MAXIMUM DISTANCE OF 60 FEET.
2. CENTER DOWEL HORIZONTALLY ON JOINT.
3. EXPANSION JOINT BARS SHALL BE HELD PARALLEL TO THE FINISHED CONCRETE SURFACE.



STEP 1 DEMOLITION OF EXISTING PAVEMENT



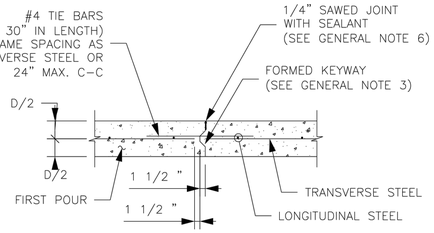
STEP 2 CONSTRUCTION OF NEW PAVEMENT

CONCRETE TO CONCRETE STANDARD PAVEMENT TIE-IN

SCALE: 1" = 1'-6"

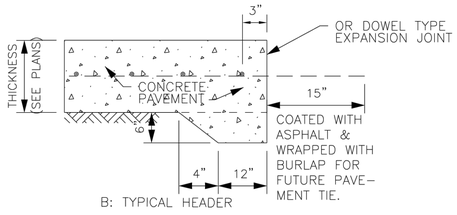
NOTES FOR STANDARD PAVEMENT TIE-IN:

1. REINFORCING CENTERED IN PROPOSED PAVEMENT, 3" CLEAR AT EDGES.
2. ONLY FULL DEPTH SAWCUTS WILL BE ALLOWED
3. USE FULL DEPTH SAWCUT WITH DRILLED IN DOWELS (AS SHOWN IN THE "TYPICAL CONCRETE ROADWAY WIDENING DETAIL" ON THIS SHEET. THE SAWCUTTING AND DOWELS WILL BE AT CONTRACTOR'S EXPENSE.
4. ALL PAVEMENT CONCRETE SHALL BE 5½ SACK PER CY, 3500, PSI AT 28 DAYS
5. SIZE OF DOWEL BARS SHALL CONFORM TO TABLE 1. DOWELS SHALL BE PLACED 24" CENTER TO CENTER OR MATCH EXISTING, IF CLOSER



LONGITUDINAL CONSTRUCTION JOINT

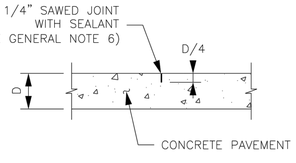
SCALE: 1" = 1'-6"



B: TYPICAL HEADER

PAVEMENT HEADER/ UNDERCUT

N.T.S

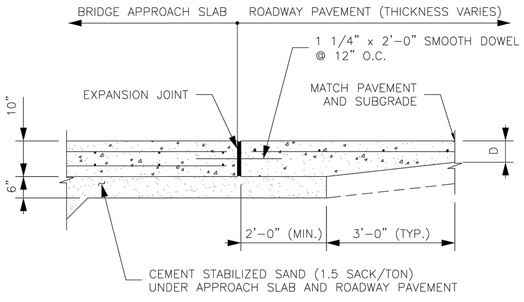


CONTRACTION JOINT (SAWED)

SCALE: 1" = 1'-6"

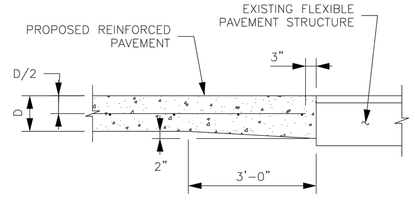
NOTE FOR CONTRACTION JOINT:

1. 20'-0" MAXIMUM SPACING BETWEEN JOINTS.



TYPICAL SECTION PAVING TIE-IN TO BRIDGE APPROACH SLAB

SCALE: 1" = 1'-6"



TYPICAL PAVING HEADER

SCALE: 1" = 1'-6"

NOTES FOR PAVING HEADER:

1. ADDITIONAL CONCRETE FOR PAVING HEADER SHALL BE CONSIDERED INCIDENTAL TO VARIOUS PAVING BID ITEMS.
2. DISTURBED MATERIAL IN THE FLEXIBLE PAVEMENT WILL BE BACKFILLED WITH ASPHALT CONCRETE PAVEMENT (ACP). THE ACP WILL BE CONSIDERED INCIDENTAL TO VARIOUS PAVING BID ITEMS.

GENERAL NOTES:

1. FOR FURTHER INFORMATION REGARDING THE PLACEMENT OF CONCRETE AND REINFORCING, REFER TO ITEM 360 HARRIS COUNTY SPECIFICATIONS
2. THE CHAIRS USED TO SUPPORT THE BAR MATS SHALL BE OF SUFFICIENT STRUCTURAL QUALITY AND NUMBER TO HOLD THE MAT WITHIN THE PLACEMENT HEIGHT, AND SHALL BE OF A TYPE APPROVED BY THE ENGINEER. SPACING OF BAR SUPPORT CHAIRS SHALL BE 3'-0" MAXIMUM.
3. SAWED CONTRACTION JOINTS SHALL BE USED FOR LONGITUDINAL JOINTS WHEREVER MORE THAN ONE LANE WIDTH IS PLACED IN A SINGLE POUR. KEYED CONSTRUCTION JOINTS SHALL BE USED AT ALL OTHER JOINTS.
4. ALL SAW CUTTING SHOWN ON THIS DETAIL SHALL BE INCIDENTAL TO ITEM 360 "CONCRETE PAVEMENT".
5. D = THICKNESS OF CONCRETE PAVEMENT.
   - FOR DEVELOPMENT PROJECTS SEE REGULATIONS OF FORT BEND COUNTY, TEXAS FOR THE APPROVAL AND ACCEPTANCE OF INFRASTRUCTURE.
6. ALL CONSTRUCTION JOINTS SHALL BE SEALED. JOINT SEALANT SHALL CONFORM TO THE REQUIREMENTS OF ITEM 360
7. NO TRAFFIC ON CONCRETE PAVEMENT UNTIL 7 DAYS CURE TIME AND 3,500 PSI HAS BEEN REACHED.

NO.	REVISIONS	DATE	NAME
1	ORIGINAL STANDARD ISSUED	2-1-22	RJS

FORT BEND COUNTY
ENGINEERING DEPARTMENT

THE STATE OF TEXAS · FORT BEND COUNTY

PROJECT TITLE:		
DRAWN BY: INIT		FBCED STANDARD
CK'D BY: INIT	SHEET DESCRIPTION: CONCRETE PAVEMENT DETAILS	05
SCALE: AS NOTED	SHEET 1 OF 3	SHEET NO: /
DATE: 2-1-22	APPROVED BY:	

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PROJECT #: N032023
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REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

PAVING DETAILS 1 OF 5

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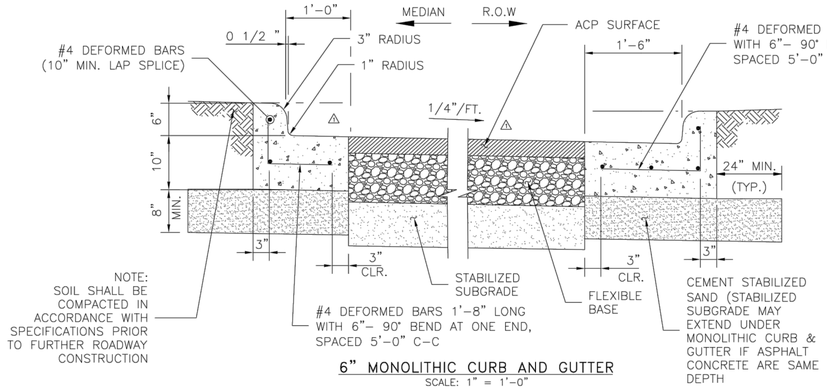
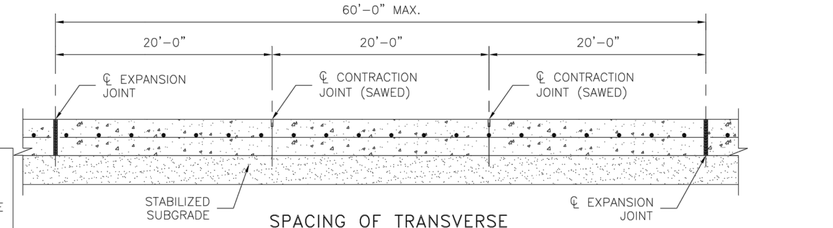


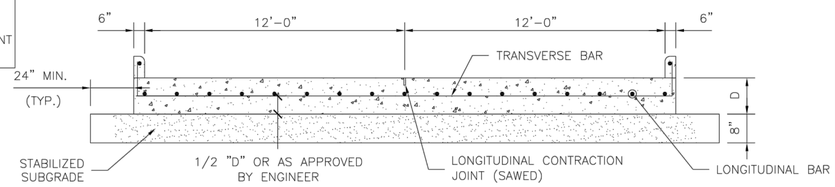
6" MONOLITHIC CURB AND GUTTER
SCALE: 1" = 1'-0"

SLAB AND REBAR NOTES:

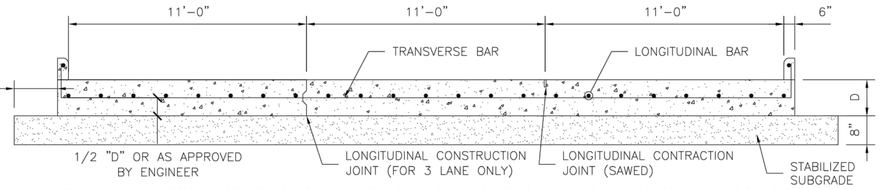
1. TYPICAL SLAB THICKNESS D=8"
2. TYPICAL REBAR SIZE AND SPACING ARE:
   a. #4 BAR @ 18" C-C LONGITUDINAL
   b. #4 BAR @ 18" C-C TRANSVERSE
3. REBAR SIZE FOR PAVEMENT LESS THAN 8" THICK
   a. #4 BAR @ 24" C-C LONGITUDINAL
   b. #4 BAR @ 24" C-C TRANSVERSE
4. REBAR SHALL NOT BE PLACED WITHIN 3" FROM THE EDGE OF PAVEMENT.
5. TYPICAL STABILIZED SUBGRADE THICKNESS IS 8 INCHES.
6. FOR HEAVY INDUSTRIAL TRAFFIC, SLAB THICKNESS AND REBAR SIZE AND SPACING WILL BE AS PER GEOTECHNICAL RECOMMENDATION.
7. ALL BENT BARS SHALL BE GRADE 40 STEEL, ALL OTHER SHALL BE GRADE 60.
8. MINIMUM LAP SPLICE 16".
9. LAP SPLICES SHOULD BE ON ALTERNATING BARS, ADJACENT LAP SPLICES ARE NOT ACCEPTABLE.



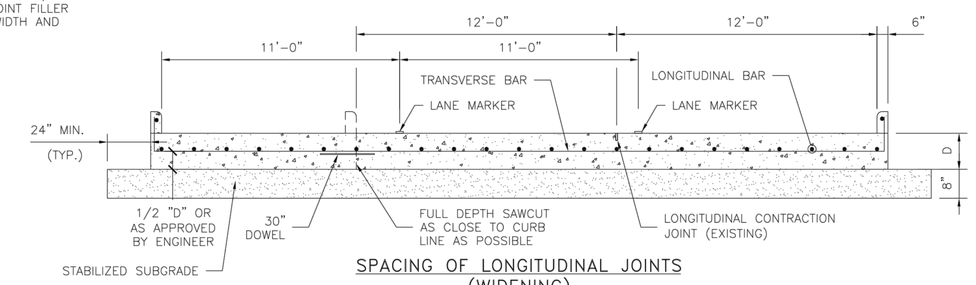
SPACING OF TRANSVERSE
EXPANSION AND CONTRACTION JOINTS
HORIZONTAL SCALE: 1" = 6'-0"
VERTICAL SCALE: 1" = 1'-6"



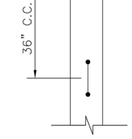
TYPICAL STEEL REBAR REPLACEMENT AND SPACING OF LONGITUDINAL JOINTS
(NEW CONSTRUCTION FOR A 4 LANE HALF BOULEVARD)
HORIZONTAL SCALE: 1" = 3'-0"
VERTICAL SCALE: 1" = 1'-6"



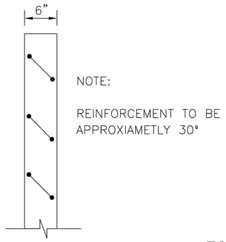
TYPICAL STEEL REBAR REPLACEMENT AND SPACING OF LONGITUDINAL JOINTS
(NEW CONSTRUCTION FOR A 6 LANE HALF BOULEVARD)
HORIZONTAL SCALE: 1" = 3'-0"
VERTICAL SCALE: 1" = 1'-6"



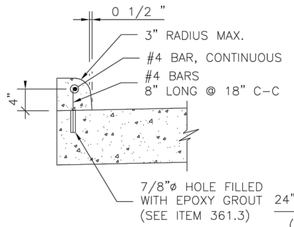
SPACING OF LONGITUDINAL JOINTS
(WIDENING)
HORIZONTAL SCALE: 1" = 3'-0"
VERTICAL SCALE: 1" = 1'-6"



TYPICAL CONCRETE CURB
REINFORCEMENT PLAN VIEW



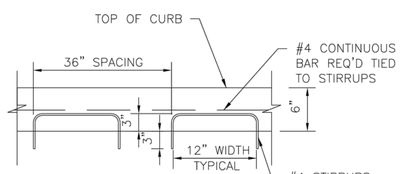
4" X 12" CURB
PLAN VIEW



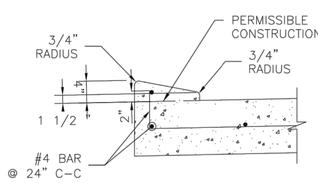
CONCRETE DOWELED ON CURB
FOR CONCRETE OR ASPHALT PAVEMENT
SCALE: 1" = 1'-0"

NOTES FOR CURB:

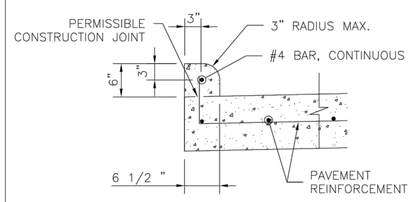
1. AT EACH PAVEMENT CONTRACTION JOINT, PROVIDE A 1/4" THICK PRE-MOLDED EXPANSION JOINT AT THE FULL WIDTH AND HEIGHT OF THE CURB.
2. FOR EACH PAVEMENT EXPANSION JOINT, THE PRE-MOLDED EXPANSION JOINT FILLER MATERIAL SHALL BE THE FULL WIDTH AND HEIGHT OF THE CURB.



TYPICAL CONCRETE
CURB REINFORCEMENT
NTS



4" X 12" CURB
(MONOLITHIC OR DOWEL)
SCALE: 1" = 1'-0"



TYPICAL CONCRETE CURB
REINFORCING DETAILS
SCALE: 1" = 1'-0"

NO.	REVISIONS	DATE	NAME
1	ORIGINAL STANDARD ISSUED	2-1-22	RJS

FORT BEND COUNTY
ENGINEERING DEPARTMENT

PROJECT TITLE:		
DRAWN BY: INIT		FBCED STANDARD
CK'D BY: INIT	SHEET DESCRIPTION: CONCRETE PAVEMENT DETAILS	06
SCALE: AS NOTED	SHEET 2 OF 3	SHEET NO: /
DATE: 2-1-22	APPROVED BY:	

J:\1704\1601\Fort Bend County Standards\Fort Bend County STD\DONE\FBC CONCRETE PAVEMENT DETAILS\CONCRETE_PAVEMENT_DETAILS-2of2.dwg

SMITH&COMPANY
ARCHITECTS

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SMITH & COMPANY ARCHITECTS
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CIVIL ENGINEER
LJA ENGINEERING
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KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., SUITE 260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE
647 RICHMOND AVE., SUITE 220
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

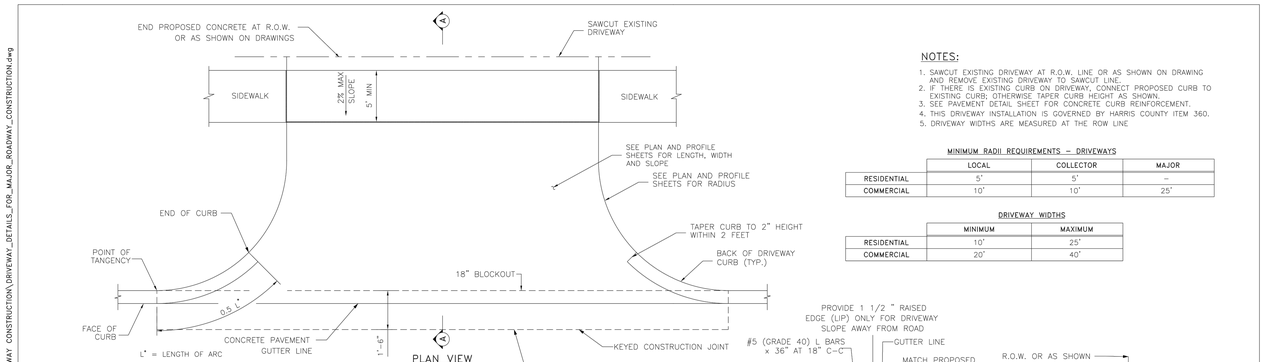
FRESNO BOYS & GIRLS CLUB
5031 W SYCAMORE RD
FRESNO, TX 77545

PAVING DETAILS 2 OF 5

100% Construction Document
02.29.2024

STATE OF TEXAS
AMANDA F. BARBER
122357
LICENSED
PROFESSIONAL ENGINEER
2024-02-28

C7.08



NOTES:

1. SAWCUT EXISTING DRIVEWAY AT R.O.W. LINE OR AS SHOWN ON DRAWING AND REMOVE EXISTING DRIVEWAY TO SAWCUT LINE.
2. IF THERE IS EXISTING CURB ON DRIVEWAY, CONNECT PROPOSED CURB TO EXISTING CURB; OTHERWISE TAPER CURB HEIGHT AS SHOWN.
3. SEE PAVEMENT DETAIL SHEET FOR CONCRETE CURB REINFORCEMENT.
4. THIS DRIVEWAY INSTALLATION IS GOVERNED BY HARRIS COUNTY ITEM 360.
5. DRIVEWAY WIDTHS ARE MEASURED AT THE ROW LINE

MINIMUM RADII REQUIREMENTS – DRIVEWAYS

	LOCAL	COLLECTOR	MAJOR
RESIDENTIAL	5'	5'	–
COMMERCIAL	10'	10'	25'

DRIVEWAY WIDTHS

	MINIMUM	MAXIMUM
RESIDENTIAL	10'	25'
COMMERCIAL	20'	40'

	PAVEMENT THICKNESS	COLLECTOR/MAJOR	RESIDENTIAL (MAJOR THOROUGHFARE)	RESIDENTIAL (COLLECTORS AND LOCAL STREETS)
REINFORCEMENT	6"	#4 @ 24" O.C.E.W.	N/A	#4 @ 24" O.C.E.W.
	7"	#4 @ 24" O.C.E.W.	#4 @ 24" O.C.E.W.	#4 @ 24" O.C.E.W.
	8"	#4 @ 18" O.C.E.W.	#4 @ 18" O.C.E.W.	#4 @ 18" O.C.E.W.
	9"–10"	#5 @ 18" O.C.E.W.	#5 @ 18" O.C.E.W.	#5 @ 18" O.C.E.W.
EXPANSION DOWEL JOINT	6"	3/4" DIA. SMOOTH BAR	3/4" DIA. SMOOTH BAR	3/4" DIA. SMOOTH BAR
	7"	1" DIA. SMOOTH BAR	1" DIA. SMOOTH BAR	1" DIA. SMOOTH BAR
	8"	1" DIA. SMOOTH BAR	1" DIA. SMOOTH BAR	1" DIA. SMOOTH BAR
	9"–10"	1½" DIA. SMOOTH BAR	1½" DIA. SMOOTH BAR	1½" DIA. SMOOTH BAR
CONSTRUCTION JOINT DOWEL	ALL	#5 REBAR	#5 REBAR	#5 REBAR
SUBGRADE	ALL	6" CEMENT-STABALIZED SAND	2" BANK SAND	2" BANK SAND
DRIVEWAY SLOPE	ALL	2% TO 4%	2% TO 6%	2% TO 10%*

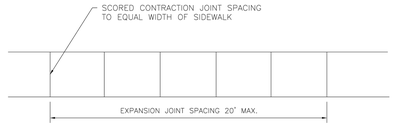
*10% ALLOWABLE ON PRIVATELY CONSTRUCTED PROJECTS
6% MAX ON PUBLIC PROJECTS

J:\1704\1601\Fort Bend County Standards\Fort Bend County STD\DONE\FBC DRIVEWAY DETAILS FOR MAJOR ROADWAY CONSTRUCTION\DRIVEWAY_DETAILS_FOR_MAJOR_ROADWAY_CONSTRUCTION.dwg

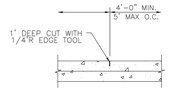
NO.	REVISIONS	DATE	NAME
1	ORIGINAL STANDARD ISSUED	3-1-22	RJS

FORT BEND COUNTY
ENGINEERING DEPARTMENT

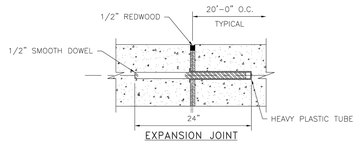
PROJECT TITLE:
DRAWN BY: INIT
CK'D BY: INIT
SCALE: 1"=1'-6"
DATE: 3-1-22
SHEET DESCRIPTION: DRIVEWAY DETAILS FOR MAJOR ROADWAY CONSTRUCTION
APPROVED BY:
FBCED STANDARD 10
SHEET NO: /



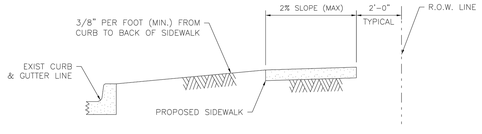
SIDEWALK JOINT DETAILS

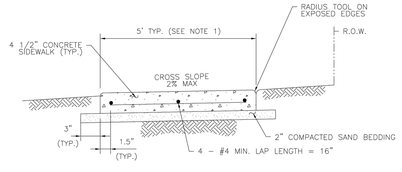


CONTRACTION JOINT SEAL



EXPANSION JOINT





SIDEWALK CROSS SECTION

NOTES:

1. TYPICAL SIDEWALK WIDTH IS 5'. SIDEWALKS OF 4' WIDTH ARE ALLOWED IN FRONT OF SINGLE FAMILY HOMES IF ALL DRIVEWAYS PROVIDE A 5' AREA FOR PASSING. SIDEWALKS OF 4' WITH 5' X 5' PASSING ZONES MUST BE SPECIFICALLY APPROVED BY FORT BEND COUNTY
2. THE MAXIMUM WIDTH BETWEEN EXPANSION JOINTS SHALL NOT EXCEED 20'-0"
3. EXPANSION JOINT IS TO BE 1/2" THICK CLEAR HEART REDWOOD DOWELS
4. SCORED CONTRACTION JOINTS SHALL BE EVERY 5' OR EQUAL TO SIDEWALK WIDTH
5. ALL EARTHEN AREAS ARE TO BE SODDED UNLESS SHOWN OTHERWISE ON DRAWINGS.
6. SIDEWALKS ARE TO BE REINFORCED CONCRETE (3500 PSI) WITH #3 BARS, 18 INCHES C-C.
7. USE RADIUS TOOL ON ALL EXPOSED EDGES.
8. MEMBRANE CURING COMPOUND IS REQUIRED AS DESCRIBED IN ITEM 526 IN THE TXDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION
9. SIDEWALK EXPANSION JOINTS SHALL CONFORM TO STREET EXPANSION JOINT STANDARDS

NOTE:

BANK SAND IS DEFINED AS A WELL-GRADED SAND, FREE OF SILT, CLAY, LOAM, FRIABLE OR SOLUBLE MATERIALS AND ORGANIC MATTER, MEETING THE UNIFIED SOILS CLASSIFICATION SYSTEM GROUP SW CRITERIA W/ A PLASTICITY INDEX OF LESS THAN 10, AND NO MORE THAN 12% OF MATERIAL CAN PASS THE NO. 200 SIEVE.

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NO.	REVISIONS	DATE	NAME
1	ORIGINAL STANDARD ISSUED	2-1-22	RJS

FORT BEND COUNTY
ENGINEERING DEPARTMENT

PROJECT TITLE:
DRAWN BY: INIT
CK'D BY: INIT
SCALE: AS NOTED
DATE: 2-1-22
SHEET DESCRIPTION: SIDEWALK DETAILS
APPROVED BY:
FBCED STANDARD 13
SHEET NO: /

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
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LANDSCAPE ARCHITECT
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SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE
647 RICHMOND AVE., SUITE 220
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
5 ' 031 W SYCAMORE RD
FRESNO, TX 77545

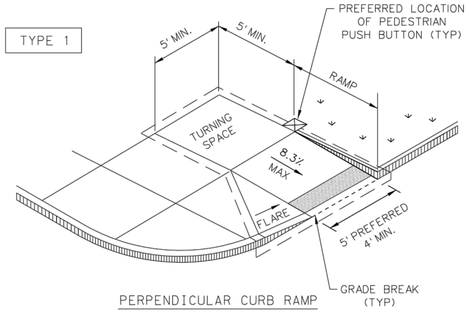
PAVING DETIALS 3 OF 5

100% Construction Document
02.29.2024

STATE OF TEXAS
AMANDA F. BARBIER
122357
LICENSED
PROFESSIONAL ENGINEER
2024-02-28

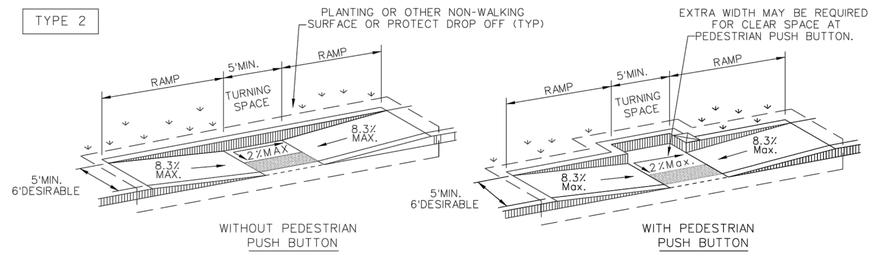
C7.09

TYPE 1



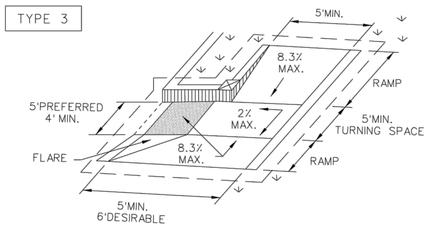
PERPENDICULAR CURB RAMP

TYPE 2

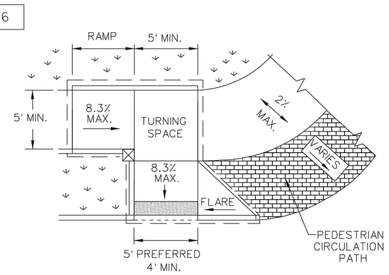


PARALLEL CURB RAMP

TYPE 3

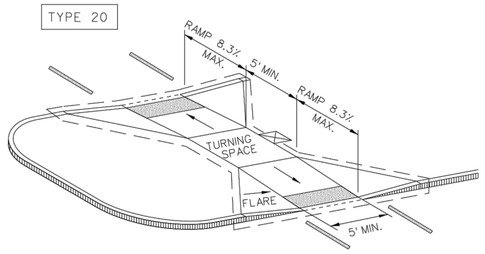


TYPE 6



COMBINATION CURB RAMPS

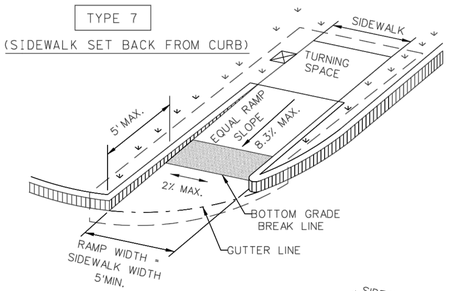
TYPE 20



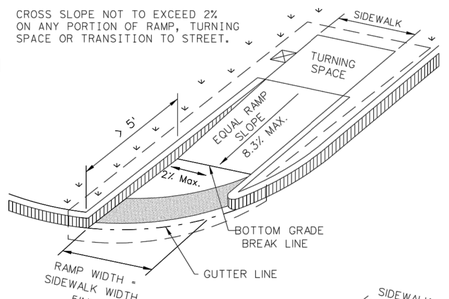
CURB RAMPS AT MEDIAN ISLANDS

TYPE 7

(SIDEWALK SET BACK FROM CURB)

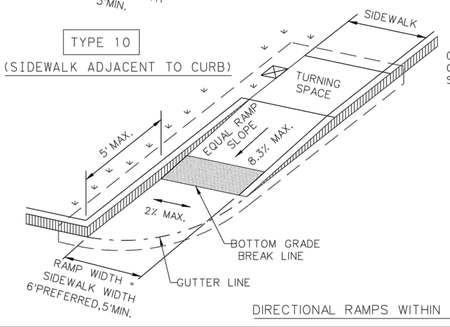


CROSS SLOPE NOT TO EXCEED 2% ON ANY PORTION OF RAMP, TURNING SPACE OR TRANSITION TO STREET.

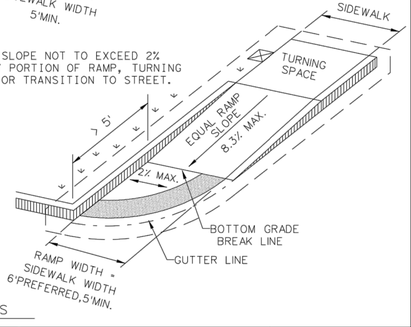


TYPE 10

(SIDEWALK ADJACENT TO CURB)

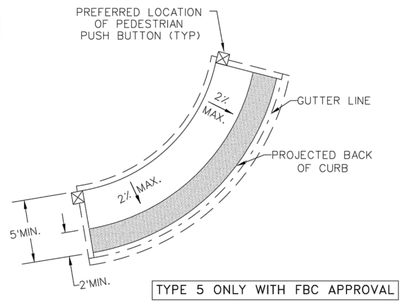


CROSS SLOPE NOT TO EXCEED 2% ON ANY PORTION OF RAMP, TURNING SPACE OR TRANSITION TO STREET.



DIRECTIONAL RAMPS WITHIN RADIUS

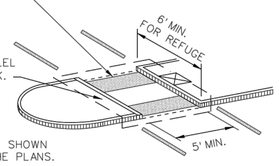
TYPE 5



TYPE 5 ONLY WITH FBC APPROVAL

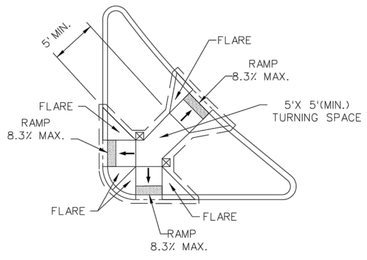
TYPE 21

INSTALL DETECTABLE WARNING SURFACE AT EACH END OF THE CUT-THROUGH RAMP WITH A MINIMUM 2' USUAL SIDEWALK SURFACE BETWEEN. IF MEDIAN IS LESS THAN 6' WIDE, ELIMINATE DETECTABLE WARNING SURFACES.

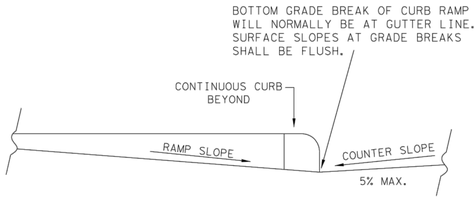


NOTE: CURB DETAILS ARE SHOWN ELSEWHERE IN THE PLANS.

TYPE 22



COMBINATION ISLAND RAMPS



TYPICAL SECTION OF PERPENDICULAR CURB RAMP AT CONNECTION TO ROADWAY

NOTES / LEGEND:

SEE GENERAL NOTES ON SHEET 2 OF 4 FOR MORE INFORMATION.

DENOTES PLANTING OR NON-WALKING SURFACE NOT PART OF PEDESTRIAN CIRCULATION PATH.

GUTTER LINE — - —

DETECTABLE WARNING SURFACE

GRADE BREAK ------

DENOTES PREFERRED LOCATION OF PEDESTRIAN PUSH BUTTON IF APPLICABLE.

RAMP LIMITS OF PAYMENT — —

NO.	REVISIONS	DATE	NAME
1	ORIGINAL STANDARD ISSUED	1-1-22	RJS
2			
3			
4			
5			

FORT BEND COUNTY
ENGINEERING DEPARTMENT

THE STATE OF TEXAS FORT BEND COUNTY

PROJECT TITLE:

DRAWN BY: INIT		FBCED STANDARD 14
CK'D BY: INIT	SHEET DESCRIPTION: PED-18 RAMP DETAILS	
SCALE: 1" = 1'	SHEET 1 OF 4	SHEET NO: /
DATE: 2-1-22	APPROVED BY:	

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ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
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CIVIL ENGINEER
LJA ENGINEERING
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KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., SUITE 260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE
647 RICHMOND AVE., SUITE 220
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
5031 W SYCAMORE RD
FRESNO, TX 77545

PAVING DETAILS 4 OF 5

100% Construction Document
02.29.2024

STATE OF TEXAS
AMANDA F. BARBIER
122357
LICENSED PROFESSIONAL ENGINEER
2024-02-28

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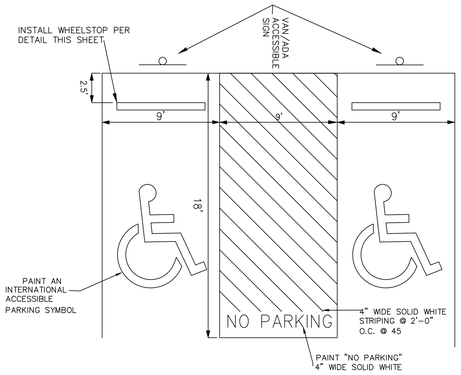
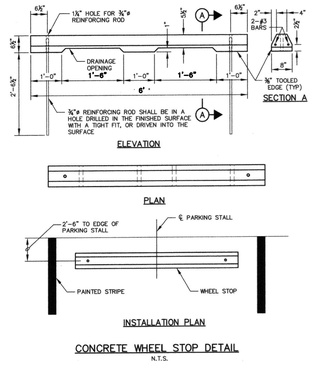
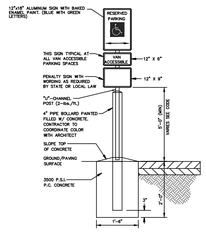


TYPICAL UNIVERSAL ADA/VAN ACCESSIBLE PARKING DETAIL



CONCRETE WHEEL STOP DETAIL

N.T.S.



ACCESSIBLE PARKING AND SIGN DETAIL

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

STRUCTURAL ENGINEER
STANLEY SPURLING & HAMILTON INC.
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CIVIL ENGINEER
LJA ENGINEERING
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INFRASTRUCTURE
647 RICHMOND AVE., SUITE 220
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

PAVING DETAILS 5 OF 5

100% Construction Document
02.29.2024

2024-02-28

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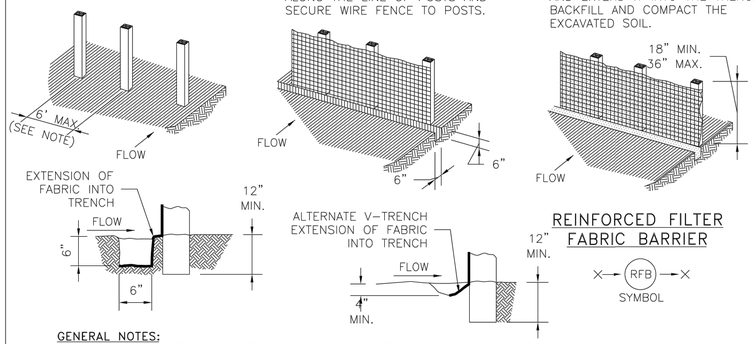
J:\1704\1601\Fort Bend County Standards\Fort Bend County STD\DONE\FBC STORM WATER POLLUTION PRREVENTION PLAN DETAILS\STORM_WATER_POLLUTION_PREVENTION_PLAN_DETAILS.dwg

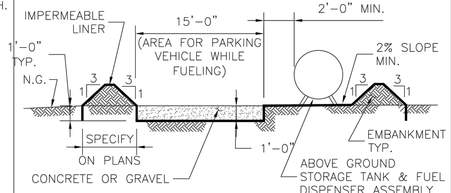
1. SET POSTS AT REQUIRED SPACING
2. EXCAVATE A 6"x6" TRENCH UPSLOPE ALONG THE LINE OF POSTS AND SECURE WIRE FENCE TO POSTS.
3. ATTACH FILTER FABRIC TO POSTS AND EXTEND IT INTO THE TRENCH. BACKFILL AND COMPACT THE EXCAVATED SOIL.



REINFORCED FILTER FABRIC BARRIER

RFB — SYMBOL

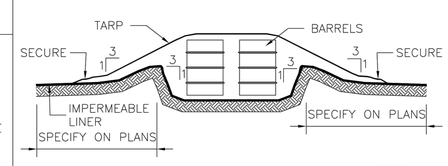
GENERAL NOTES:
1. SECURELY FASTEN MESH FENCING TO POSTS WITH STAPLES OR TIE WIRES.
2. SECURELY FASTEN FILTER FABRIC TO MESH FENCING.
3. WHEN TWO SECTIONS OF FILTER FABRIC ADJOIN EACH OTHER, OVERLAP 6 INCHES AT A POST, FOLD TOGETHER, AND ATTACH TO A POST.
4. REMOVE SEDIMENT DEPOSITS WHEN SILT REACHES ONE-THIRD OF THE HEIGHT OF THE FENCE IN DEPTH.
5. SILT FENCE MINIMUM 2' BEHIND CURB.



ABOVE GROUND TEMP. VEHICLE & EQUIPMENT FUELING AREA WITH TANK

TFA — SYMBOL

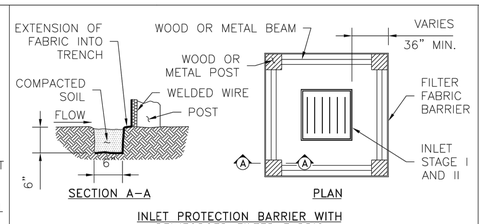
GENERAL NOTES:
1. THE SIZE OF TANK FOUNDATION AREA DEPENDS ON THE SIZE OF ABOVE GROUND STORAGE TANK AND DISPENSER ASSEMBLY.
2. PROVIDE A MINIMUM SLOPE OF 2 % TOWARD THE SUMP PIT.
3. INSTALL IMPERMEABLE LINER AS PER MANUFACTURER'S RECOMMENDATIONS.



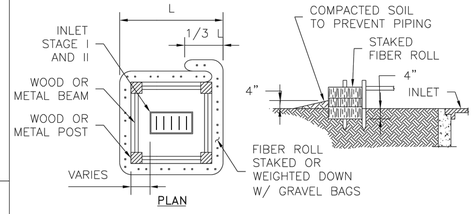
BARREL STORAGE AREA

BSA — SYMBOL

GENERAL NOTES:
1. ALTERNATIVELY, STORE BARRELS IN AN ENCLOSED BUILDING OR SHED.
2. INSTALL IMPERMEABLE LINER AS PER MANUFACTURER'S RECOMMENDATIONS. 60 mil MINIMUM.
3. CONSTRUCT BERMED AREA WITH VOLUME GREATER THAN OR EQUAL TO 110% VOLUME OF BARRELS.



INLET PROTECTION BARRIER WITH REINFORCED FILTER FABRIC

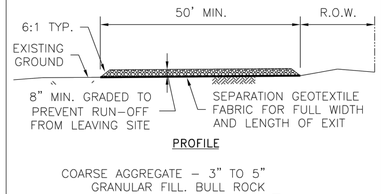


INLET PROTECTION BARRIER WITH FILTER ROLLS

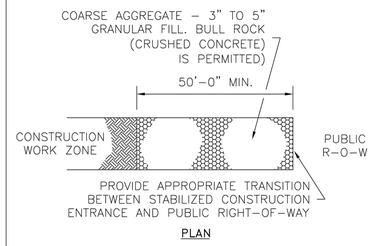
GENERAL NOTES:
1. FIBER ROLLS WILL BE UTILIZED ONLY WHEN SITE CONDITIONS DO NOT PERMIT THE USE OF FILTER FABRIC BARRIER, AND AS APPROVED BY THE ENGINEER.

INLET PROTECTION BARRIERS FOR STAGE I INLETS

IPB — SYMBOL



PROFILE

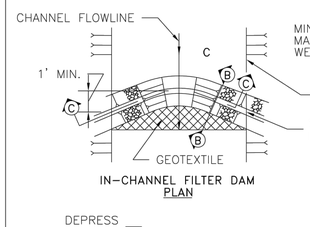


PLAN

STABILIZED CONSTRUCTION ACCESS

SC-1 — SYMBOL

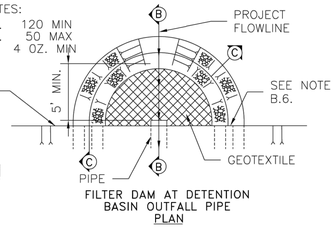
GENERAL NOTES:
1. MINIMUM LENGTH IS AS SHOWN ON CONSTRUCTION DRAWINGS OR 50 FEET, WHICHEVER IS MORE.
2. CONSTRUCT AND MAINTAIN CONSTRUCTION EXIT WITH CONSTANT WIDTH ACROSS ITS LENGTH, INCLUDING ALL POINTS OF INGRESS OR EGRESS.
3. UNLESS SHOWN ON THE CONSTRUCTION DRAWINGS, STABILIZATION FOR OTHER AREAS WILL HAVE THE SAME AGGREGATE THICKNESS AND WIDTH REQUIREMENTS AS THE STABILIZED CONSTRUCTION EXIT.
4. WHEN SHOWN ON THE CONSTRUCTION DRAWINGS, WIDEN OR LENGTHEN STABILIZED AREA TO ACCOMMODATE A TRUCK WASHING AREA. PROVIDE OUTLET SEDIMENT TRAP FOR THE TRUCK WASHING AREA.
5. PROVIDE PERIODIC TOP DRESSING WITH ADDITIONAL COARSE AGGREGATE TO MAINTAIN THE REQUIRED DEPTH OR WHEN SURFACE BECOMES PACKED WITH MUD.
6. PERIODICALLY TURN AGGREGATE TO EXPOSE A CLEAN DRIVING SURFACE.
7. MINIMUM 14' WIDTH FOR ONE WAY TRAFFIC AND 20' WIDTH FOR TWO WAY TRAFFIC.



IN-CHANNEL FILTER DAM PLAN

GEOTEXTILE NOTES:

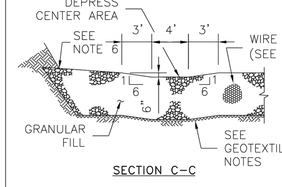
MIN. AOS	SIEVE NO.	120 MIN	
MAX. AOS	SIEVE NO.	50 MAX	
WEIGHT	OZ/SY	4 OZ. MIN	



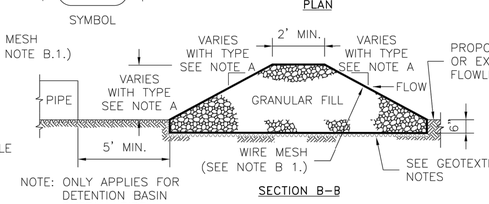
FILTER DAM AT DETENTION BASIN OUTFALL PIPE PLAN

FILTER DAM

RFD-TYPE — SYMBOL



SECTION C-C

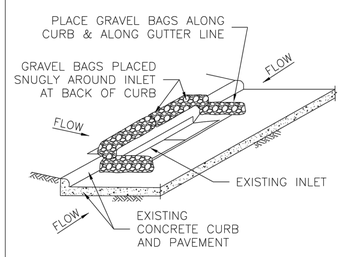


NOTE: ONLY APPLIES FOR DETENTION BASIN OUTFALL PIPE PROTECTION.

SECTION B-B

A. TYPES OF FILTER DAMS
1. TYPE 1 (NON-REINFORCED)
   a. HEIGHT – 18-24 INCHES. MEASURE VERTICALLY FROM EXISTING GROUND TO TOP OF FILTER DAM.
   b. TOP WIDTH – 2 FEET (MINIMUM)
   c. SLOPES – 2:1 (MAXIMUM).
2. TYPE 2 (REINFORCED).
   a. HEIGHT – 18-36 INCHES. MEASURE VERTICALLY FROM EXISTING GROUND TO TOP OF FILTER DAM.
   b. TOP WIDTH – 2 FEET (MINIMUM).
   c. SLOPES – 2:1 (MAXIMUM).
3. TYPE 3 (REINFORCED)
   a. HEIGHT – 36-48 INCHES. MEASURE VERTICALLY FROM EXISTING GROUND TO TOP OF FILTER DAM.
   b. TOP WIDTH – 2 FEET (MINIMUM).
   c. SLOPES – 3:1 (MAXIMUM).
4. TYPE 4 (GABION)
   a. HEIGHT – 30 INCHES (MINIMUM). MEASURE VERTICALLY FROM EXISTING GROUND TO TOP OF FILTER DAM.
   b. TOP WIDTH – 2 FEET (MINIMUM).
5. TYPE 5. AS SHOWN ON THE PLANS.

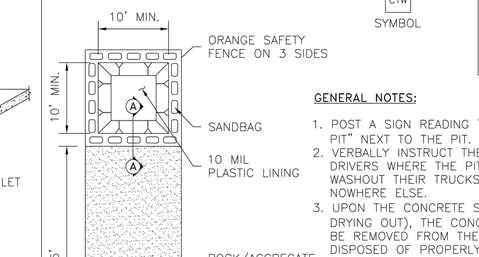
B. CONSTRUCT FILTER DAMS ACCORDING TO THE FOLLOWING CRITERIA UNLESS SHOWN OTHERWISE ON THE PLANS.
1. TYPE 2 AND 3 FILTER DAMS: SECURE WITH 20 GAUGE GALVANIZED WOVEN WIRE MESH WITH 1 INCH DIAMETER HEXAGONAL OPENINGS.
2. PLACE GRANULAR FILL ON THE WIRE MESH TO HEIGHT AND SLOPES SHOWN ON PLANS OR AS SPECIFIED BY THE ENGINEER.
   a. 3-5 INCHES FOR ROCK FILTER DAM TYPES 1, 2 AND 4.
   b. 4-8 INCHES FOR ROCK FILTER DAM TYPE REFER TO GRANULAR FILL IN SPECIFICATION SECTION No. 02378 RIPRAP AND GRANULAR FILL.
3. FOLD WIRE MESH AT UPSTREAM SIDE OVER GRANULAR FILL AND TIGHTLY SECURED TO ITSELF ON THE DOWNSTREAM SIDE USING WIRE TIES OR HOG RINGS.
4. IN STREAMS: SECURE OR STAKE MESH TO STREAM BED PRIOR TO AGGREGATE PLACEMENT.
5. SEE HCFCD SPECIFICATION SECTION NO. 02364-FILTER DAMS.
6. EMBED ONE FOOT MINIMUM INTO SLOPE AND RAISE ONE FOOT HIGHER THAN CENTER OF DEPRESSED AREA AT SLOPE.



INLET PROTECTION BARRIERS FOR STAGE II INLETS

IPB-II — SYMBOL

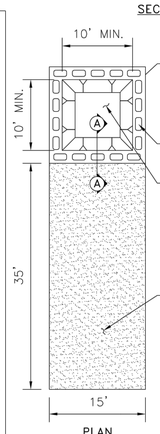
GENERAL NOTES:
1. REMOVE SEDIMENT DEPOSIT WHEN THE SEDIMENT HAS ACCUMULATED TO ONE-THIRD THE HEIGHT OF THE BARRIER.
2. GRAVEL BAGS SHALL NOT BLOCK THROAT OF INLET UNLESS DIRECTED BY ENGINEER.



SECTION A-A

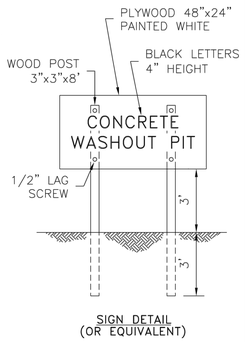
CONCRETE TRUCK WASHOUT AREA

CTW — SYMBOL



PLAN

GENERAL NOTES:
1. POST A SIGN READING "CONCRETE WASHOUT PIT" NEXT TO THE PIT.
2. VERBALLY INSTRUCT THE CONCRETE TRUCK DRIVERS WHERE THE PIT IS AND TO WASHOUT THEIR TRUCKS IN THE PIT AND NOWHERE ELSE.
3. UPON THE CONCRETE SETTING UP (CURING, DRYING OUT), THE CONCRETE WASTE SHALL BE REMOVED FROM THE PROJECT SITE AND DISPOSED OF PROPERLY BY THE CONTRACTOR. AFTER REMOVAL OF THE CONCRETE WASTE, THE WASHOUT PIT SHALL BE FILLED WITH CLEAN FILL MATERIAL AND COMPACTED TO IN-SITU CONDITIONS, OR AS DIRECTED BY THE PROJECT SPECIFICATIONS.
4. CONCRETE WASHOUT PITS SHALL NOT BE LOCATED DIRECTLY ADJACENT TO, NOR AT ANY TIME DRAIN INTO THE STORM SEWER SYSTEM OR ANY OTHER SWALE, DITCH, OR WATERWAY.
5. CONSTRUCT ENTRY ROAD AND BOTTOM OF WASHOUT AREA TO SUPPORT EXPECTED LOADINGS FROM TRUCKS EQUIPMENT.



SIGN DETAIL (OR EQUIVALENT)

NO.	REVISIONS	DATE	NAME
1	ORIGINAL STANDARD ISSUED	2-1-22	RJS
2			
3			
4			
5			

FORT BEND COUNTY
ENGINEERING DEPARTMENT

THE STATE OF TEXAS · FORT BEND COUNTY

PROJECT TITLE:

DRAWN BY: INIT		FBCED STANDARD
CK'D BY: INIT	SHEET DESCRIPTION: STORM WATER POLLUTION	54
SCALE: NONE	PREVENTION PLAN DETAILS	SHEET NO: /
DATE: 2-1-22	APPROVED BY:	

SMITH&COMPANY ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

STRUCTURAL ENGINEER
STANLEY SPURLING & HAMILTON INC.
3301 EDLOE ST.
HOUSTON, TX 77027

CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., SUITE 260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE
647 RICHMOND AVE., SUITE 220
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

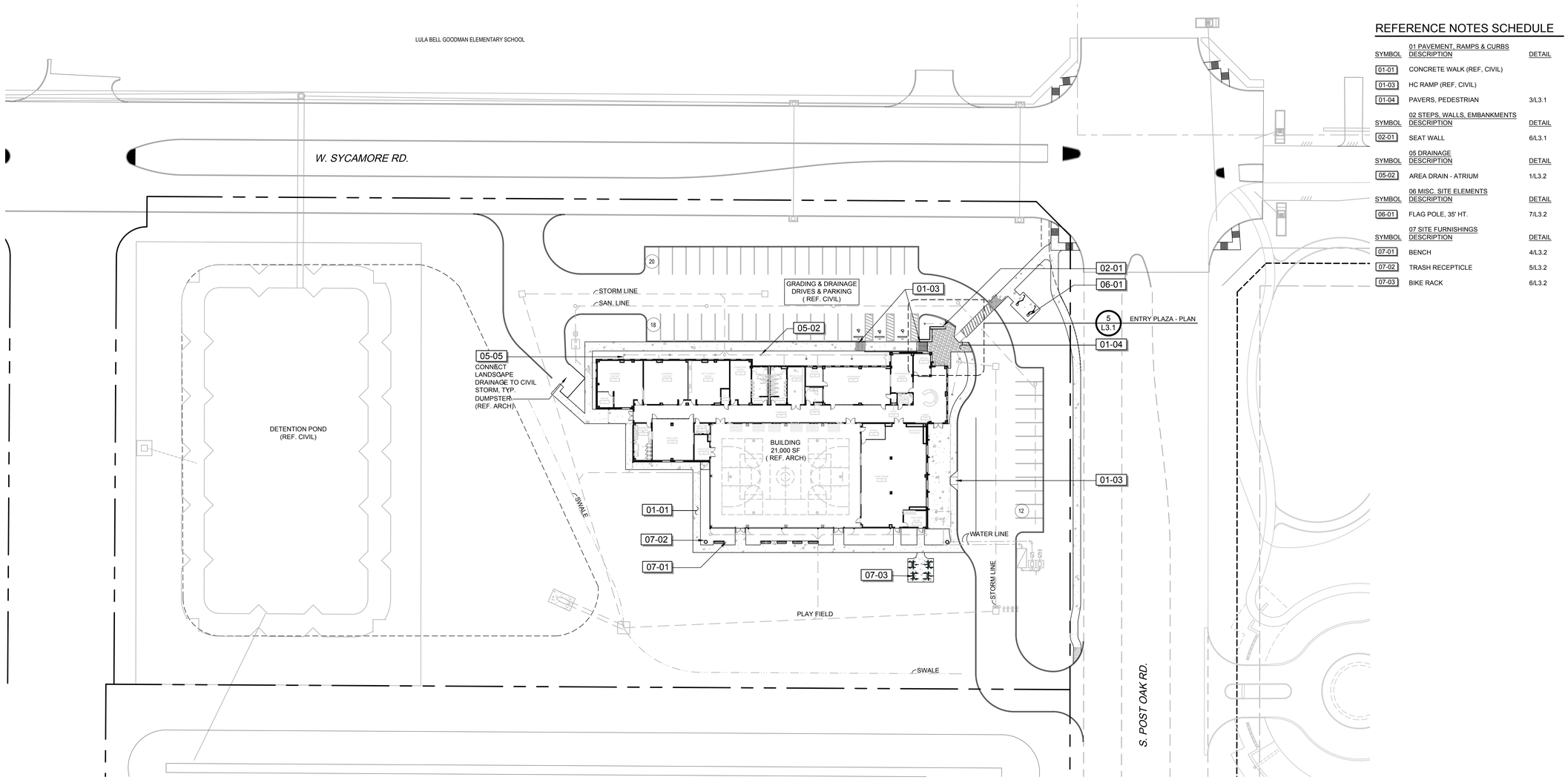
FRESNO BOYS & GIRLS CLUB
' 031 W SYCAMORE RD
FRESNO, TX 77545

SWPPP DETAILS

100% Construction Document
02.29.2024

STATE OF TEXAS · AMANDA F. BARBER · 122357 · LICENSED · PROFESSIONAL ENGINEER
2024-02-28

C7.12



REFERENCE NOTES SCHEDULE

SYMBOL	01 PAVEMENT, RAMPS & CURBS DESCRIPTION	DETAIL
01-01	CONCRETE WALK (REF, CIVIL)	
01-03	HC RAMP (REF, CIVIL)	
01-04	PAVERS, PEDESTRIAN	3/L3.1
SYMBOL	02 STEPS, WALLS, EMBANKMENTS DESCRIPTION	DETAIL
02-01	SEAT WALL	6/L3.1
SYMBOL	05 DRAINAGE DESCRIPTION	DETAIL
05-02	AREA DRAIN - ATRIUM	1/L3.2
SYMBOL	06 MISC. SITE ELEMENTS DESCRIPTION	DETAIL
06-01	FLAG POLE, 35' HT.	7/L3.2
SYMBOL	07 SITE FURNISHINGS DESCRIPTION	DETAIL
07-01	BENCH	4/L3.2
07-02	TRASH RECEPTICLE	5/L3.2
07-03	BIKE RACK	6/L3.2

CONSTRUCTION NOTES

1. SOURCE OF THE BASE SHEETS IS THE PLANS PREPARED BY SMITH & COMPANY ARCHITECTS AND LJA ENGINEERING.
2. REFER TO CIVIL ENGINEER'S UTILITY AND GRADING PLANS FOR UTILITY LOCATION AND FINAL GRADING. IF ACTUAL SITE CONDITIONS VARY FROM WHAT IS SHOW ON THE PLANS, CONTACT THE OWNER'S REPRESENTATIVE FOR DIRECTION AS TO HOW TO PROCEED.
3. DO NOT WILLFULLY PROCEED WITH CONSTRUCTION AS DESIGNED WHEN UNKNOWN OBSTRUCTIONS AND/OR GRADE DIFFERENCES EXIST THAT MAY HAVE NOT BEEN KNOWN DURING DESIGN. SUCH CONDITIONS SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE. THE CONTRACTOR SHALL ASSUME FULL RESPONSIBILITY FOR ALL NECESSARY REVISIONS DUE TO FAILURE TO GIVE SUCH NOTIFICATION.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COORDINATION WITH HIS SUBCONTRACTORS TO ACCOMPLISH HIS SCOPE OF WORK. CONTRACTOR SHALL COORDINATE WITH OTHER TRADES WORKING ON THE SITE SIMULTANEOUSLY.
5. CONTRACTOR SHALL NOTIFY OWNER AND OWNER'S REPRESENTATIVE 48 HOURS PRIOR TO COMMENCEMENT OF WORK TO COORDINATE INSPECTION SCHEDULES.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD VERIFICATION OF EXISTING CONDITIONS, AND SHALL PERFORM FIELD MEASUREMENTS PRIOR TO FABRICATION AND/OR PURCHASE OF AN MATERIAL AND SHALL CONTACT THE OWNER'S REPRESENTATIVE SHOULD EXISTING CONDITIONS BE DIFFERENT FROM THE DESIGN DRAWINGS FOR THIS PROJECT. CONFLICTS ARISING DUE TO LACK OF COORDINATION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
7. ANY REQUIRED CHANGES TO THE DRAWINGS RESULTING FROM THE ACCEPTANCE OF CONTRACTOR'S ALTERNATES AND/OR SUBSTITUTIONS ARE THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE SUBMITTED TO THE LANDSCAPE ARCHITECT AND THE OWNER FOR APPROVAL.
8. THE CONTRACTOR SHALL COORDINATE THE STORING OF MATERIALS, PARKING OF VEHICLES AND RESTRICTIONS OF WORK AND ACCESS WITH THE OWNER. UNDER NO CIRCUMSTANCES SHALL ANY CONTRACTOR STORE MATERIALS OR PARK VEHICLES UNDER THE CANOPY OF EXISTING TREES.
9. CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE ORDINANCES AND LOCAL CODES. REQUIRED PERMITS SHALL BE OBTAINED BY THE CONTRACTOR.
10. CONTRACTOR SHALL PROVIDE UNIT PRICES BASED ON QUANTITIES ON THE DRAWINGS. FIELD CONDITIONS MAY REVISE ACTUAL LOCATION, INCREASING OR DECREASING THE EXTENT OF WORK PERFORMED. CHANGES TO THE EXTENT OF WORK RESULTING IN A AN INCREASE OR DECREASE WILL BE BASED ON UNIT PRICES AND PERFORMED SUBJECT TO APPROVAL OF THE OWNER AND THE LANDSCAPE ARCHITECT IN THE FOR OF A CHANGE ORDER.
11. UNIT PRICES SHALL NOT ONLY INCLUDE THE COST OF THE ITEM BUT ALSO ALL LABOR, EQUIPMENT, AND OTHER MATERIALS ASSOCIATED WITH AND NECESSARY TO DELIVER THE ITEM COMPLETE AS DOCUMENTED IN THE DRAWINGS.
12. ALL CONSTRUCTION COVERED BY THESE CONTRACT DOCUMENTS SHALL BE IN CONFORMANCE WITH THE LATEST EDITION OF ALL APPLICABLE CITY AND OSHA CODES AND STANDARDS INCLUDING BUT NOT LIMITED TO THE UNIFORM BUILDING CODE, ENACTED BY THE CONFERENCE OF BUILDING OFFICIALS, MOST RECENT EDITION, AND AMENDMENTS AS ADOPTED BY LOCAL GOVERNMENT.
13. THE CONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, AND SUPERVISION NECESSARY TO ACCOMPLISH THE WORK AS SHOWN AND NOTED ON THE DRAWINGS UNLESS OTHERWISE NOTED.
14. CONTRACTORS AND SUBCONTRACTORS ARE RESPONSIBLE FOR REMOVAL OF TRASH AND REPAIR OF HAZARDOUS CONDITIONS (IE. TOOLS, OPEN EXCAVATIONS, ETC.) ON A DAILY BASIS BY END OF THE WORK DAY.
15. UPON COMPLETION OF CONSTRUCTION AND PRIOR TO THE FINAL APPROVAL, THE CONTRACTOR SHALL THOROUGHLY CLEAN UP THE PROJECT SITE OF ALL TRASH, SCRAPS, BRICK, ROCKS, MORTAR, ETC. REPAIR ALL DAMAGE TO FINISH GRADES INCLUDING TAILINGS FROM EXCAVATIONS, WHEEL RUTS, OR ANY SETTLING OR EROSION OCCURRING PRIOR TO COMPLETION.

0 15 30 60
SCALE : 1" = 30'

N

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

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CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., #260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE ASSOCIATES
6117 RICHMOND AVE., SUITE 200
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023 SA23434
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

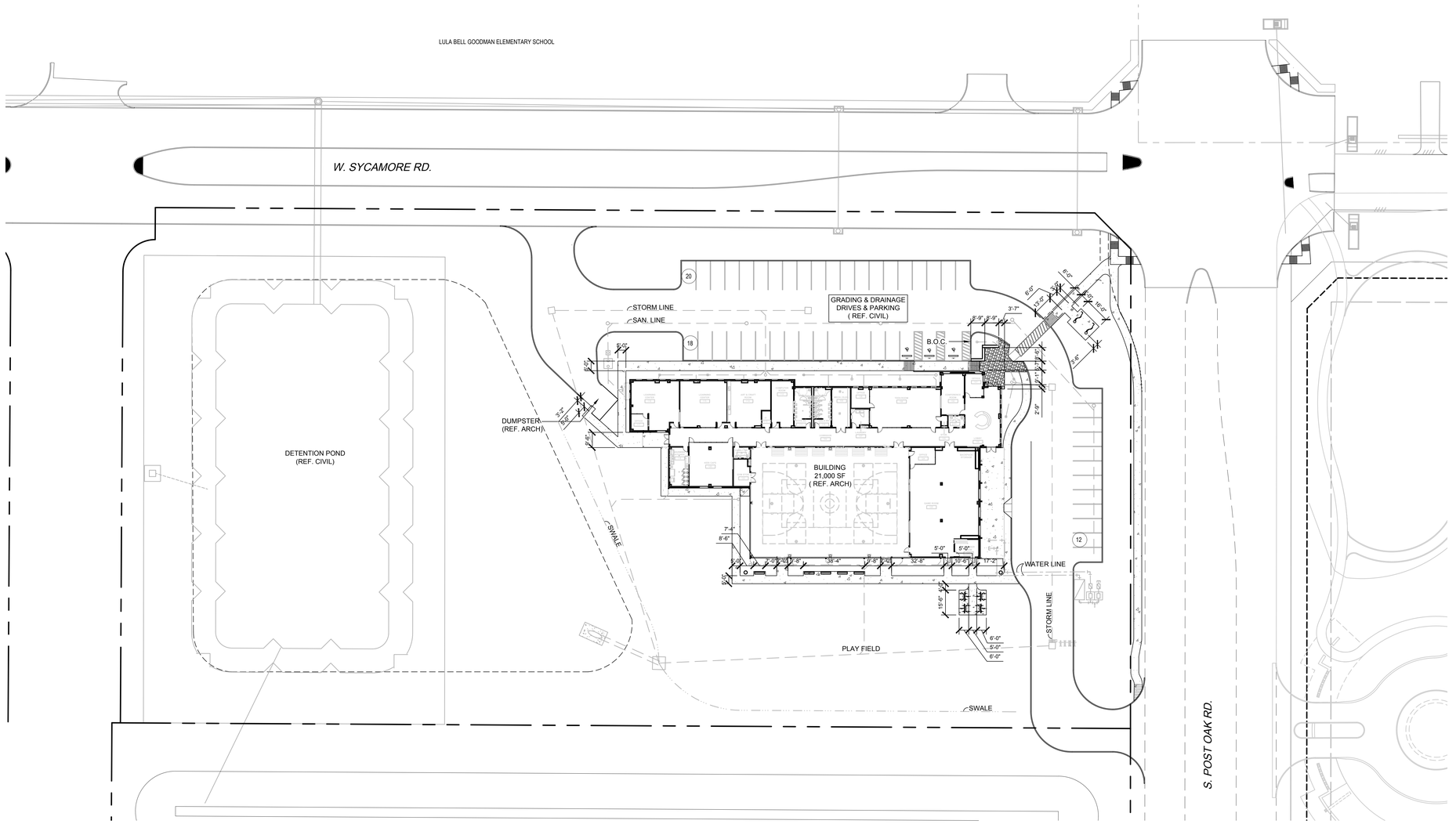
LANDSCAPE SITE PLAN

100% Construction Documents
02.29.2024

REGISTERED LANDSCAPE ARCHITECT
COLBY J. DAVISON
2190
STATE OF TEXAS

02.29.2024

L1.01



LAYOUT NOTES

1. CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL EXISTING UTILITIES.
2. LAYOUT AND VERIFY DIMENSIONS PRIOR TO CONSTRUCTION. BRING DISCREPANCIES TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE.
3. FOR DIMENSIONS OF THE BUILDINGS, REFER TO THE ARCHITECTURAL DRAWINGS.
4. WRITTEN DIMENSIONS TAKE PRECEDENCE OVER SCALE. DO NOT SCALE DRAWINGS.
5. MEASUREMENTS ARE TO FACE OF BUILDING, WALL OR THE FIXED SITE IMPROVEMENT. DIMENSIONS TO CENTER LINES IS INDICATED.
6. INSTALL INTERSECTING ELEMENTS AT 90 DEGREE ANGLES TO EACH OTHER UNLESS OTHERWISE NOTED.
7. WHERE DIMENSIONS ARE CALLED AS "EQUAL", ALL REFERENCED ITEMS SHALL BE SPACED EQUALLY, MEASURED TO THEIR CENTER LINES OR OTHER NOTED REFERENCES.
8. PROVIDE EXPANSION JOINTS WHERE CONCRETE FLATWORK MEETS VERTICAL STRUCTURES SUCH AS WALLS, CURBS, STEPS AND BUILDING ELEMENTS.
9. ALL WALKWAYS SHALL BE LOCATED FROM FINISHED FACE OF BUILDINGS.
10. WRITTEN DIMENSIONS TAKE PRECEDENCE OVER SCALED DIMENSIONS.
11. FOR HANDICAPPED STANDARDS, VERIFY COMPLIANCE WITH LATEST EDITION OF ADA AND LOCAL AND STATE HANDICAP STANDARDS PRIOR TO CONSTRUCTION. WHERE FIELD MODIFICATIONS ARE REQUIRED FOR COMPLIANCE, CONSTRUCTION CHANGES MAY BE APPLIED INCLUDING DIFFERENT GRADES AND LAYOUT THAN THOSE NOTED HEREIN.
12. SURFACES SHALL BE ADA COMPLIANT ALONG ACCESS AND EGRESS. PAVING MATERIALS SHALL HAVE NO ADJACENT SURFACE IRREGULARITIES GREATER THAN 1/4" IN ANY PIECE OR BETWEEN ADJACENT PIECES.

0 15 30 60
SCALE : 1" = 30'

N

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

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HOUSTON, TX 77027

CIVIL ENGINEER
LJA ENGINEERING
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KATY, TX 77449

LANDSCAPE ARCHITECT
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FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

LANDSCAPE SITE LAYOUT PLAN

100% Construction Documents
02.29.2024

REGISTERED LANDSCAPE ARCHITECT
COLBY J. DAVIDSON
2190
STATE OF TEXAS

02.29.2024

L2.01

REFERENCE NOTES SCHEDULE

	01 PAVEMENT, RAMPS & CURBS						
SYMBOL	DESCRIPTION	DETAIL	MANF.	MODEL	FINISH/COLOR	CONTACT	REMARKS/ SUBMITTALS/ MOCKUPS
01-01	CONCRETE WALK (REF, CIVIL)			NA	MEDIUM BROOM FINISH		REFER TO CIVIL FOR DETAILS
01-03	HC RAMP (REF, CIVIL)						REFER TO CIVIL FOR DETAILS
01-04	PAVERS, PEDESTRIAN	3/L3.1	BELGARD	MODULINE J	TBD	BELGARDCOMMERCIAL.COM	67% 12X12 SQUARES 22% 6X12 RECTANGLES 11% 6X6 SQUARES
	02 STEPS, WALLS, EMBANKMENTS						
SYMBOL	DESCRIPTION	DETAIL	FINISH/COLOR	REMARKS/ SUBMITTALS/ MOCKUPS			
02-01	SEAT WALL	6/L3.1	TBD	PREPARE MOCK UP FOR APPROVAL.			
	05 DRAINAGE						
SYMBOL	DESCRIPTION	DETAIL	MANF.	MODEL	FINISH/COLOR	REMARKS/ SUBMITTALS/ MOCKUPS	
05-02	AREA DRAIN - ATRIUM	1/L3.2	NDS	12"X12"			
	06 MISC. SITE ELEMENTS						
SYMBOL	DESCRIPTION	DETAIL	MANF.	MODEL	FINISH/COLOR	CONTACT	REMARKS/ SUBMITTALS/ MOCKUPS
06-01	FLAG POLE, 35' HT.	7/L3.2	KRONBERG`S FLAGS & FLAGPOLES	ECV35-ICC30D61	SATIN ALUMINUM	PH. 713-661-9222	FLAG POLES TO HAVE DOUBLE CLEATS FOR 2 FLAGS, COORD. W/ OWNER PRIOR TO ORDER; PROVIDE 1 US AND 1 TEXAS FLAG 6` X 8`, 100% 2-PLY POLYESTER, OWNER TO SUPPLY BOY`S & GIRL`S CLUB FLAG.
	07 SITE FURNISHINGS						
SYMBOL	DESCRIPTION	DETAIL	MANF.	MODEL	FINISH/COLOR	CONTACT	
07-01	BENCH	4/L3.2	KEYSTONE RIDGE	EV26	TBD	JUSTIN MASKAL, EMAIL: JUSTINM@KEYSTONERIDGEDESIGNS.COM	
07-02	TRASH RECEPTICLE	5/L3.2	KEYSTONE RIDGE	EV3-32	TBD	JUSTIN MASKAL, EMAIL: JUSTINM@KEYSTONERIDGEDESIGNS.COM	
07-03	BIKE RACK	6/L3.2	KEYSTONE RIDGE	SN05-7	TBD	JUSTIN MASKAL, EMAIL: JUSTINM@KEYSTONERIDGEDESIGNS.COM	

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

STRUCTURAL ENGINEER
STANLEY SPURLING & HAMILTON INC.
3301 EDLOE ST.
HOUSTON, TX 77027

CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., #260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE ASSOCIATES
6117 RICHMOND AVE., SUITE 200
HOUSTON, TX 77057
TBPE FIRM REG:#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023 SA23434
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

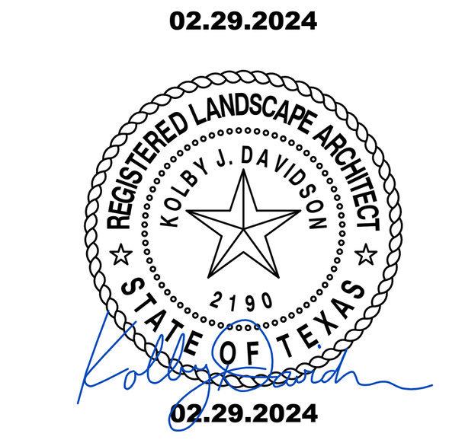
REVISIONS:

NO. DATE DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

LANDSCAPE
REFERNCE
SCHEDULE

100% Construction Documents
02.29.2024



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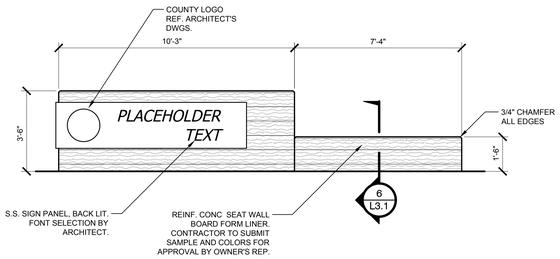
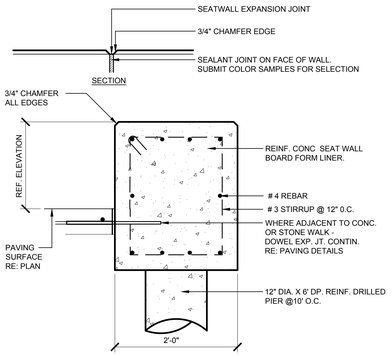


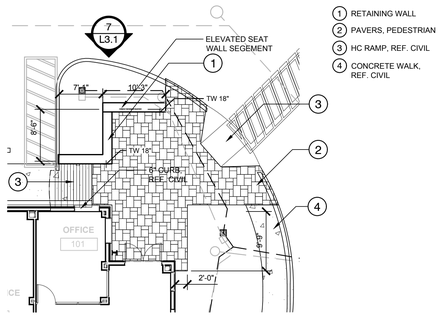
7 SEAT WALL - ELEVATION

3/8" = 1'-0"



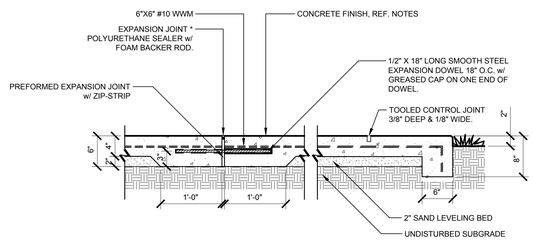
6 CONCRETE SEAT WALL

1" = 1'-0"



5 ENTRY PLAZA - PLAN

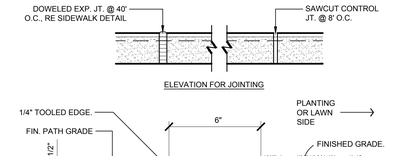
1" = 10'

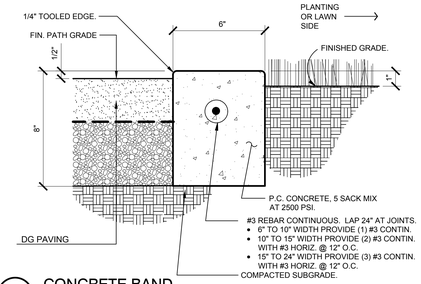


NOTES:
1. AT EXPANSION JOINT, INCREASE DEPTH OF SLAB 2" TO ACCOMMODATE DOWEL.
2. EXPANSION JOINT MAY BE FORMED WITH REDWOOD OR PRE-FORMED EXPANSION JOINT MATERIAL. INSTALL WITH "ZIP STRIP" OR 3/4" x 3/4" WOOD STRIP AT SURFACE TO LEAVE A VOID FOR BACKER ROD AND JOINT SEALER.
3. EXPANSION JOINTS ARE TO BE 24' ON CENTER UNLESS NOTED OTHERWISE ON PLAN. CONTROL JOINTS ARE TO BE 5' ON CENTER UNLESS NOTED OTHERWISE ON PLAN.
4. REFERENCE PLANS FOR SCORING PATTERN AND DIMENSIONS.
5. CONTRACTOR TO PROVIDE SAMPLE FOR APPROVAL USING ALL SPECIFIED MATERIALS. SAMPLE SECTION SHALL BE AT LEAST 5' X 5'. SAMPLE MAY BE PART OF FINISHED SURFACE AREA.

1 CONCRETE WALK - WWM

1" = 1'-0"

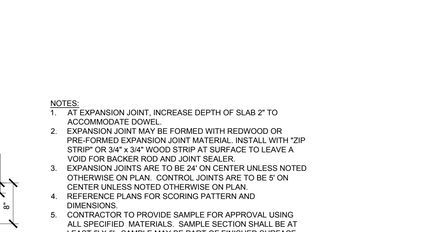




4 CONCRETE BAND

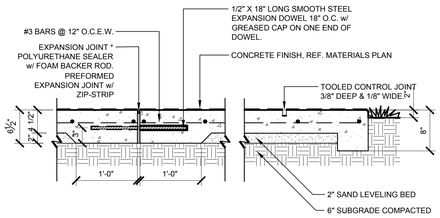
3" = 1'-0"

NOTE:
1. RE PLAN: FOR PATTERN
2. COLORS TO BE DETERMINED.
3. WHERE REQUIRED, CUT PAVERS TO FIT ACCURATELY, NEATLY AND WITHOUT DAMAGED EDGES.



3 PAVERS, PEDESTRIAN

3/4" = 1'-0"



CONCRETE NOTES:
SUBGRADE COMPACTED TO 95% STD PROCTOR DENSITY @ ±2% OPTIMUM MOISTURE CONTENT. COORDINATE CONCRETE DESIGN AND REINFORCING WITH GEOTECH RECOMMENDATIONS.

2 CONCRETE WALK - REINF.

1" = 1'-0"

SMITH&COMPANY
ARCHITECTS

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LJA ENGINEERING
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KATY, TX 77449

LANDSCAPE ARCHITECT
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SPRING, TX 77379

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INFRASTRUCTURE ASSOCIATES
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FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

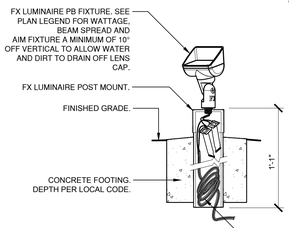
LANDSCAPE SITE DETAILS

100% Construction Documents
02.29.2024

REGISTERED LANDSCAPE ARCHITECT
JOHN J. DAVIDSON
2190
STATE OF TEXAS

02.29.2024

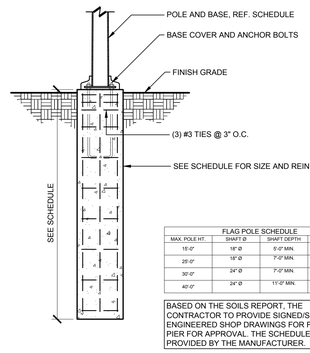
L3.01



FX LUMINAIRE
1940 Diamond Street
San Marcos, CA 92078
Main: 760-744-5240
Technical Support:
760-591-7383
www.fxl.com

10 LED UP LIGHT WITH CONC. FOOTING

1 1/2" = 1'-0"

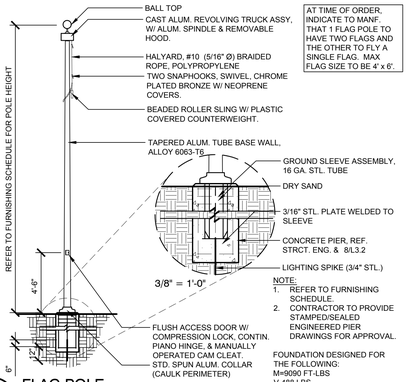


FLAG POLE SCHEDULE			
MAX. POLE HT.	SHAFT Ø	SHAFT DEPTH	REINF.
15'-0"	18" Ø	5'-0" MIN.	(6) #5 VERT. #3 TIES @ 12" O.C.
25'-0"	18" Ø	7'-0" MIN.	(6) #5 VERT. #3 TIES @ 12" O.C.
30'-0"	24" Ø	7'-0" MIN.	(6) #7 VERT. #3 TIES @ 12" O.C.
40'-0"	24" Ø	11'-0" MIN.	(6) #7 VERT. #3 TIES @ 12" O.C.

BASED ON THE SOILS REPORT, THE CONTRACTOR TO PROVIDE SIGNED/SEALED ENGINEERED SHOP DRAWINGS FOR FLAG POLE PIER FOR APPROVAL. THE SCHEDULE ABOVE IS PROVIDED BY THE MANUFACTURER.

8 FLAG POLE PIER

3/8" = 1'-0"



AT TIME OF ORDER, INDICATE TO MANF. THAT 1 FLAG POLE TO HAVE TWO FLAGS AND THE OTHER TO FLY A SINGLE FLAG. MAX FLAG SIZE TO BE 4' x 6'.

NOTE:
1. REFER TO FURNISHING SCHEDULE.
2. CONTRACTOR TO PROVIDE STAMPED/SEALED ENGINEERED PIER DRAWINGS FOR APPROVAL.

FOUNDATION DESIGNED FOR THE FOLLOWING:
M=9090 FT-LBS
V-488 LBS

7 FLAG POLE

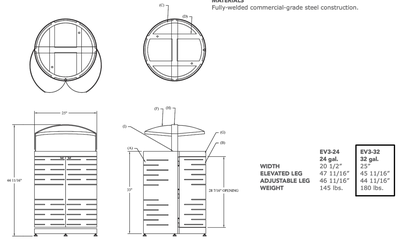
3/16" = 1'-0"

EVERETT LITTER RECEPTACLE
Bench with back and flat bench are covered by Patent No. Des. D794,971. Litter receptacle is Exclusive By Design™.

KEYSHIELD® METAL FINISH
The trademarked KEYSHIELD® finish protects each piece of furniture from chipping, cracking, and UVA damage while providing unparalleled corrosion resistance. Steel products are finished with a two-coat powder coating process applied to a 7-15 mil thickness. Substrate preparation includes sandblasting to a white finish to remove all surface contaminants. The raw product then receives a corrosion-inhibiting phosphate coating prior to the application of the powder coating. The first coat applied to the substrate is zinc rich epoxy powder primer used exclusively on sandblasted parts. The second coat is a colored polyester powder coating. Both coats are electrostatically applied and oven cured according to powder coating manufacturing specifications to create a smooth, satin-like finish and a low-emitting non-porous armor.

FULLY ASSEMBLED UNIT
The Everett litter receptacle is manufactured in the USA as a fully assembled unit to provide ultimate stability and avoid damage during transit to the site, saving time and money.

MATERIALS
Fully-welded commercial-grade steel construction.

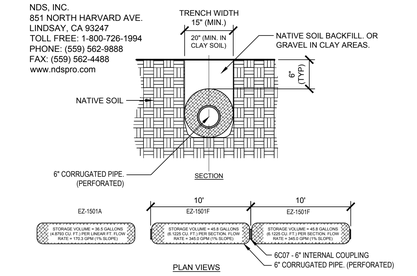


	EV3-24	EV3-32
WIDTH	24 gal.	32 gal.
ELEVATED LEG	20 1/2"	25"
ADJUSTABLE LEG	47 11/16"	45 11/16"
WEIGHT	46 11/16"	44 11/16"
	145 lbs.	180 lbs.

670 Mercer Road | Butler, PA 16001-1840
Toll-free: 1-800-284-8208 | Phone: 724-284-1213 | Fax: 724-284-1253
www.keystoneridgedesigns.com

5 TRASH RECEPTICLE

NOT TO SCALE

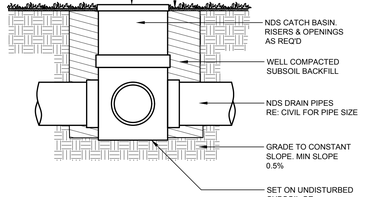


ADDITIONAL COVER MAY BE REQUIRED BASED ON SITE CONDITIONS. 12" COVER REQUIRED TO OBTAIN AN H-10 LOAD RATING.

NOTES:
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
2. DO NOT SCALE DRAWING.
3. THIS DRAWING IS INTENDED FOR USE BY ARCHITECTS, ENGINEERS, CONTRACTORS, CONSULTANTS AND DESIGN PROFESSIONALS FOR PLANNING PURPOSES ONLY.
4. ALL INFORMATION CONTAINED HEREIN WAS CURRENT AT THE TIME OF DEVELOPMENT BUT MUST BE REVIEWED AND APPROVED BY THE PRODUCT MANUFACTURER TO BE CONSIDERED ACCURATE.

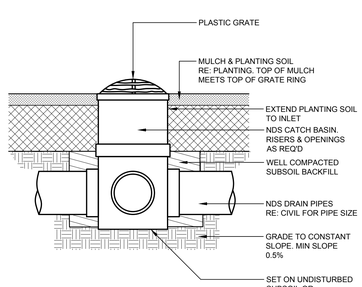
3 SUBDRAIN - EZ FLOW

3/4" = 1'-0"



2 AREA DRAIN - LAWN

3/4" = 1'-0"



1 AREA DRAIN - ATRIUM

3/4" = 1'-0"

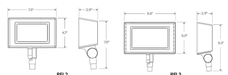
BEACON
design. performance. technology.

Ratio Flood
COMPACT

DATE: | LOCATION:
TYPE: | PROJECT:
CATALOG #:

RATIO

IP66 | DLC LISTED | DLC DESIGN PREMIUM | BAA | TAA



	Weight	EPA (Front/Side)
RFL2	37 lbs / 612 kg	0.34ft² / 0.03ft²
RFL3	55 lbs / 618 kg	0.07ft² / 0.00ft²

FEATURES
- Compact LED flood with a variety of NEMA distributions for lighting applications such as: safety/security, accent, flag pole, columns or signs
- Part of the Ratio flood series, this luminaire was designed in cohesion with the site/area products to provide a sleek and timeless look
- Features a dense optical array, providing reduced pixelation and increased visual comfort without compromising performance

SERVICE PROGRAMS
STOCK

SPECIFICATIONS

CONSTRUCTION
- Corrosion resistant, rugged die-cast aluminum housing with powder coat paint finish
- High impact UV stabilized acrylic outer lens protects LEDs and allows for cleaning and debris removal
- Internal venting fins create optimal heat dissipation and allow all water to drain from the face of the luminaire
- Lens hardware is internal to the fixture allowing for uniform pressure on the gasket for an optimal water tight seal

OPTICS
- 44 or 90 midpower LEDs
- Stock Versions: 4000K and 5000K CCT
- Variety of NEMA distributions - N (2x2), M (4x4) and W (6x6) - Stock version Wide (6x6) only
- Entire optical aperture illuminates to create a larger luminous surface area resulting in a low glare appearance without sacrificing optical performance

INSTALLATION
- Traditional 10" x 14 NPS threaded adjustable knuckle mounting
- Easy maintenance access to electrical components with removal of 4 screws from back of fixture housing
- Trunnion mount available (sold separately)

ELECTRICAL
- 120–277V operation, 50/60Hz
- Driver IP66 and RoHS compliant driver
- 10kV surge protector optional
- 0–10V dimming driver standard, continuous dimming option to have leads pulled out for easy connection
- Drivers have 90% power factor and less than 20% THD
- LED drivers have output power over-voltage, over-current protection and short circuit protection with auto recovery
- Dimming drivers are standard, but must contact factory to request wiring leads for purpose of external dimming controls

CERTIFICATIONS
- Fixture is IP66 rated
- Listed to UL1598 for use in wet locations
- This product meets federal procurement law requirements under the Buy American Act (FAR 52.225-9) and Trade Agreements Act (FAR 52.225-7). See Buy America(n) Solutions (link to https://www.currentlighting.com/resources/america-solutions)

WARRANTY
- 5 year limited warranty
- See HLI Standard Warranty for additional information

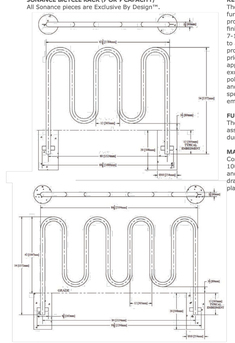
Current

currentlighting.com/beacon

9 FLAG UPLIGHT

NOT TO SCALE

SONANCE BICYCLE RACK (7 OR 9 CAPACITY)
All Sonance pieces are Exclusive By Design™.



KEYSHIELD® METAL FINISH
The trademarked KEYSHIELD® finish protects each piece of furniture from chipping, cracking, and UVA damage while providing unparalleled corrosion resistance. Steel products are finished with a two-coat powder coating process applied to a 7-15 mil thickness. Substrate preparation includes sandblasting to a white finish to remove all surface contaminants. The raw product then receives a corrosion-inhibiting phosphate coating prior to the application of the powder coating. The first coat applied to the substrate is zinc rich epoxy powder primer used exclusively on sandblasted parts. The second coat is a colored polyester powder coating. Both coats are electrostatically applied and oven cured according to powder coating manufacturing specifications to create a smooth, satin-like finish and a low-emitting non-porous armor.

FULLY ASSEMBLED UNIT
The Sonance bicycle rack is manufactured in the USA as a fully assembled unit to provide ultimate stability and avoid damage during transit to the site, saving time and money.

MATERIALS
Commercial-grade materials, at least 25% recycled raw steel, 100% recyclable steel; completely welded for optimum strength and stability according to Keystone Ridge Designs, Inc. CAD drawing; 2" schedule 40 pipe, ¼" x 2" flat steel embedment plate or .188 flat steel bolt down flanges.

	SN05-7	SN07-9
LENGTH	7 cap.	9 cap.
OVERALL HEIGHT	66 3/8"	90 3/8"
EMBEDDED	54"	54"
WEIGHT	12"	12"
	95 lbs.	120 lbs.

670 Mercer Road | Butler, PA 16001-1840
Toll-free: 1-800-284-8208 | Phone: 724-284-1213 | Fax: 724-284-1253
www.keystoneridgedesigns.com

6 BIKE RACK

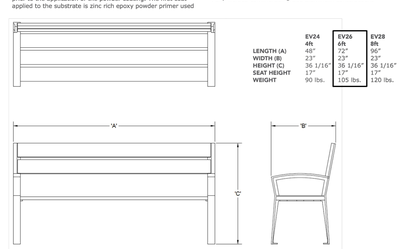
NOT TO SCALE

EVERETT BENCH WITH BACK
Bench with back and flat bench are covered by Patent No. Des. D794,971. Litter receptacle is Exclusive By Design™.

KEYSHIELD® METAL FINISH
The trademarked KEYSHIELD® finish protects each piece of furniture from chipping, cracking, and UVA damage while providing unparalleled corrosion resistance. Steel products are finished with a two-coat powder coating process applied to a 7-15 mil thickness. Substrate preparation includes sandblasting to a white finish to remove all surface contaminants. The raw product then receives a corrosion-inhibiting phosphate coating prior to the application of the powder coating. The first coat applied to the substrate is zinc rich epoxy powder primer used exclusively on sandblasted parts. The second coat is a colored polyester powder coating. Both coats are electrostatically applied and oven cured according to powder coating manufacturing specifications to create a smooth, satin-like finish and a low-emitting non-porous armor.

FULLY ASSEMBLED UNIT
The Everett bench with back is manufactured in the USA as a fully assembled unit to provide ultimate stability and avoid damage during transit to the site, saving time and money.

MATERIALS
Fully-welded commercial-grade aluminum construction.



	EV24	EV26	EV28
LENGTH (A)	4ft	6ft	8ft
WIDTH (B)	48"	72"	96"
HEIGHT (C)	23"	23"	23"
SEAT HEIGHT	36 1/16"	36 1/16"	36 1/16"
WEIGHT	17"	17"	17"
	90 lbs.	105 lbs.	120 lbs.

670 Mercer Road | Butler, PA 16001-1840
Toll-free: 1-800-284-8208 | Phone: 724-284-1213 | Fax: 724-284-1253
www.keystoneridgedesigns.com

4 BENCH

NOT TO SCALE

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

STRUCTURAL ENGINEER
STANLEY SPURLING & HAMILTON INC.
3301 EDLOE ST.
HOUSTON, TX 77027

CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., #260
SPRING, TX 77373

MEP ENGINEER
INFRASTRUCTURE ASSOCIATES
6117 RICHMOND AVE., SUITE 200
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023 SA23434
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

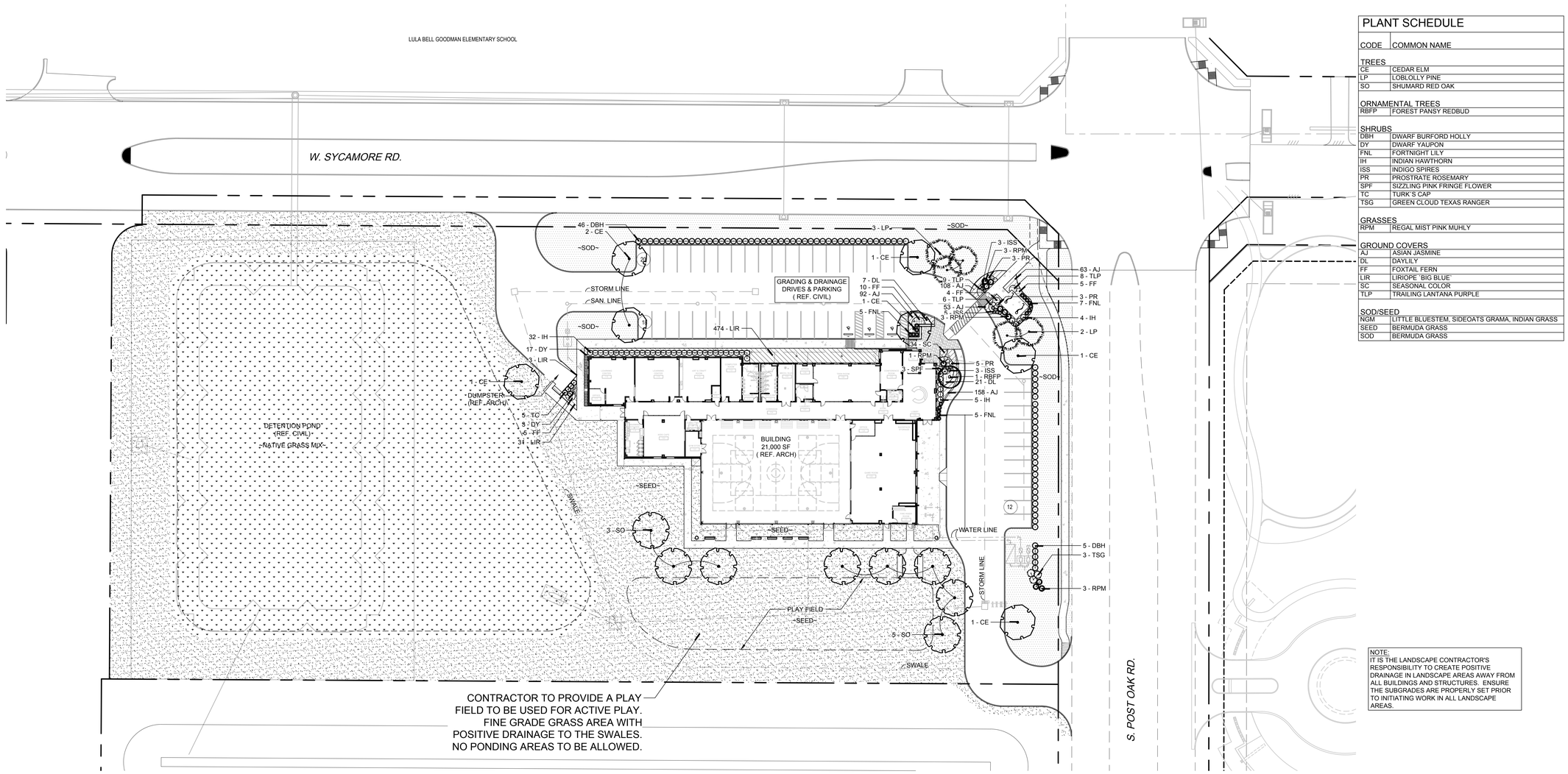
LANDSCAPE SITE DETAILS

100% Construction Documents
02.29.2024

REGISTERED LANDSCAPE ARCHITECT
COLBY J. DAVIDSON
2190
STATE OF TEXAS

02.29.2024

L3.02



PLANT SCHEDULE	
CODE	COMMON NAME
TREES	
CE	CEDAR ELM
LP	LOBLOLLY PINE
SO	SHUMARD RED OAK
ORNAMENTAL TREES	
RBFP	FOREST PANSY REDBUD
SHRUBS	
DBH	DWARF BURFORD HOLLY
DY	DWARF YAUPON
FNL	FORTNIGHT LILY
IH	INDIAN HAWTHORN
ISS	INDIGO SPIRES
PR	PROSTRATE ROSEMARY
SPF	SIZZLING PINK FRINGE FLOWER
TC	TURK`S CAP
TSG	GREEN CLOUD TEXAS RANGER
GRASSES	
RPM	REGAL MIST PINK MUHLY
GROUND COVERS	
AJ	ASIAN JASMINE
DL	DAYLILY
FF	FOXTAIL FERN
LIR	LIRIOPE `BIG BLUE`
SC	SEASONAL COLOR
TLP	TRAILING LANTANA`PURPLE
SOD/SEED	
NGM	LITTLE BLUESTEM, SIDEOATS GRAMA, INDIAN GRASS
SEED	BERMUDA GRASS
SOD	BERMUDA GRASS

NOTE:
IT IS THE LANDSCAPE CONTRACTOR'S RESPONSIBILITY TO CREATE POSITIVE DRAINAGE IN LANDSCAPE AREAS AWAY FROM ALL BUILDINGS AND STRUCTURES. ENSURE THE SUBGRADES ARE PROPERLY SET PRIOR TO INITIATING WORK IN ALL LANDSCAPE AREAS.

0 15 30 60
SCALE : 1" = 30'

N

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

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CIVIL ENGINEER
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KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
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SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE ASSOCIATES
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TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023 SA23434

DATE ISSUED: 02.29.2024

TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

PLANTING PLAN

100% Construction Documents
02.29.2024

REGISTERED LANDSCAPE ARCHITECT
KELBY DAVIDSON
2199
STATE OF TEXAS

02.29.2024

L4.01

LANDSCAPE PLANTING NOTES

1. EXISTING CONDITIONS: The Landscape Contractor shall be responsible for visiting the site prior to submitting Bid Proposal, to become familiar with all conditions affecting the proposed work. The Landscape Contractor shall identify and review all underground utility locations prior to commencing work and shall exercise extreme caution when working close to utilities, and shall notify the Owner's Representative of apparent conflicts with construction and utilities so that adjustments can be planned prior to installation. Contact the local underground utility services for utility location and identification. The Landscape Contractor bears full responsibility for this work and disruption or damage to utilities shall be repaired immediately at no expense to the Owner.

2. LAYOUT and GRADING: The Landscape Contractor shall be responsible for accurately laying out the plant beds and turf areas by scaling the Drawings. Layout shall be painted or staked on the ground for review and approval of Owner's Representative prior to excavation. Following approval of layout, closely coordinate the installation of the irrigation system to conform to the approved layout.

   The Landscape Contractor shall be responsible for clearing and fine grading of the planting areas. The Landscape Contractor and Owner shall review the extent of grading of area prior to commencing work. Turf areas shall be raked smooth, removing and disposing of stones over 1" diameter and sticks, roots, and other extraneous matter and legally disposing of them off Owner's property. All areas shall be fine graded to achieve positive drainage without puddles or standing water and feather into natural grade. Roll and rake, remove ridges, and fill depressions to meet finish grades to within plus or minus ½ inch of finish elevation. Limit finish grading to areas that can be planted in the immediate future.

   Landscape Contractor shall be responsible for erosion control of sloped areas. Contractor to restore turf or planting areas if eroded or otherwise disturbed after finish grading.

3. TOPSOIL: The Landscape Contractor shall be responsible for importing and placing topsoil to prepare the turf areas for the specified grass sod and/or seeding. Turf areas shall receive a 2" layer of amended topsoil. The Landscape Architect, Landscape Contractor and Owner shall review the extent of this work prior to commencement of installation. Do not spread topsoil if soil or subgrade is frozen, muddy or excessively wet. Landscape Contractor to refer to specifications regarding soil testing and soil analysis. IN BID PROPOSAL, FURNISH UNIT PRICE PER CUBIC YARD OF AMENDED IMPORTED TOPSOIL, PREPARED AND SPREAD. CONTRACT AMOUNT WILL BE ADJUSTED BASED ON ACTUAL, APPROVED QUANTITIES NEEDED AND FURNISHED.

4. PLANT BEDS: The Landscape Contractor shall excavate fully prepared plant beds as required to accommodate a full 6" of prepared soil and 2" mulch layer. Clean, native topsoil removed from these beds may be spread on nearby areas to be sodded or seeded. Following excavation, place prepared soil in these plant beds. Prepared soil shall consist of 4" imported topsoil and 2" compost, thoroughly blended together. Create positive drainage in landscape areas away from all buildings and structures. This mix shall also be used to backfill planting pits of all pit-planted shrubs and trees. IN BID PROPOSAL, FURNISH UNIT PRICES PER CUBIC YARD OF PREPARED SOIL MIX. SUBMIT SAMPLE FOR REVIEW AND APPROVAL BY LANDSCAPE ARCHITECT.

   Finish grades of shrub areas and lawns shall be 1½" below adjacent paving or header.

5. WEED CONTROL: Prior to preparing lawn areas and plant beds, eradicate all weeds, briars and vines with "Burn Out" Weed and Grass Concentrate Killer by Bronide or approved equal applied by licensed personnel following manufacturer's recommendations and taking all necessary precautions. Apply 10 lb of MicroLife Humates Plus per 1,000 sq ft to restore soil health.

6. SOD and GRASS SEEDING: Limits of sod and grass seeding areas shown on the Drawings are schematic and not to be construed to be precise. The Landscape Architect, Landscape Contractor and Owner shall review the limits of seeding and sodding prior to commencing installation. IN BID PROPOSAL, FURNISH UNIT PRICES FOR SOD AND GRASS SEEDING PER SQUARE YARD. THE CONTRACT AMOUNT WILL BE ADJUSTED BASED ON ACTUAL, APPROVED QUANTITIES INSTALLED.

   The Landscape Architect, Landscape Contractor and owner shall review the limits of seeding prior to commencing installation. Landscape Contractor shall provide a uniform stand of grass by watering and maintaining seeded areas until date of substantial completion. Reseed areas, with specified materials, which fail to provide a uniform stand until Owner's Representative reviews all affected areas. Replace immediately unless required to seed in the succeeding planting season. Restrict traffic from seeded areas until established. Erect signs, flagging and barriers as required. Sow grass seed when soil temperature is above 65 degrees f (in early spring through late summer).

7. MULCH: Following planting, mulch "fully-prepared" beds and mulched areas with 2" layer of shredded hardwood mulch and fill basins of pit-planted shrubs and trees with mulch. IN BID PROPOSAL, FURNISH UNIT PRICE PER CUBIC YARD.

8. PLANTS: All plants shall be nursery grown, Grade 1 plants meeting Nurseryman Association Standards, typical in shape and size for species. Provide matching forms and sizes for plant materials within each species and size designated on the drawings. Plants shall not be root-bound nor loose in their containers. Handle all plants with care in transporting, planting and maintenance until inspection and final acceptance. Planting pits for 1 and 5 gallon shrubs shall be at least 8" larger in diameter than the container size. Larger containers sizes and B&B plants shall be planted in pits at least 18" larger in diameter than the ball size. Plants shall be installed to present their best side facing the viewer. Use total quantities of plants indicated; adjust spacing as needed to evenly fill beds. Owner's Representative shall have final approval of plant material layout. Prune newly planted trees only as directed by Landscape Architect. Cut and remove burlap from top ⅓ of ball (if B&B material is specified or approved). PROVIDE UNIT PRICES FOR ALL PLANT MATERIALS. UNIT PRICE IS TO INCLUDE COST OF MATERIAL, LABOR AND TAXES AS REQUIRED TO INSTALL THE PLANTS. UNIT PRICES SHALL BE USED IN THE CASE THAT FEWER OR MORE PLANTS ARE TO BE PLANTED.

9. WARRANTY: Provide a one-year replacement warranty for all plant materials. Warranty shall cover plants which have died or partially died (thereby ruining their natural shape), but shall not include damage by vandalism, browsing, hail, abnormal freezes, drought or negligence by the Owner. The Warranty is intended to cover Contractor negligence, infestations, disease and damage or shock to plants. Plants replaced under Warranty will be warranted for one year following replacement.

Native Grass Seed Mix

Botanical Name	Common Name			Percent
Panicum hallii var. hallii	Oso Germplasm Halls Panicum	1	lbs PLS/ acre	2%
Tridens albescens	Guadalupe Germplasm White Tridens	1	lbs PLS/ acre	2%
Andropogon gerardii Vitman	Kaw Big Bluestem	6	lbs PLS/ acre	14%
Tripsacum dactyloides	Eastern Gamagrass	10	lbs PLS/ acre	23%
Sorghastrum nutans	Indiangrass, Cheyenne	4.5	lbs PLS/ acre	10%
Panicum virgatum L.	Switchgrass, Blackwell	2	lbs PLS/ acre	5%
Elymus canadensis	Wildrye, Canada	10	lbs PLS/ acre	23%
Elymus virginicus	Wildrye, Virginia	3	lbs PLS/ acre	7%
Desmanthus illinoensis Michx	Sabine Illinois Bundleflower	3	lbs PLS/ acre	7%
Helianthus dalyi	Sunflowers, Maximilian	3	lbs PLS/ acre	7%

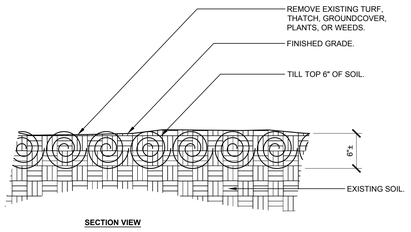
Cover Crop

Planting Month	*Botanical Name*	Common Name		
Nov - Feb	*Secale cereale*	Elbon Cereal Rye	50	lbs PLS/ acre
March-April	*Urochloa ramosa*	Browntop Millet	50	lbs PLS/ acre

SEED SOURCE: DOUGLASS KING SEED, PH. 888-DK-SEEDS, OR APPROVED EQUAL.

PLANT SCHEDULE

CODE	QTY	COMMON NAME	CONT.	CAL.	HT.	SPD.	
TREES							
CE	7	CEDAR ELM	45 GAL.	2.5" CAL.	10` HT.	5` SPD.	
LP	5	LOBLOLLY PINE	30 GAL.	2" CAL.	10` HT.	5` SPD.	
SO	8	SHUMARD RED OAK	45 GAL.	2.5" CAL.	12` HT.	6` SPD.	
ORNAMENTAL TREES							
RBFP	1	FOREST PANSY REDBUD	30 GAL.	1.5" CAL.	8-10` HT.	5-7` SPD.	
CODE	QTY	COMMON NAME	CONT	SPACING	HT.	SPD.	SPACING
SHRUBS							
DBH	79	DWARF BURFORD HOLLY	5 GAL.	48" O.C.	18-24" HT.	18-24" SPD.	48" o.c.
DY	20	DWARF YAUPON	1 GAL.				24" o.c.
FNL	17	FORTNIGHT LILY	5 GAL.	36" O.C.	30" HT.	24" SPD.	36" o.c.
IH	41	INDIAN HAWTHORN	7 GAL.				42" o.c.
ISS	11	INDIGO SPIRES	3 GAL.				24" o.c.
PR	11	PROSTRATE ROSEMARY	1 GAL.	30" O.C.	12" HT.	18" SPD.	30" o.c.
SPF	3	SIZZLING PINK FRINGE FLOWER	5 GAL.	18-24" HT.	18-24" SPD.		42" o.c.
TC	5	TURK`S CAP	2 GAL.				42" o.c.
TSG	3	GREEN CLOUD TEXAS RANGER	5 GAL.	60" O.C.	24-30" HT.	24-30" SPD.	60" o.c.
GRASSES							
RPM	10	REGAL MIST PINK MUHLY	1 GAL	18" HT.	FULL		48" o.c.
CODE	QTY	COMMON NAME	CONT	SPACING	SIZE		SPACING
GROUND COVERS							
AJ	447	ASIAN JASMINE	4" POT	12" O.C.	MIN. 3 RUNNERS, 6" EA.		12" o.c.
DL	28	DAYLILY	4" POT	12" HT.	18" O.C.		18" o.c.
FF	24	FOXTAIL FERN	1 GAL.	24" O.C.			24" o.c.
LIR	508	LIRIOPE `BIG BLUE`	1 GAL.	18" O.C.	FULL		18" o.c.
SC	34	SEASONAL COLOR	4" POT @				10" o.c.
TLP	23	TRAILING LANTANA PURPLE	4" POT @	18" O.C.	FULL		18" o.c.
SOD/SEED							
NGM	61,276 SF	LITTLE BLUESTEM, SIDEOATS GRAMA, INDIAN GRASS REFER TO NATIVE GRASS SCHEDULE THIS SHEET.	SEED	3 LBS./1000 SF			
SEED	58,674 SF	BERMUDA GRASS	SEED	2 LBS./1000 SF			
SOD	17,338 SF	BERMUDA GRASS VERIFY QUANTITIES ON SITE	SOLID SOD				

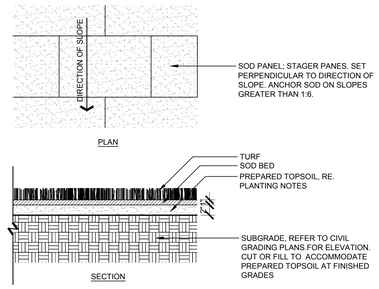


SECTION VIEW

NOTES:
1- SEE PLANTING SOIL SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

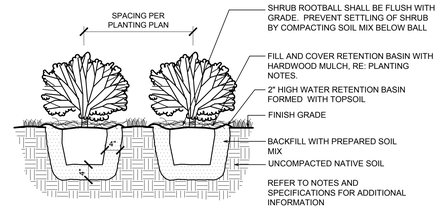
8 EXISTING SOIL - MINOR MODIFICATION

NOT TO SCALE



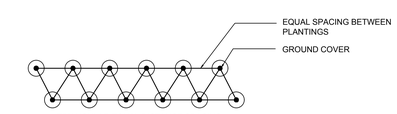
5 TYPICAL SOD PLANTING

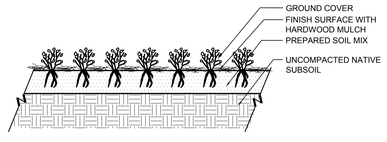
1" = 1'-0"



3 SHRUB PIT PLANTING

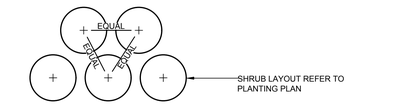
NOT TO SCALE

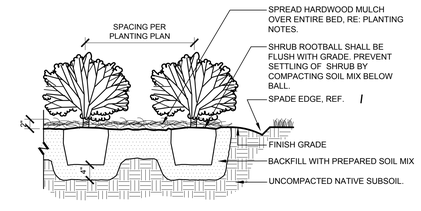




4 GROUNDCOVER

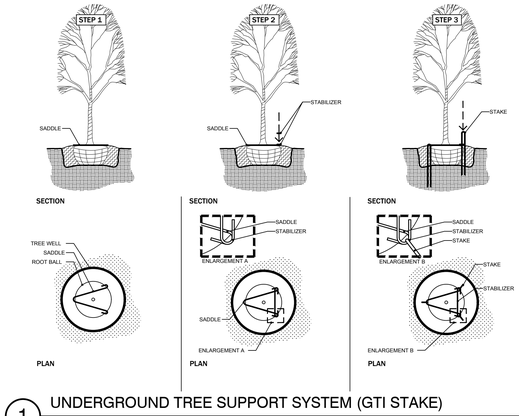
NOT TO SCALE





2 SHRUB BED PLANTING

NOT TO SCALE



STEP 1:
- **REFER TO PLANTING DETAILS FOR TREE INSTALLATION INSTRUCTIONS.**
- **PLACE SADDLE DIRECTLY ON ROOT BALL OF TREE.**

STEP 2:
- **LAY STABILIZER DIRECTLY ON OPEN END OF SADDLE, AS SEEN ABOVE.**
- **ALIGN CURVED ENDS OF STABILIZER WITH CURVED ENDS OF SADDLE.**

STEP 3:
- **INSERT ONE END OF STAKE THROUGH SADDLE OPENING. PINCH OPEN ENDS OF STAKE TOGETHER AS IT IS SET IN UNDISTURBED SOIL.**
- **HAMMER IN EACH STAKE UNTIL TOP OF STAKE REST 1" BELOW TOP OF ROOT BALL.**

GINGER TREE INNOVATIONS
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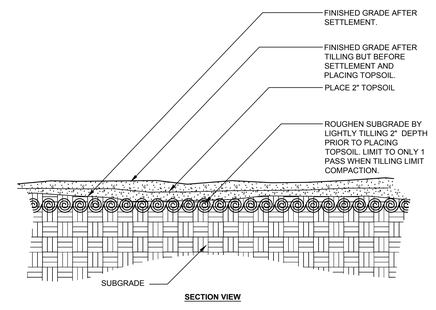
M 903.203.4007

GUARANTEE:
GINGER TREE INNOVATIONS GUARANTEES THAT ALL TREES USING THE GTI TREE STAKE WILL NOT TOPPLE DUE TO LATERAL WIND FORCE. EXCLUDING ANY ACTS OF GOD DEFINED BY ALL INSURANCE AGENCIES WITHIN THE JURISDICTION OF THE TREES INSTALLATION. ALL QUALIFYING PROJECTS MUST BE REGISTERED WITH GTI's GUARANTEE DEPARTMENT TO QUALIFY FOR GUARANTEE

CONTAINER /ROOT BALL SIZES	GTI STAKE SIZE
10 Gal/16in	SMALL
15 Gal/18in	SMALL
20 Gal/20in	SMALL
25 Gal/22in	MEDIUM
35 Gal/24in	MEDIUM
45 Gal/26in	LARGE
65 Gal/30in	LARGE
100 Gal PLUS	UPON REQUEST

1 UNDERGROUND TREE SUPPORT SYSTEM (GTI STAKE)

1/4" = 1'-0"



SECTION VIEW

NOTES:
1. SEE PLANTING NOTES FOR ADDITIONAL REQUIREMENTS.
2. CONTRACTOR SHALL CAREFULLY EXAMINE THE CIVIL, RECORD, AND SURVEY DRAWINGS TO BECOME FAMILIAR WITH THE EXISTING UNDERGROUND CONDITIONS BEFORE DIGGING.
3. PHASE WORK SUCH THAT EQUIPMENT TO DELIVER OR GRADE SOIL DOES NOT HAVE TO OPERATE OVER PREVIOUSLY INSTALLED PLANTING SOIL.

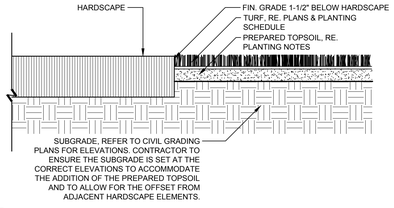
10 TOPSOIL PREPARATION AND PLACEMENT

NOT TO SCALE

7 TYPICAL SPADE CUT PLANTING EDGE

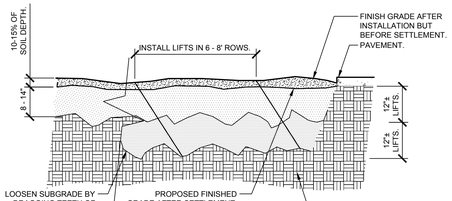
1" = 1'-0"

NOTE:
1. REFER TO PLANTING NOTES REGARDING PREPARED TOPSOIL.
2. LIMIT LAWN SUBGRADE PREPARATION TO AREAS TO BE PLANTED.
3. FOR NEWLY GRADED SUBGRADES, LOOSEN SUBGRADE TO A MINIMUM DEPTH OF 4 INCHES. REMOVE STONES LARGER THAN 1 INCH IN ANY DIMENSION AND STICKS, ROOTS, RUBBISH, AND OTHER EXTRANEOUS MATTER AND LEGALLY DISPOSE OF THEM OFF OWNER'S PROPERTY.
4. IF LAWNS ARE TO BE PLANTED IN AREAS UNALTERED OR UNDISTURBED BY EXCAVATING, GRADING, OR SURFACE SOIL STRIPPING OPERATIONS, PREPARE SURFACE SOIL AS FOLLOWS: REMOVE EXISTING GRASS, VEGETATION, AND TURF. DO NOT MIX INTO SURFACE SOIL. LOOSEN SURFACE SOIL TO A DEPTH OF AT LEAST OF 6 INCHES. APPLY SOIL AMENDMENTS AND FERTILIZERS ACCORDING TO PLANTING SOIL MIX PROPORTIONS AND MIX THOROUGHLY INTO TOP 4 INCHES OF SOIL.
5. PROMPTLY REMOVE SOIL AND DEBRIS CREATED BY LAWN WORK FROM PAVED AREAS.



6 TURF EDGE AT HARDSCAPE

1" = 1'-0"



SECTION VIEW

NOTES:
1. MEANS AND METHODS OF SOIL COMPACTION SHALL BE DETERMINED AT TIME OF SOIL MOCK UP.
2. SOIL COMPACTION AFTER INSTALLATION SHALL BE 75 - 250 PSI AT SOIL MOISTURE BETWEEN FIELD CAPACITY AND WILTING POINT.
3. FOR SOIL DEPTHS SEE PLANTING SOIL SPECIFICATIONS.
4. SEE PLANTING NOTES AND SOIL SPECIFICATION FOR ADDITIONAL REQUIREMENTS.

9 MODIFIED EXISTING SOIL - INSTALLED PLANTING MIX

NOT TO SCALE

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ARCHITECTS

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FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

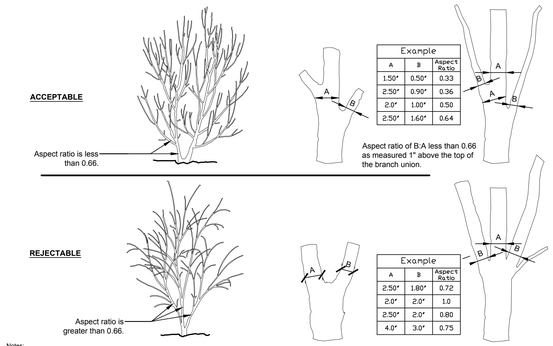
PLANTING SCHEDULE, NOTES & DETAILS

100% Construction Documents
02.29.2024

REGISTERED LANDSCAPE ARCHITECT
KRISTI L. DAVIDSON
2199
STATE OF TEXAS

02.29.2024

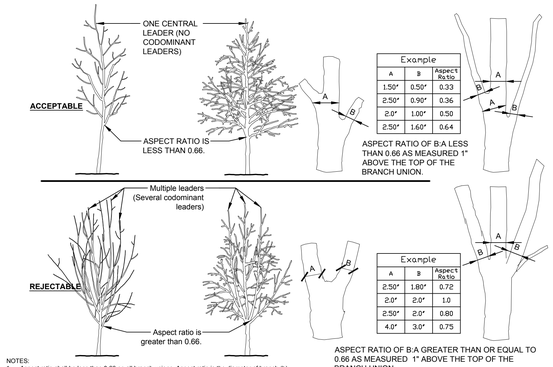
L5.01



Notes:
1- Aspect ratio shall be less than 0.66 on all branch unions. Aspect ratio is the diameter of branch (B) divided by the diameter of the trunk (A) as measured 1" above the top of the branch union.
2- Any tree not meeting the crown observations detail may be rejected.

4 CROWN OBSERVATION DETAIL - MULTI

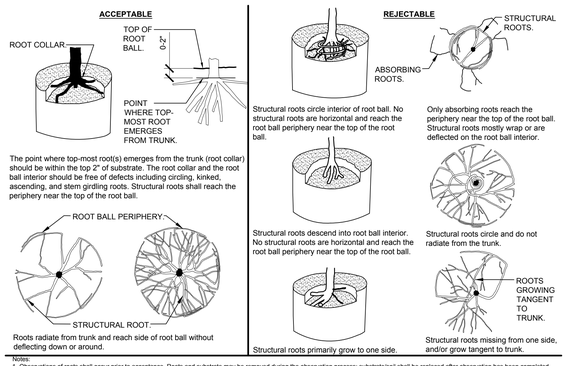
NOT TO SCALE



NOTES:
1. Aspect ratio shall be less than 0.66 on all branch unions. Aspect ratio is the diameter of branch (b) divided by the diameter of the trunk (a) as measured 1" above the top of the branch union.
2. Any tree not meeting the crown observations detail may be rejected.

3 CROWN OBSERVATIONS - HIGH BRANCHED

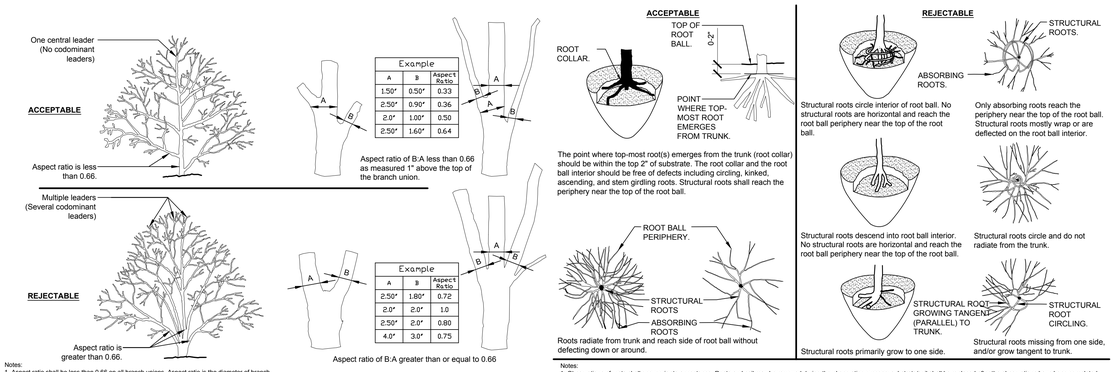
1/4" = 1'-0"



Notes:
1- Observations of roots shall occur prior to acceptance. Roots and substrate may be removed during the observation process; substrate/soil shall be replaced after observation has been completed.
2- Small roots (¼" or less) that grow around, up, or down the root ball periphery are considered a normal condition in container production and are acceptable however they should be eliminated at the time of planting. Roots on the periperhy can be removed at the time of planting. (See root ball shaving container detail).
3- See specifications for observation process and requirements.

2 ROOT OBSERVATIONS DETAIL - CONTAINER

NOT TO SCALE



Notes:
1- Aspect ratio shall be less than 0.66 on all branch unions. Aspect ratio is the diameter of branch (B) divided by the diameter of the trunk (A) as measured 1" above the top of the branch union.
2- Any tree not meeting the crown observations detail may be rejected.

5 CROWN OBSERVATIONS - LOW BRANCHED

1/4" = 1'-0"

Notes:
1- Observations of roots shall occur prior to acceptance. Roots and soil may be removed during the observation process; substrate/soil shall be replaced after the observations have been completed.
2- See specifications for observation process and requirements.

1 ROOT OBSERVATIONS DETAIL - BALLED AND BURLAPPED

NOT TO SCALE

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ARCHITECTS

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PLANTING DETAILS

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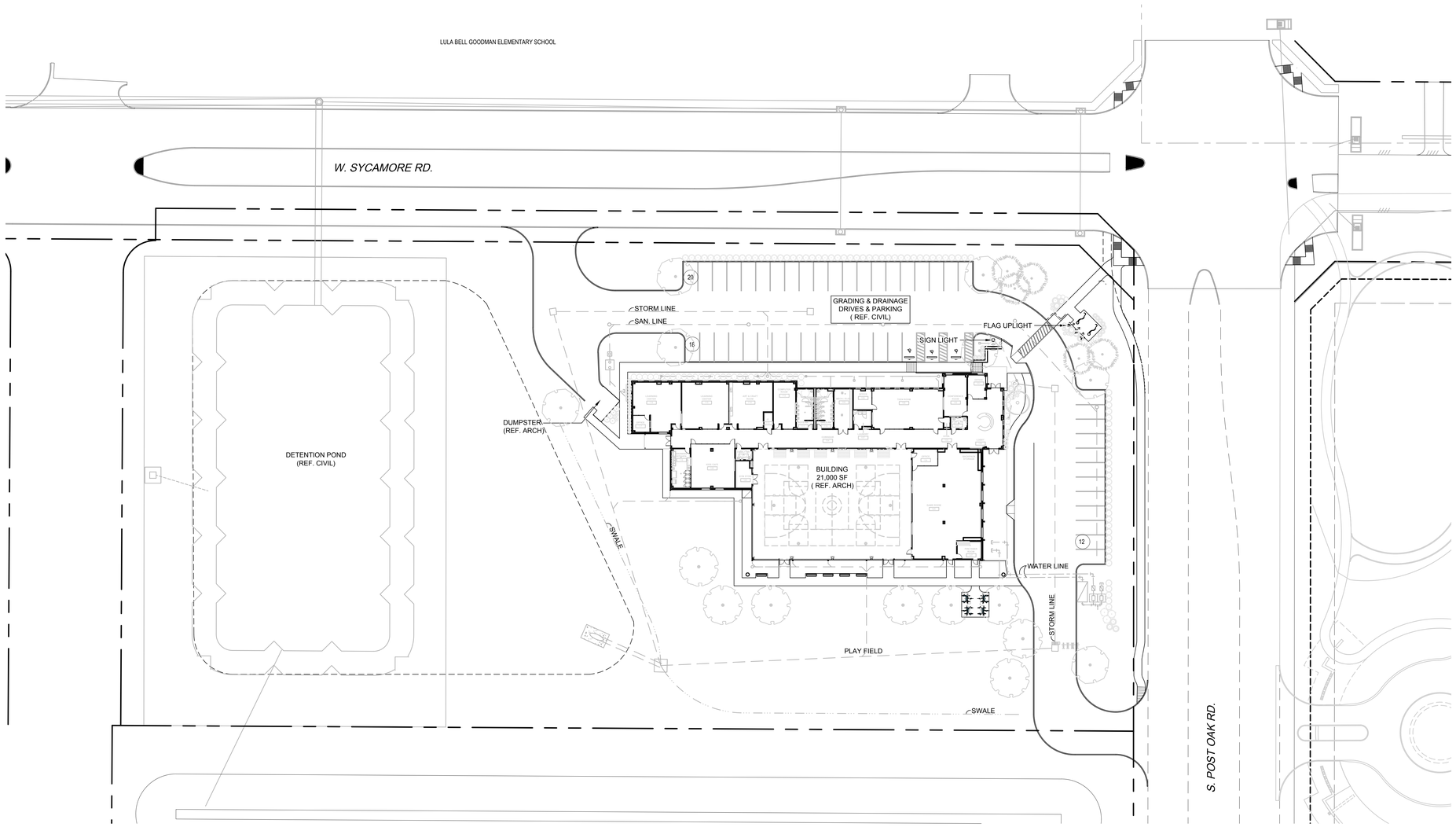
02.29.2024

02.29.2024

L5.02



GENERAL LIGHTING NOTES:

1. THIS PLAN IS INTENDED FOR LANDSCAPE LIGHTING PURPOSES ONLY. ALL LIGHTING FIXTURES AND TRANSFORMERS SHALL BE INSTALLED PER MANUFACTURERS SPECIFICATIONS. IT IS THE CONTRACTORS RESPONSIBILITY TO MAINTAIN COMPLIANCE WITH ALL LOCAL BUILDING SAFETY CODES AND ORDINANCES.
2. FIXTURES ARE SHOWN IN APPROXIMATE LOCATION. THE CONTRACTOR SHOW FIELD VERIFY THE ACTUAL PLACEMENT OF EACH FIXTURE UPON COMPLETION OF LANDSCAPE INSTALLATION.
3. ALL PATH LIGHTS ARE TO BE INSTALLED AT A MINIMUM OF 12 INCHES FROM ANY SIDEWALK OR VERTICAL STRUCTURE.
4. ALL LOW-VOLTAGE DIRECT BURIAL WIRE TO BE INSTALLED AT >/= 6" BELOW FINISH GRADE PER ELECTRICAL CODE.
5. IN ORDER TO MINIMIZE FUTURE DISTURBANCE, ALL WIRE RUNS SHALL BE INSTALLED PARALLEL AND ADJACENT TO HARD SURFACES SUCH AS SIDEWALKS DRIVEWAYS AND WALLS.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING SLEEVES UNDER ALL HARDSCAPE SURFACES USING A MINIMUM 1 INCH PVC PIPE.
7. ALL UNDERGROUND SPLICES SHALL BE UL-486RATED AND INSTALLED IN UNDERGROUND J-BOXES WITH WATER TIGHT CONNECTIONS LEAVING 12 INCHES OF EXCESS WIRE SLACK.
8. ALL EXTERIOR 120 - VOLT ELECTRICAL OUTLETS SHALL BE GFI PROTECTED AS PER NATIONAL ELECTRICAL CODE
9. ALL TRANSFORMERS PLUGGED INTO AN OUTDOOR RECEPTACLE SHALL HAVE AN "IN USE" COVER. CONTRACTOR SHALL INSTALL TAYMAC TYPE COVERS AT ALL OUTLETS.
10. ALL PLUG-IN TRANSFORMERS SHALL HAVE A DRIP LOOP IN THE POWER CORD.
11. ALL EXPOSED CONDUIT'S SHALL BE PAINTED TO MATCH SURROUNDINGS.
12. THE INSTALLING CONTRACTOR SHALL BE RESPONSIBLE FOR ADJUSTING THE FIXTURES AT NIGHT TO HELP ELIMINATE GLARE AND TO ENSURE OPTIMUM LIGHTING EFFECT.
13. CONTRACTOR TO VERIFY A MINIMUM OF 10 VOLTS AT THE LAST AT THE LAST FIXTURE FOR OPTIMAL OPERATION.
14. CONTRACTOR TO CENTER FEED THE SYSTEM WHEN AT ALL POSSIBLE AND VERIFY ALL WIRE CONNECTIONS ARE AT THE FIXTURES.
15. ALL WIRE CONNECTIONS AT FIXTURES SHALL BE MADE USING WATER TIGHT CONNECTIONS.

LIGHTING SCHEDULE			
SYMBOL	MANUFACTURER/MODEL/DESCRIPTION	QTY	DETAIL
	FLAG UPLIGHT (CURRENT RATIO FLOOD COMPACT) #RFL3-90L-50-3K7-N-UNV-K-DBT, INCLUDE SLIP FIT, S-302, FROM EXO, BY BELL & MCCOY LIGHTING AND CONTROLS, PH. 713.671.8000 DARK BRONZE, POST LAMP: 1-233W LED/3000K, 3000 K, BEAMSPREAD: NARROW ACCESSORIES: S-302	3	9/L3.2
	SIGN LIGHT (FX LUMINAIRE PB) IDEAL SELECTION FOR LARGE BROAD OBJECTS OR WASHING LIGHT. 2.23" W X 6.72" H X 4.03" L. ORDER CODE: PB, BRASS, (FB) FLAT BLACK, SUPER J-BOX SPIKE LAMP: PB-1LED, 2W *2.4VA, 2700K, BEAMSPREAD: VERY WIDE FLOOD*	1	10/L3.2

0 15 30 60
SCALE : 1" = 30'

N

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

STRUCTURAL ENGINEER
STANLEY SPURLING & HAMILTON INC.
3301 EDLOE ST.
HOUSTON, TX 77027

CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., #260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE ASSOCIATES
6117 RICHMOND AVE., SUITE 200
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023 SA23434

DATE ISSUED: 02.29.2024

TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

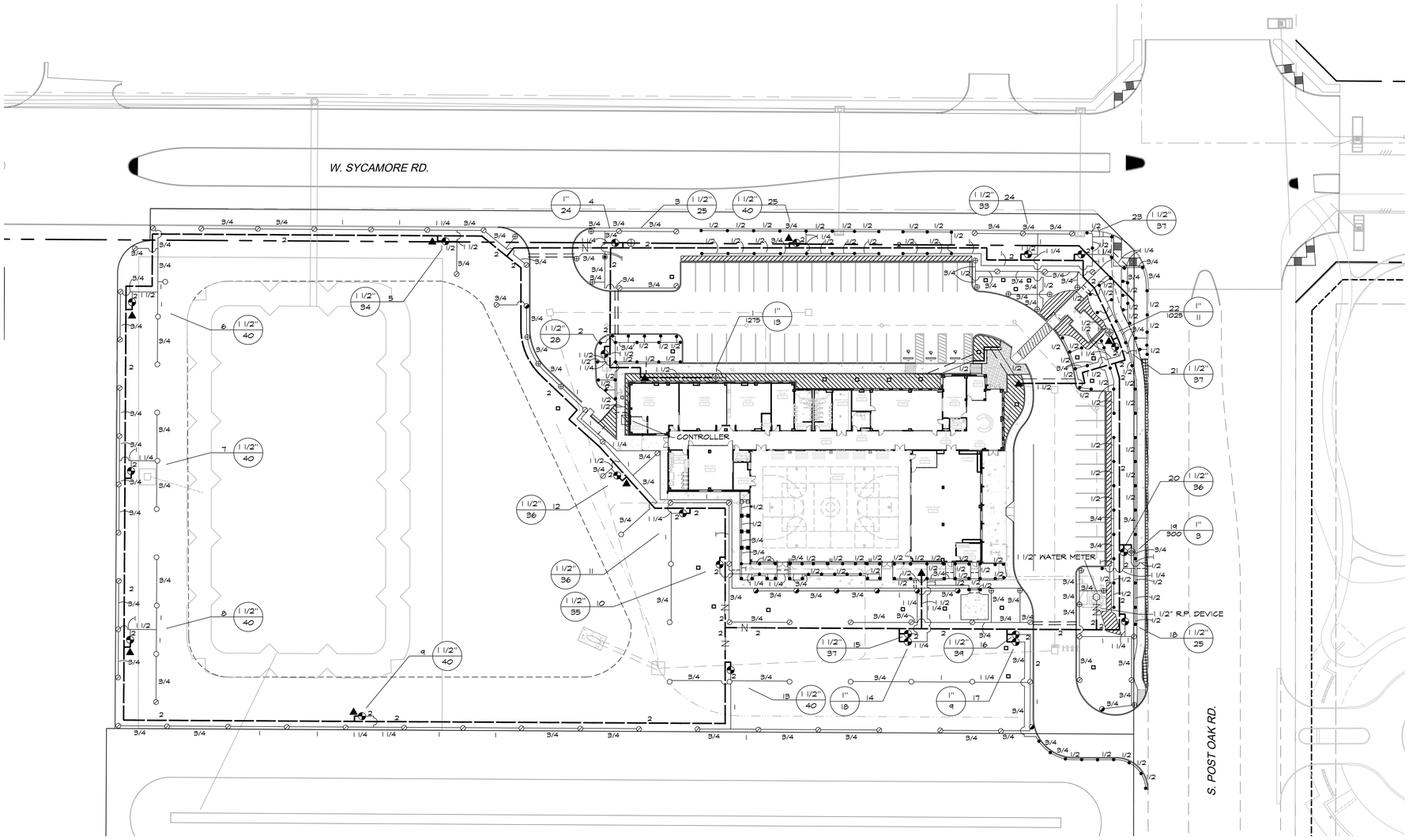
LANDSCAPE LIGHTING PLAN

100% Construction Documents
02.29.2024

REGISTERED LANDSCAPE ARCHITECT
COLBY J. DAVIDSON
2190
STATE OF TEXAS

02.29.2024

L6.01



LEGEND

- HUNTER PROS-06-NSI-PRS30 SERIES POP UP SPRAY HEAD WITH HUNTER MSBN-5OH STREAM BUBBLER NOZZLE. (TWO PER TREE)
  SEE INSTALLATION NOTE #13 REGARDING TREE BUBBLER LATERAL PIPE
- HUNTER PROS-04-PRS30 SERIES POP UP SPRAY HEAD WITH SIDE / END / CORNER STRIP SERIES STRIP NOZZLE UNLESS NOTED OTHERWISE
- HUNTER PROS-04-PRS30 SERIES POP UP SPRAY HEAD WITH PRO SPRAY SERIES NOZZLE AS NOTED BELOW
- NETAFIM TECHLINE TLHCVXR5-12 SERIES DRIP TUBE IN SHRUB BED INSTALLED AT 2" DEPTH
  SEE INSTALLATION NOTE #16 REGARDING DRIP TUBE LAYOUT IN SHRUB BEDS.
- NETAFIM TECHLINE TLHCVXR5-12 SERIES DRIP TUBE IN NARROW TURF AREAS INSTALLED AT 4" DEPTH
  SEE INSTALLATION NOTE #17 REGARDING DRIP TUBE LAYOUT IN TURF.
- HUNTER PGP ULTRA, ADJUSTABLE ARC 4" POP UP ROTARY HEAD, PART CIRCLE, #1.5SR BLACK UNLESS NOTED OTHERWISE
- HUNTER PGP ULTRA, ADJUSTABLE ARC 4" POP UP ROTARY HEAD, FULL CIRCLE, #3.0SR BLACK NOZZLE UNLESS NOTED OTHERWISE
- HUNTER PGP ULTRA, ADJUSTABLE ARC 4" POP UP ROTARY HEAD, PART CIRCLE, #3.0 BLUE NOZZLE UNLESS NOTED OTHERWISE
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- HUNTER PGP ULTRA, ADJUSTABLE ARC 4" POP UP ROTARY HEAD, FULL CIRCLE, #8.0 BLUE NOZZLE UNLESS NOTED OTHERWISE
- HUNTER ICV SERIES ELECTRIC REMOTE CONTROL VALVE
- HUNTER ICV SERIES ELECTRIC REMOTE CONTROL, "TREE BUBBLER ZONE" VALVE
  SEE INSTALLATION NOTE #13 REGARDING TREE BUBBLER LATERAL PIPE
- NETAFIM LVCZ SERIES DRIP VALVE ASSEMBLY WITH 40 PSI REGULATOR AND 140 MESH FILTER
  USE MODEL LVCZSBOI0075-LF FOR DRIP ZONES WITH .25 TO 4.4 GPM FLOW RATE
  USE MODEL LVCZI0075-HFHP FOR DRIP ZONES WITH 4.5 TO 17.6 GPM FLOW RATE
- LASCO "VIOIN" SERIES SCH. 80 PVC TRUE UNION BALL VALVE, MAINLINE SIZE
- HUNTER HQ-33-LRC-R QUICK COUPLING VALVE WITH LOCKING PURPLE COVER AND 3/4" PVC BALL VALVE
- WILKINS 375-B SERIES REDUCED PRESSURE TYPE BACKFLOW PREVENTOR INSTALLED PER CITY CODE
- IRRIGATION WATER METER AND TAP, SIZE AS NOTED ON THE PLAN
- HUNTER I2C-800-M SERIES AUTOMATIC CONTROLLER WITH ICM-2200 EXPANSION MODULE AND 'WSS-SEN' WIRELESS ET SENSOR
  LOCATE SENSOR AS FIELD DIRECTED BY THE LANDSCAPE ARCHITECT
- CLASS 200 (EXCEPT 1/2 INCH #315) PVC LATERAL PIPE
- SCH. 40 PVC MAINLINE PIPE
- TWO 4" CLASS 200 SLEEVE PIPES
- ONE 4" CLASS 200 SLEEVE PIPE

L.I.C. SHALL SELECT PRO-SPRAY SPRAY NOZZLES FOR "HEAD-TO-HEAD" COVERAGE, ADJUSTED FOR NO OVERSPRAY ONTO WALLS AND WALKS. NO OVERSPRAY INTO STREETS IS PERMITTED.

COORDINATION WITH EXISTING TREES

NO MACHINE TRENCHING SHALL BE PERMITTED WITHIN THE ROOT ZONE OF EXISTING TREES. HAND-DIG ONLY, WITHIN THE ROOT ZONES OF EXISTING TREES. NO ROOTS OVER 1" DIAMETER SHALL BE CUT. STAKE ALL PROPOSED TRENCH ROUTES NEAR EXISTING TREES FOR APPROVAL BY THE LANDSCAPE ARCHITECT BEFORE DIGGING BEGINS.

James Pole
IRRIGATION CONSULTANTS
IRRIGATION DESIGN, CONSULTING, AND LANDSCAPE WATER MANAGEMENT
TEXAS L.I.C. #658
P.O. BOX 1845
DENTON, TEXAS 76202
PHONE: 940.243.2364
james@jamespoleirrigation.com

IRRIGATION IN TEXAS IS REGULATED BY THE TEXAS COMMISION ON ENVIRONMENTAL QUALITY (TCEQ) (MC-178) P.O. BOX 13087 T.C.E.Q.'S WEB SITE IS: WWW.TCEQ.STATE.TX.US

0 15 30 60
SCALE : 1" = 30'

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TECHNOLOGY CONSULTANT
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3409 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023 SA23434
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REVISIONS:

NO.	DATE	DESCRIPTION

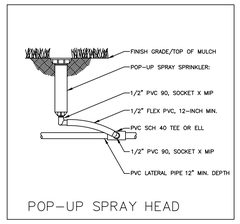
FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

IRRIGATION PLAN

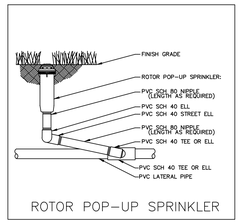
100% Construction Documents
02.29.2024

LICENSED IRRIGATOR
20811
02.29.2024
02 / 29 / 2024

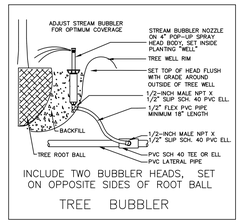
LI1.01



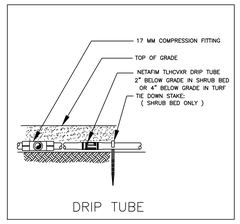
POP-UP SPRAY HEAD



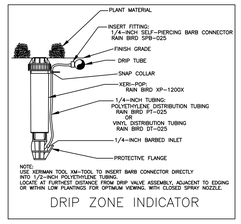
ROTOR POP-UP SPRINKLER



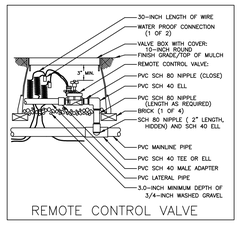
INCLUDE TWO BUBBLER HEADS, SET ON OPPOSITE SIDES OF ROOT BALL
TREE BUBBLER



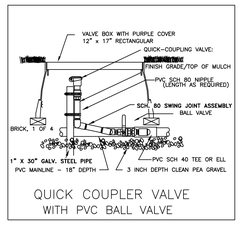
DRIP TUBE



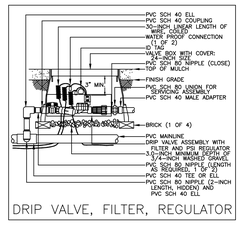
DRIP ZONE INDICATOR



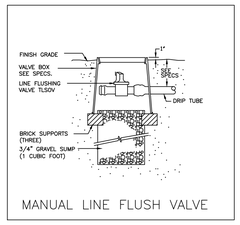
REMOTE CONTROL VALVE



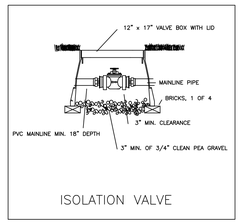
QUICK COUPLER VALVE WITH PVC BALL VALVE



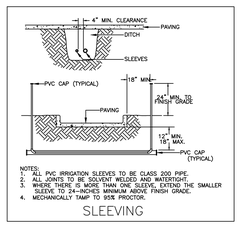
DRIP VALVE, FILTER, REGULATOR



MANUAL LINE FLUSH VALVE

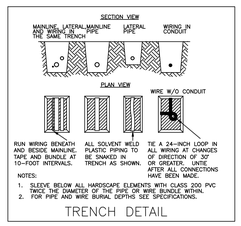


ISOLATION VALVE



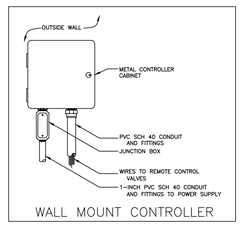
NOTES:
1. ALL PVC IRRIGATION SLEEVES TO BE CLASS 200 PIPE.
2. ALL JOINTS TO BE SOLVENT WELDED AND WATERTIGHT.
3. WHERE THERE IS MORE THAN ONE SLEEVE, EXTEND THE SMALLER SLEEVE TO 24-INCHES MINIMUM ABOVE FINISH GRADE.
4. MECHANICALLY TAMP TO 95% PROCTOR.

SLEEVING

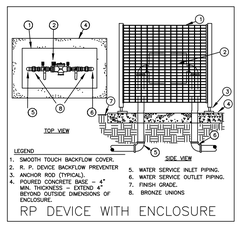


NOTES:
1. SLEEVE BELOW ALL HARDSCAPE ELEMENTS WITH CLASS 200 PVC TWICE THE DIAMETER OF THE PIPE OR WIRE BUNDLE WITHIN.
2. FOR PIPE AND WIRE BURIAL DEPTHS SEE SPECIFICATIONS.

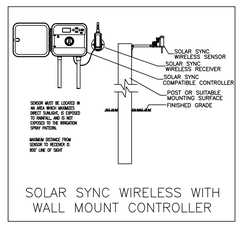
TRENCH DETAIL



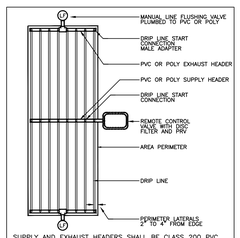
WALL MOUNT CONTROLLER



RP DEVICE WITH ENCLOSURE



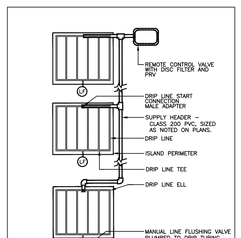
SOLAR SYNC WIRELESS WITH WALL MOUNT CONTROLLER



SUPPLY AND EXHAUST HEADERS SHALL BE CLASS 200 PVC PIPE, OF THE SAME DIAMETER AS THE ZONE VALVE SIZE.

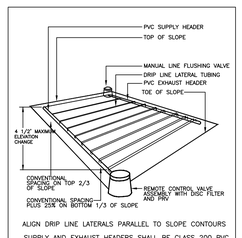
USE DRIP TUBE FOR SUPPLY AND EXHAUST HEADERS ON GRIDS WITH FLOW SMALLER THAN 5 GPM ONLY.

DRIP CENTER FEED LAYOUT



USE DRIP TUBE FOR SUPPLY AND EXHAUST HEADERS ON GRIDS WITH FLOW SMALLER THAN 5 GPM ONLY.

DRIP ISLAND LAYOUT

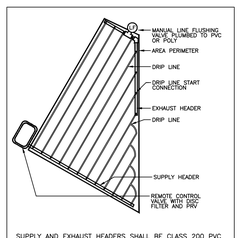


ALIGN DRIP LINE LATERALS PARALLEL TO SLOPE CONTOURS

SUPPLY AND EXHAUST HEADERS SHALL BE CLASS 200 PVC PIPE, OF THE SAME DIAMETER AS THE ZONE VALVE SIZE.

USE DRIP TUBE FOR SUPPLY AND EXHAUST HEADERS ON GRIDS WITH FLOW SMALLER THAN 5 GPM ONLY.

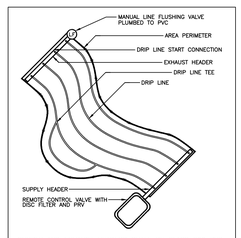
DRIP SLOPE FEED LAYOUT



SUPPLY AND EXHAUST HEADERS SHALL BE CLASS 200 PVC PIPE, OF THE SAME DIAMETER AS THE ZONE VALVE SIZE.

USE DRIP TUBE FOR SUPPLY AND EXHAUST HEADERS ON GRIDS WITH FLOW SMALLER THAN 5 GPM ONLY.

IRREGULAR AREA DRIP LAYOUT



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CURVED AREA DRIP LAYOUT

LEGEND

- HUNTER PROS-06-NSI-PRS30 SERIES POP UP SPRAY HEAD WITH HUNTER MSBN-50H STREAM BUBBLER NOZZLE. (TWO PER TREE)
  SEE INSTALLATION NOTE #18 REGARDING TREE BUBBLER LATERAL PIPE
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  LOCATE SENSOR AS FIELD DIRECTED BY THE LANDSCAPE ARCHITECT
- CLASS 200 (EXCEPT 1/2 INCH #315) PVC LATERAL PIPE
- SCH. 40 PVC MAINLINE PIPE
- TWO 4" CLASS 200 SLEEVE PIPES
- ONE 4" CLASS 200 SLEEVE PIPE

L.I.C. SHALL SELECT PRO-SPRAY SPRAY NOZZLES FOR "HEAD-TO-HEAD" COVERAGE, ADJUSTED FOR NO OVERSPRAY ONTO WALLS AND WALKS. NO OVERSPRAY INTO STREETS IS PERMITTED.

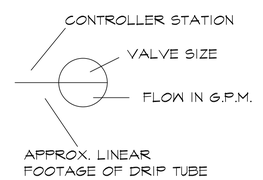
INSTALLATION NOTES

1. COORDINATE IRRIGATION INSTALLATION WITH PLANTING PLAN AND SITE CONDITIONS TO PROVIDE COMPLETE COVERAGE WITH MINIMUM OVERSPRAY. THE IRRIGATION CONTRACTOR SHALL MAKE MINOR ADJUSTMENTS TO ENSURE PROPER COVERAGE AT NO ADDITIONAL COST TO THE OWNER.
2. THE IRRIGATION CONTRACTOR SHALL COMPLY WITH ALL LOCAL AND STATE MANDATED IRRIGATION ORDINANCES AND CODES, AND WILL SECURE ALL REQUIRED PERMITS. L.I.C. SHALL PAY ANY ASSOCIATED FEES UNLESS OTHERWISE NOTED. ALL LOCAL CODES SHALL PREVAIL OVER ANY DISCREPANCIES HEREIN AND SHALL BE ADDRESSED BEFORE ANY CONSTRUCTION BEGINS.
3. CONFIRM MINIMUM STATIC WATER PRESSURE OF 60 PSI AT THE HIGHEST ELEVATION OF THE SYSTEM LIMITS, AND MAXIMUM STATIC WATER PRESSURE OF 90 P.S.I. AT THE LOWEST ELEVATION OF THE SYSTEM LIMITS AT LEAST 7 DAYS BEFORE BEGINNING WORK. IF STATIC WATER PRESSURE IS OUTSIDE THE RANGE STATED ABOVE, DO NOT PROCEED UNTIL DIRECTED BY THE LANDSCAPE ARCHITECT.
4. LATERAL PIPE SHALL BE INSTALLED AT A MINIMUM DEPTH OF 12 INCHES. MAINLINE PIPE AND WIRES SHALL BE INSTALLED AT A MINIMUM DEPTH OF 18 INCHES. NO MACHINE TRENCHING SHALL BE PERMITTED WITHIN EXISTING TREE ROOT ZONES, WHEN HAND - TRENCHING WITHIN EXISTING TREE ROOT ZONES, NO ROOTS LARGER THAN 1" DIAMETER SHALL BE CUT.
5. UNSLEEVED PIPES MAY BE SHOWN UNDER PAVEMENT FOR GRAPHIC CLARITY ONLY. INSTALL THESE PIPES IN ADJACENT LANDSCAPED AREAS.
6. ELECTRIC POWER SHALL BE PROVIDED WITHIN FIVE FEET OF CONTROLLER LOCATION BY GENERAL CONTRACTOR. L.I.C. TO PROVIDE FINAL HARD-WIRE TO CONTROLLER.
7. 24 VOLT VALVE WIRE SHALL BE A MINIMUM OF #14 GAUGE, U.F. APPROVED FOR DIRECT BURIAL, SINGLE CONDUCTOR "IRRIGATION WIRE". WIRE SPLICES SHALL INCLUDE DBY CONNECTORS AS MANUFACTURED BY 3M COMPANY. ALL FIELD SPLICES SHALL BE LOCATED IN A ROUND VALVE BOX OF SUFFICIENT SIZE TO ALLOW INSPECTION.
8. VALVE BOXES SHALL BE INSTALLED FLUSH WITH GRADE, SUPPORTED BY BRICKS IF NEEDED, WITH 3 INCHES OF CLEAN PEA GRAVEL LOCATED BELOW THE VALVE. USE 12" x 17" RECTANGULAR VALVE BOXES WITH PURPLE LID FOR QUICK COUPLING VALVES, AND 10" ROUND BOXES FOR ELECTRIC VALVES UNLESS NOTED OTHERWISE.
9. USE RIGID SCH. 80 PVC SWING JOINT ASSEMBLIES TO CONNECT ALL ROTARY HEADS AND QUICK COUPLERS.
10. ALL SPRAY HEADS SHALL BE CONNECTED WITH A 12" MINIMUM LENGTH OF 1/2" FLEX PVC. THE FLEX PVC SHALL BE SOLVENT WELDED TO SCHEDULE 40 PVC FITTINGS WITH WELD-ON #745 SOLVENT AND #P-70 PRIMER.
11. PROVIDE ONE QUICK COUPLER KEY WITH SWIVEL HOSE ELL FOR EVERY SIX Q.C. VALVES. (MINIMUM ONE SET).
12. CONTRACTOR IS TO CONTACT APPROPRIATE AUTHORITIES AND LOCATE ALL UTILITIES PRIOR TO CONSTRUCTION.
13. LATERAL PIPE TO TREE STREAM BUBBLER HEADS IS OMITTED FOR GRAPHIC CLARITY. CONNECT TREE BUBBLER HEADS TO VALVES AS SHOWN WITH CLASS 200 PVC PIPE SIZED TO ALLOW A MAXIMUM FLOW VELOCITY OF 5 FEET PER SECOND
14. THE PROPOSED LOCATIONS OF ALL ABOVE- GROUND EQUIPMENT INCLUDING BACKFLOW PREVENTORS, CONTROLLERS AND WEATHER SENSORS SHALL BE STAKED BY THE CONTRACTOR FOR APPROVAL BY THE LANDSCAPE ARCHITECT OR OWNER'S REPRESENTATIVE BEFORE THESE ITEMS ARE INSTALLED.
15. ALL HEADS SHALL BE INSTALLED A MINIMUM OF 4" FROM PAVEMENT EDGES. (6" OR GREATER WHERE REQUIRED BY LOCAL CODE) FINAL HEAD ADJUSTMENTS BY THE CONTRACTOR SHALL INCLUDE THE ADDITION OF CHECK VALVES WHERE NEEDED TO PREVENT EXCESSIVE LOW HEAD DRAINAGE. THE CONTRACTOR SHALL BUDGET FOR, AND INSTALL CHECK VALVES FOR UP 10 % OF THE TOTAL NUMBER OF HEADS WHEN NEEDED, WITH NO ADDITIONAL COST TO THE OWNER.
16. WHERE SHOWN ON THE PLANS, MASS SHRUB / GROUNDCOVER BEDS SHALL INCLUDE NETAFIM TECHLINE TLHCVXR SERIES DRIP TUBE WITH PRE-INSTALLED .55 GPH DRIP EMITTERS AT 12" INTERVALS (TLHCVXR5-12), INSTALLED IN CENTER-FED GRIDS WITH RONS SPACED 18" APART. INDIVIDUAL DRIP TUBE RUNS SHALL NOT EXCEED 150 L.F. PVC LATERAL "TRUNK" LINES SHALL BE INSTALLED 10" DEEP. DRIP TUBE SHALL BE SET 2" BELOW FINISHED SOIL GRADE (NOT INCLUDING MULCH LAYER), SECURELY STAKED EVERY 18". NETAFIM #TLOSOMFV-I FLUSH VALVES SHALL BE INSTALLED AT THE FARTHEST POINTS FROM THE ZONE VALVE. USE 17 MM BARBED FITTINGS FOR DRIP LINE CONNECTIONS, SET THE MAXIMUM OPERATING PRESSURE AT 30 PSI. TECHLINE CV SHALL BE INSTALLED PERPENDICULAR TO SLOPE FACE. INSTALL TLCV IN-LINE CHECK VALVES FOR EVERY 4.5 FEET OF DRIP LINE ELEVATION CHANGE WITHIN THE ZONE. USE NETAFIM STAPLES (#TLS6) TO SECURE TUBING EVERY 18". EACH DRIP ZONE SHALL INCLUDE ONE MAINTENANCE "FLAG" WHICH SHALL CONSIST OF A 12" POP-UP SPRAY HEAD AND COMPLETELY CLOSED SPRAY NOZZLE. THE POP-UP HEAD SHALL BE CONNECTED TO THE DRIP ZONE PIPE, SET FLUSH WITH GRADE, AND LOCATED AT THE FARTHERST DISTANCE FROM THE DRIP VALVE ASSEMBLY. INSTALL THE "FLAG" HEAD ADJACENT TO EDGING OR IN LOW PLANTINGS FOR EASE OF VIEWING.
17. WHERE REQUIRED BY CODE, NARROW TURF AREAS SHALL INCLUDE NETAFIM TECHLINE TLHCVXR SERIES DRIP TUBE WITH PRE-INSTALLED .55 GPH DRIP EMITTERS AT 12" INTERVALS (TLHCVXR5-12), INSTALLED IN CENTER-FED GRIDS WITH RONS SPACED 12" APART. INDIVIDUAL DRIP TUBE RUNS SHALL NOT EXCEED 150 L.F. PVC LATERAL "TRUNK" LINES SHALL BE INSTALLED 10" DEEP. DRIP TUBE SHALL BE SET 4" BELOW FINISHED SOIL GRADE. NETAFIM #TLOSOMF-I FLUSH FLUSH VALVES SHALL BE INSTALLED AT THE FARTHEST POINTS FROM THE ZONE VALVE. USE 17 MM BARBED FITTINGS FOR DRIP LINE CONNECTIONS, SET THE MAXIMUM OPERATING PRESSURE AT 30 PSI. TECHLINE CV SHALL BE INSTALLED PERPENDICULAR TO SLOPE FACE. INSTALL TLCV IN-LINE CHECK VALVES FOR EVERY 4.5 FEET OF DRIP LINE ELEVATION CHANGE WITHIN THE ZONE. EACH DRIP ZONE SHALL INCLUDE ONE MAINTENANCE "FLAG" WHICH SHALL CONSIST OF A 12" POP-UP SPRAY HEAD AND COMPLETELY CLOSED SPRAY NOZZLE. THE POP-UP HEAD SHALL BE CONNECTED TO THE DRIP ZONE PIPE, SET FLUSH WITH GRADE, AND LOCATED AT THE FARTHERST DISTANCE FROM THE DRIP VALVE ASSEMBLY. INSTALL THE "FLAG" HEAD ADJACENT TO EDGING OR IN LOW PLANTINGS FOR EASE OF VIEWING. TEMPORARY OVERHEAD IRRIGATION MAY BE REQUIRED WHERE SUB-SURFACE DRIP TUBES SERVE NEW SEEDED PLANTINGS.

COORDINATION WITH EXISTING TREES

NO MACHINE TRENCHING SHALL BE PERMITTED WITHIN THE ROOT ZONE OF EXISTING TREES. HAND-DIG ONLY, WITHIN THE ROOT ZONES OF EXISTING TREES. NO ROOTS OVER 1" DIAMETER SHALL BE CUT. STAKE ALL PROPOSED TRENCH ROUTES NEAR EXISTING TREES FOR APPROVAL BY THE LANDSCAPE ARCHITECT BEFORE DIGGING BEGINS.

MINIMUM STATIC PRESSURE : 60 PSI
DESIGN PRESSURE : 59 PSI



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IRRIGATION DESIGN, CONSULTING, AND LANDSCAPE WATER MANAGEMENT
TEXAS L.I.C. #658
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james@jamespoleirrigation.com

IRRIGATION IN TEXAS IS REGULATED BY THE TEXAS COMMISION ON ENVIRONMENTAL QUALITY (TCEQ) (MC-178) P.O. BOX 13087, T.C.E.Q.'S WEB SITE IS: WWW.TCEQ.STATE.TX.US

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PROJECT #: N032023 SA23434
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

IRRIGATION NOTES & DETAILS

100% Construction Documents
02.29.2024

STATE OF TEXAS
ADAM CRAIG
20811
LICENSED IRRIGATOR
02.29.2024

02 / 29 / 2024

LI1.02

TOT. PARKING SPACES REQUIRED (HMC SEC. 26-492) = 1(8) + 387/10) =	**46 PARKING SPACES**
TOT. NEW PARKING SPACES PROVIDED =	**50 PARKING SPACES**
TOT. # OF NEW ACCESSIBLE SPACES REQUIRED (TAS 208.2) =	**2 PARKING SPACES**
TOT. # OF NEW ACCESSIBLE SPACES PROVIDED =	**3 PARKING SPACES**

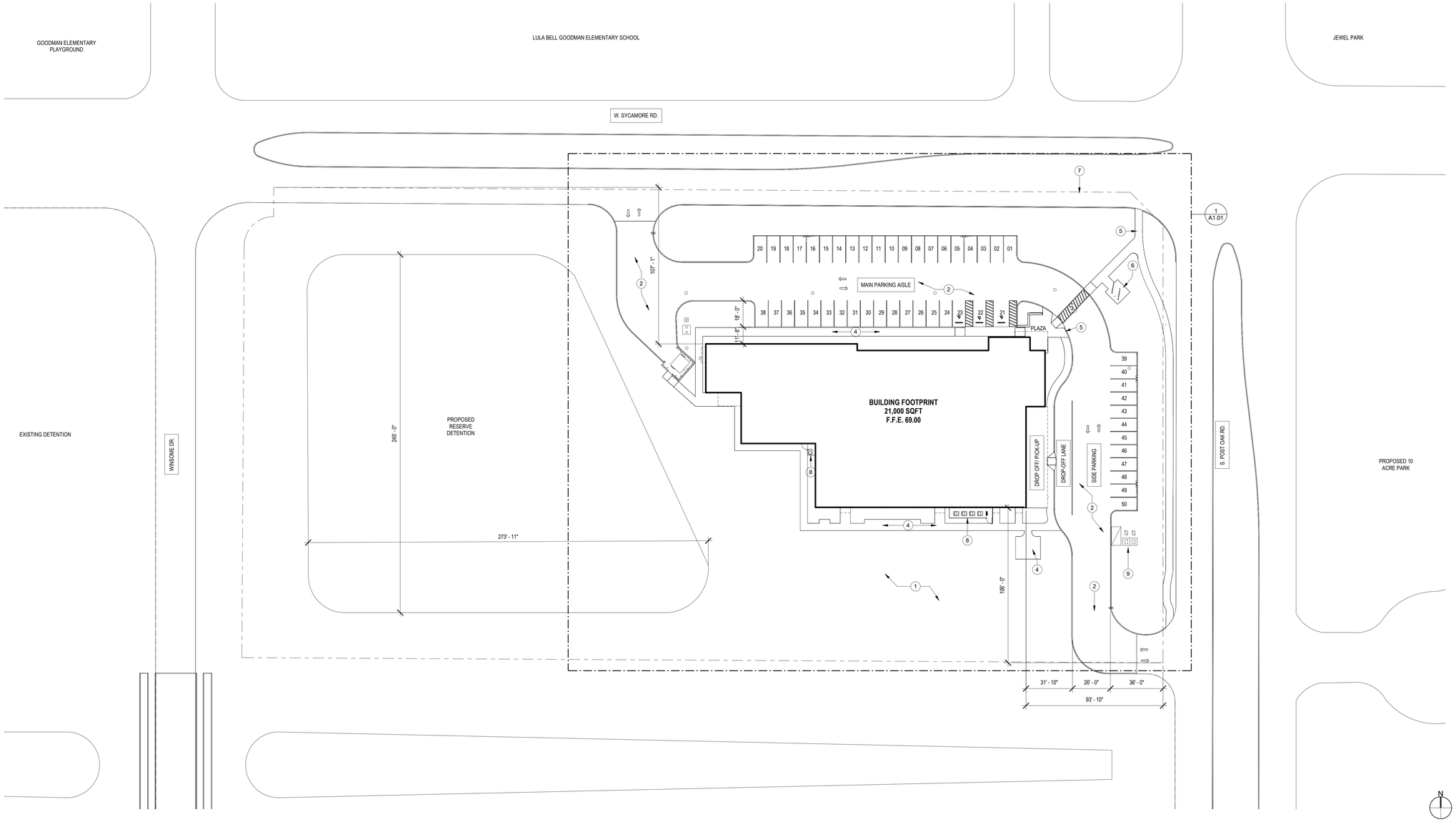
PARKING ANALYSIS | NO SCALE | 18

1. PLAYING FIELD
2. CONCRETE DRIVE RE: CIVIL
3. STRIPED CROSSWALK RE: CIVIL
4. SIDEWALK RE: CIVIL
5. PLAZA RE: LANDSCAPE
6. FLAG POLES (2)
7. PROPERTY LINE
8. MECHANICAL YARD
9. WATER METERS AND BACKFLOW PREVENTERS

SITE PLAN KEY NOTES | NO SCALE | 12

1. REFER CIVIL SHEETS FOR ADDITIONAL INFORMATION
2. REFER ELECTRICAL DRAWINGS FOR UNDERGROUND ELECTRICAL & LIGHTING REQUIREMENTS
3. REFER PLUMBING DRAWINGS FOR UNDERGROUND PLUMBING REQUIREMENTS
4. REFER LANDSCAPE DRAWINGS FOR PLANTING, IRRIGATION AND FENCING REQUIREMENTS

SITE PLAN GENERAL NOTES | NO SCALE | 6



SITE PLAN | 1" = 30'-0" | 1

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PROJECT #: N032023
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FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

SITE PLAN

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02.29.2024

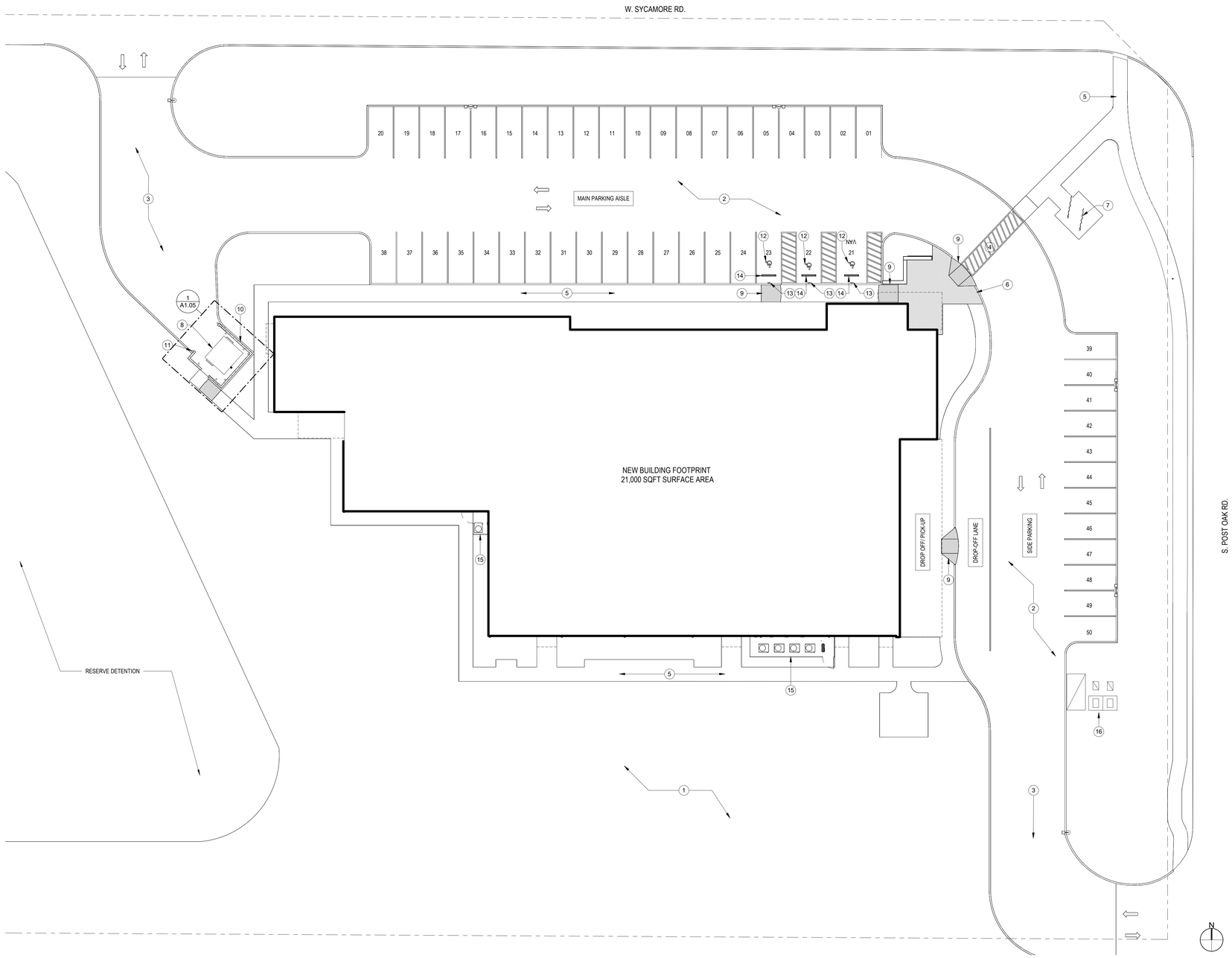
A1.00

1	PLAYING FIELD RE: CIVIL
2	PARKING LOT RE: CIVIL
3	CONCRETE DRIVE RE: CIVIL
4	STRIPED CROSSWALK RE: CIVIL
5	SIDEWALK RE: CIVIL
6	PLAZA RE: LANDSCAPE
7	FLAGPOLE (2)
8	DUMPSTER
9	ADA RAMP RE: CIVIL
10	MASONRY ENCLOSURE WALL RE: A1.01
11	PIPE BOLLARD RE: A1.01
12	ADA PARKING SYMBOL
13	ADA PARKING SIGNAGE RE: A1.01
14	WHEEL STOP
15	MECHANICAL YARD
16	WATER METERS AND BACKFLOW PREVENTERS

ENLARGED SITE PLAN KEY NOTES | NO SCALE | 12

1. REFER CIVIL SHEETS FOR ADDITIONAL INFORMATION
2. REFER ELECTRICAL DRAWINGS FOR UNDERGROUND ELECTRICAL & LIGHTING REQUIREMENTS
3. REFER PLUMBING DRAWINGS FOR UNDERGROUND PLUMBING REQUIREMENTS
4. REFER LANDSCAPE DRAWINGS FOR PLANTING, IRRIGATION AND FENCING REQUIREMENTS

SITE PLAN GENERAL NOTES | NO SCALE | 6



ENLARGED SITE PLAN | 1/16" = 1'-0" | 1

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ENLARGED SITE PLAN

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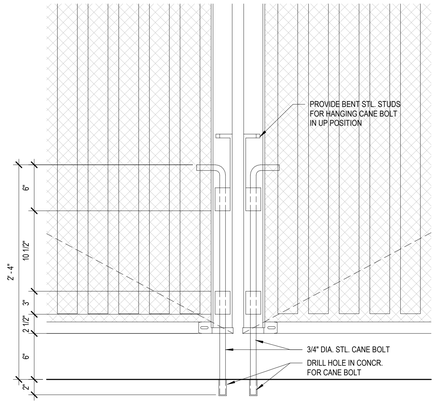
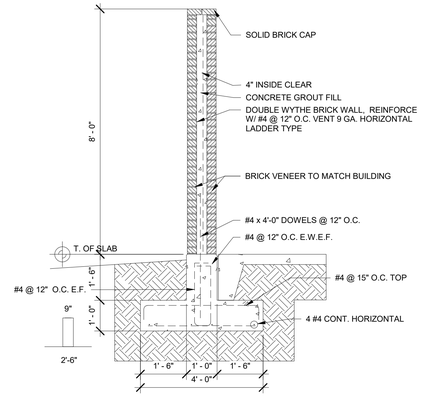
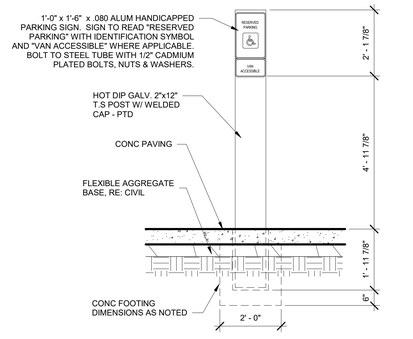


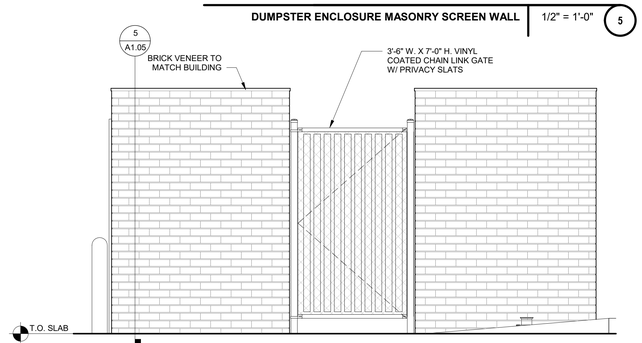
GATE CANE BOLT | 1 1/2" = 1'-0" | 17



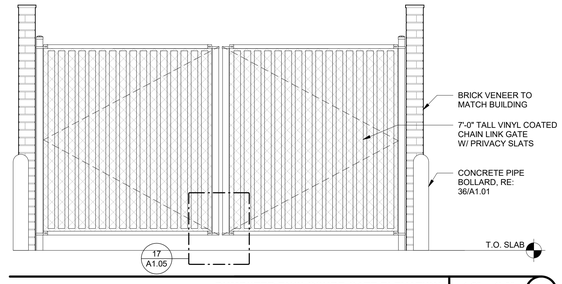
DUMPSTER ENCLOSURE MASONRY SCREEN WALL | 1/2" = 1'-0" | 5



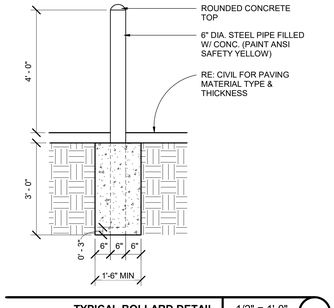
ADA SITE SIGNAGE | 1/2" = 1'-0" | 15



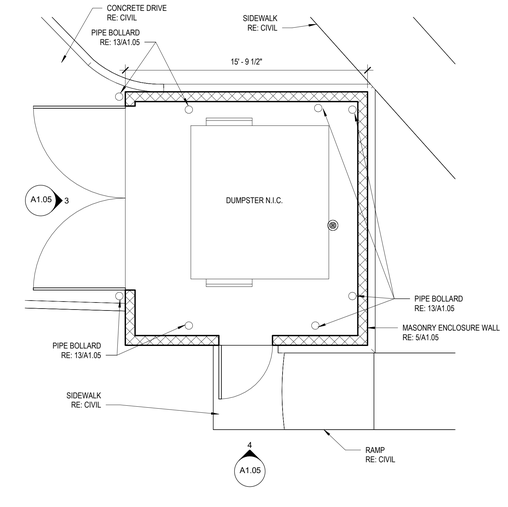
DUMPSTER ENCLOSURE GATE ELEVATION | 1/2" = 1'-0" | 4



DUMPSTER ENCLOSURE GATE ELEVATION | 1/2" = 1'-0" | 3



TYPICAL BOLLARD DETAIL | 1/2" = 1'-0" | 13



ENLARGED DUMPSTER PLAN | 1/4" = 1'-0" | 1

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PROJECT #: N032023
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FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
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SITE DETAILS

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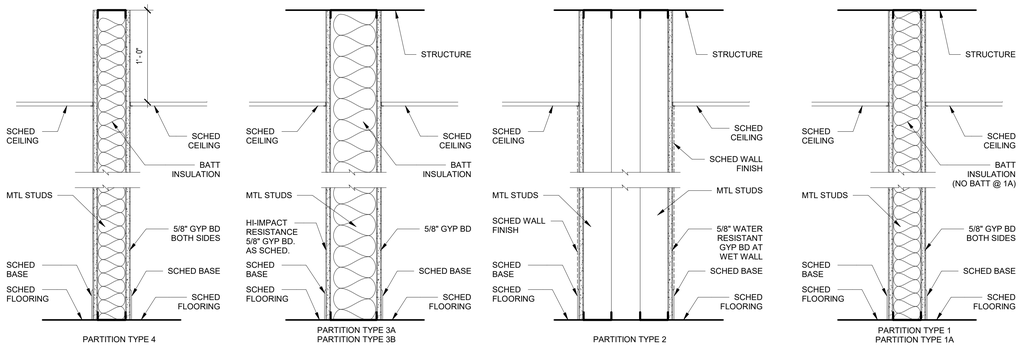


PARTITION TYPES | NO SCALE | 24

PARTITION SCHEDULE

TYPE	DETAIL REFERENCE	BASE DETAIL	STRUC. WIDTH	OVERALL DIMENSION	INSULATION THICKNESS	FIRE RATING	STC	NOTES
1	24/A2.01	AS SCHED.	3 5/8"	4 7/8"	3 1/2"	-	-	-
1A	24/A2.01	AS SCHED.	3 5/8"	4 7/8"	---	-	-	-
2	24/A2.01	AS SCHED.	3 5/8" (2)	SEE PLAN	---	-	-	-
3A	24/A2.01	AS SCHED.	6"	7 1/4"	5 1/2"	-	-	IMPACT RESISTANT GYP. BD. ON ALL GYM/ GAME ROOM WALLS
3B	24/A2.01	AS SCHED.	6"	7 1/4"	5 1/2"	-	-	-
4	24/A2.01	AS SCHED.	3 5/8"	4 7/8"	3 1/2"	-	-	-

NOTES

A. ALL METAL STUDS TO BE SPACED AT 1'-4" O.C., UNLESS NOTED OTHERWISE.

B. INSULATION COLUMN:
(1) --- INDICATES NO INSULATION TO BE PLACED IN PARTITION CAVITY.
(2) DIMENSION INDICATES THICKNESS OF SOUND ATTENUATION BLANKETS TO BE PLACED IN PARTITION CAVITY. ATTACH BLANKETS SECURELY IN WALL CAVITY TO PREVENT FALLING.

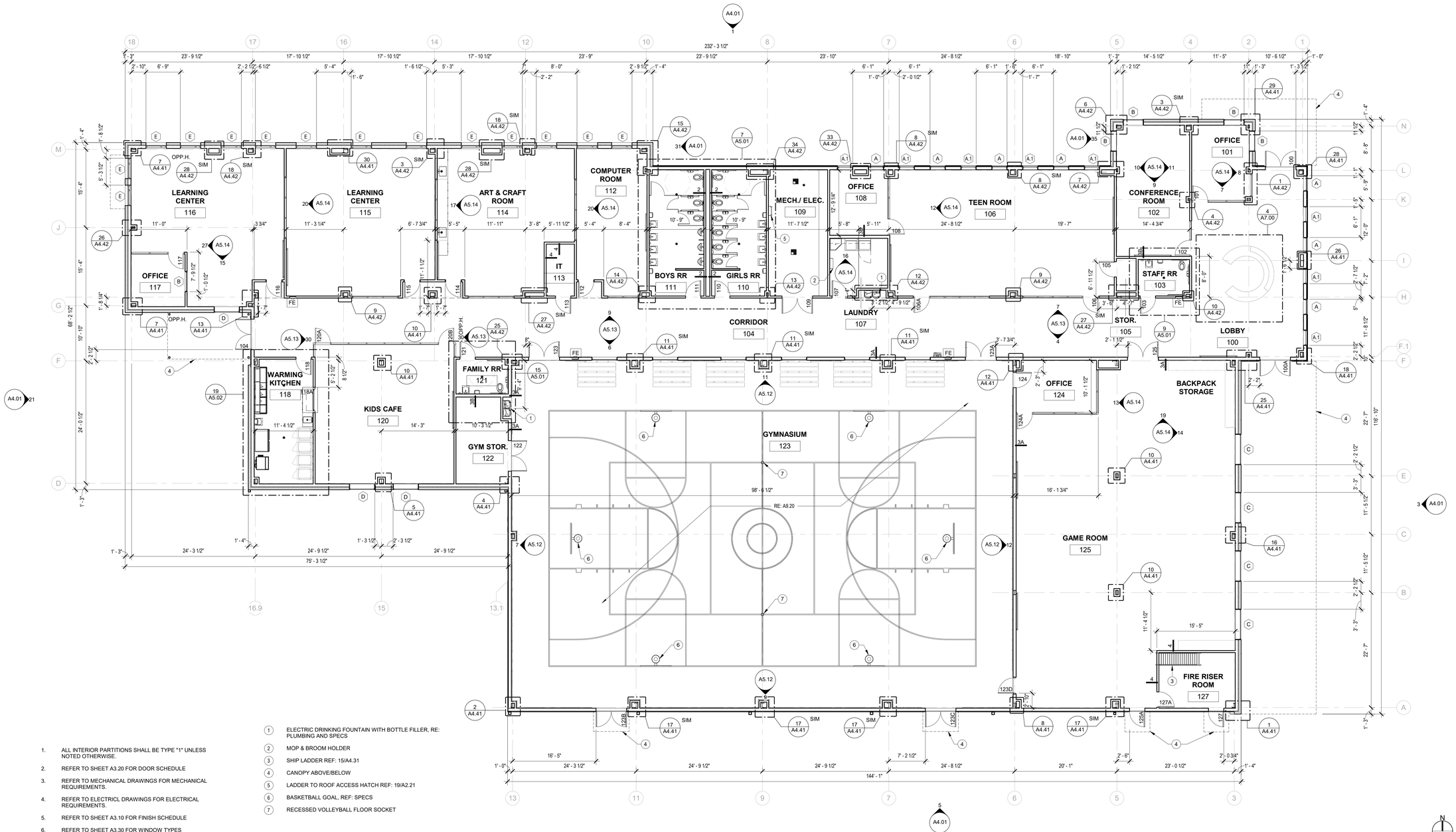
C. ALL GYPSUM BOARD TO BE 5/8" THICK, UNLESS NOTED OTHERWISE.

SPECIFIC NOTES

GENERAL NOTES

1. PARTITION TYPE DRAWINGS ARE NOT TO SCALE.
2. WALLS AND PARTITIONS ARE INTERIOR NON-BEARING SYSTEMS AND ARE NOT INTENDED TO RESIST WIND LOADS OR SUPPORT FLOOR LOADS (UNLESS OTHERWISE NOTED).
3. PARTITIONS ARE CONTINUOUS ACROSS DOORWAYS, OPENINGS AND ABUTTING PARTITIONS; A TAG SHOWN IN ONE SEGMENT OF A PARTITION APPLIES TO ALL UNMARKED SEGMENTS THAT ARE IN LINE WITH AND CONTINUOUS WITH THE TAGGED SEGMENT.
4. FOR WALL TILE APPLICATIONS, USE WATER RESISTANT GYP. BOARD.

PARTITION SCHEDULE & GENERAL NOTES | NO SCALE | 6



1. ALL INTERIOR PARTITIONS SHALL BE TYPE "1" UNLESS NOTED OTHERWISE.
2. REFER TO SHEET A3.20 FOR DOOR SCHEDULE
3. REFER TO MECHANICAL DRAWINGS FOR MECHANICAL REQUIREMENTS.
4. REFER TO ELECTRICL DRAWINGS FOR ELECTRICAL REQUIREMENTS.
5. REFER TO SHEET A3.10 FOR FINISH SCHEDULE
6. REFER TO SHEET A3.30 FOR WINDOW TYPES

FLOOR PLAN GENERAL NOTES | NO SCALE | 31

1. ELECTRIC DRINKING FOUNTAIN WITH BOTTLE FILLER, RE: PLUMBING AND SPECS
2. MOP & BROOM HOLDER
3. SHIP LADDER REF: 15/A4.31
4. CANOPY ABOVE/BELOW
5. LADDER TO ROOF ACCESS HATCH REF: 19/A2.21
6. BASKETBALL GOAL, REF: SPECS
7. RECESSED VOLLEYBALL FLOOR SOCKET

FLOOR PLAN KEY NOTES | NO SCALE | 25

FLOOR PLAN | 1/8" = 1'-0" | 1

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FLOOR PLAN

100% Construction Document
02.29.2024

A2.01

1. ELECTRIC DRINKING FOUNTAIN WITH BOTTLE FILLER, RE: PLUMBING AND SPECS
2. MOP & BROOM HOLDER
3. SHIP LADDER REF: 15/A4.31
4. CANOPY ABOVE/BELOW
5. LADDER TO ROOF ACCESS HATCH REF: 19/A2.21
6. BASKETBALL GOAL, REF: SPECS
7. RECESSED VOLLEYBALL FLOOR SOCKET

FLOOR PLAN KEY NOTES | NO SCALE | 25

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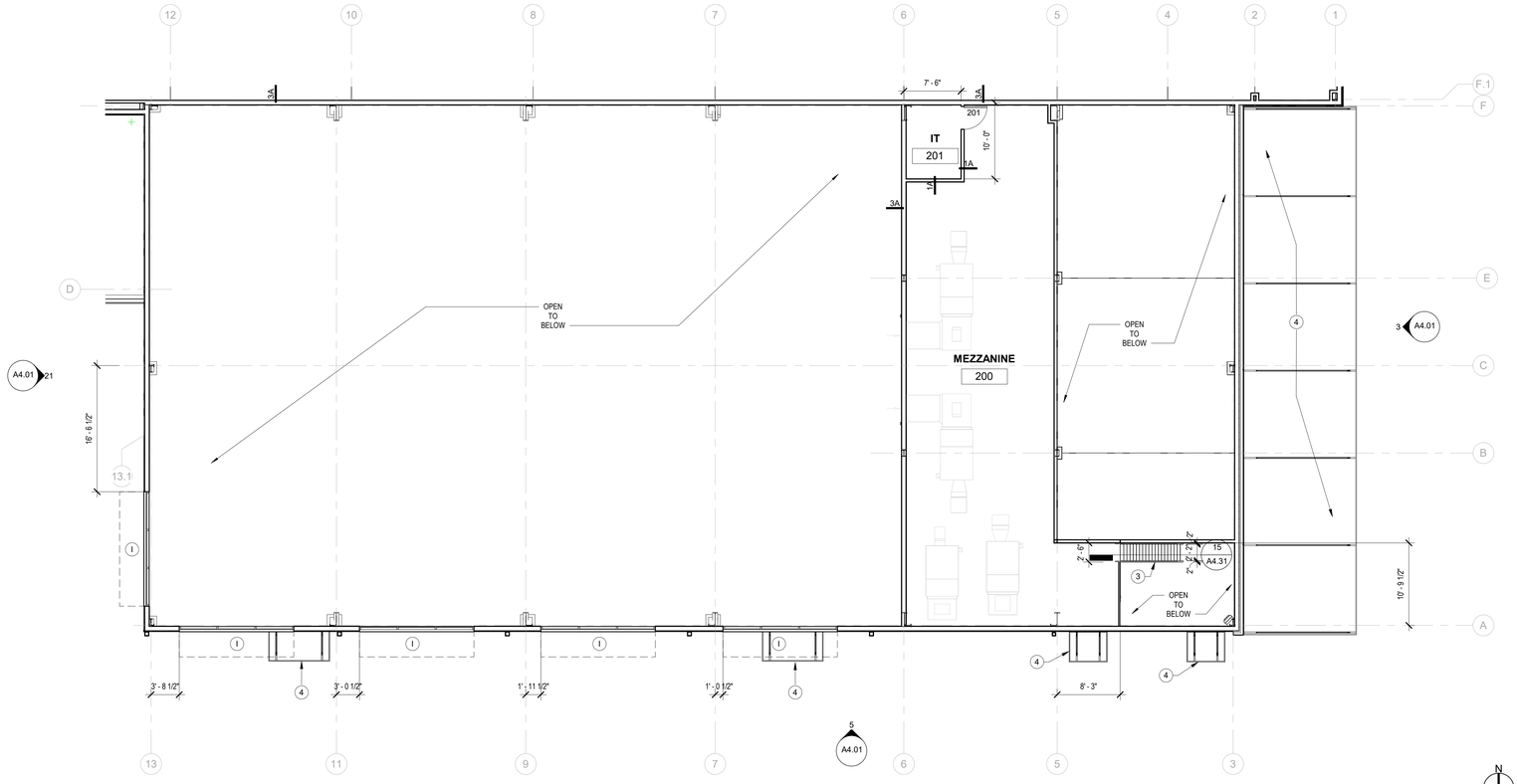
FLOOR PLAN GENERAL NOTES | NO SCALE | 31



MEZZANINE FLOOR PLAN | 1/8" = 1'-0" | 1

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LJA ENGINEERING
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KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
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SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE ASSOCIATES
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TBPE FIRM REG.#F-4506

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TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

FLOOR PLAN – MEZZANINE

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02.29.2024

A2.02

ROOF WALKING PADS

STANDING SEAM ROOF SYSTEM OVER HIGH TEMP. MTL. ROOFING UNDERLAYMENT OVER 5" RIGID BOARD INSULATION ; RE: SPECS

TPO ROOF SYSTEM OVER 1/2" PER FT TAPERED INSULATION BOARD RE: SPECS

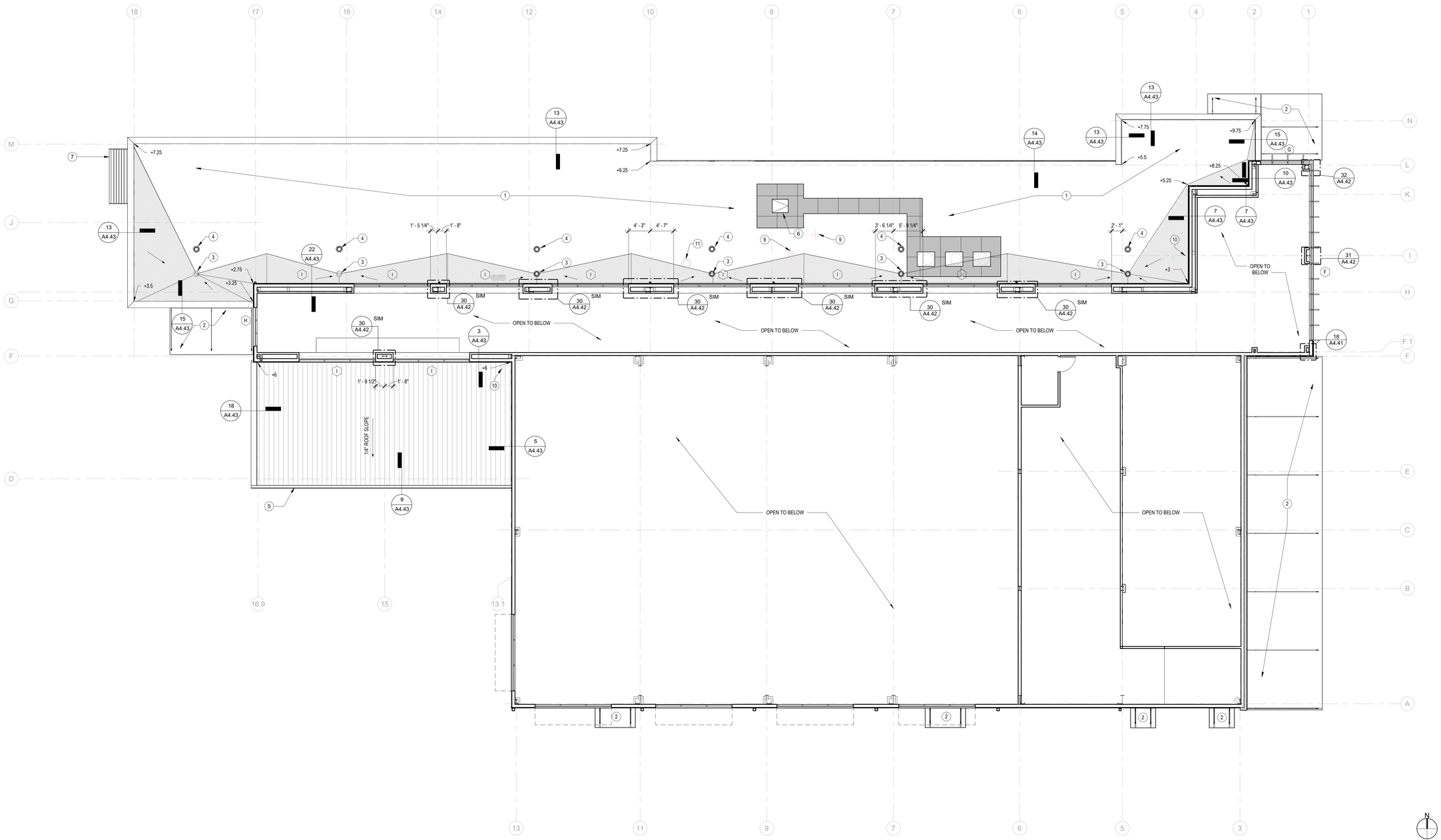
ROOF PLAN LEGEND | NO SCALE | 18

1. TPO ROOFING SYSTEM OVER 5" (R30) RIGID BOARD INSULATION
2. AVADEK CANOPY WITH STANDING SEAM METAL ROOF- ALL STEEL MEMBERS PAINTED
3. ROOF DRAIN, RE: 1/A8.51
4. ROOF OVERFLOW DRAIN, RE: 1/A8.51
5. GUTTER
6. ROOF ACCESS HATCH, RE: 35/A2.21
7. HORIZONTAL SUNSHADES
8. VERTICAL SUNSHADES
9. O/A INTAKE; REF: MECH.
10. EXHAUST DUCT; REF: MECH.
11. EXHAUST FAN; REF: MECH.

ROOF PLAN KEY NOTES | NO SCALE | 12

1. REFER SHEET A8.50 AND A8.51 FOR TYPICAL ROOFING DETAILS
2. MINIMUM TOTAL SOLAR REFLECTANCE OF 0.70 AS TESTED PERONE OF THE FOLLOWING: ASTM C1549, ASTM E903, ASTM E1175, OR ASTM E1918
3. MINIMUM THERMAL EMITTANCE OF 0.75 WHEN TESTED PER ONE OF THE FOLLOWING: ASTM C835, ASTM 1371, OR ASTM E408
4. COORDINATE ROOF PENETRATION LOCATIONS WITH MEP DRAWINGS. PENETRATIONS SHALL BE FLASHED TO MEET "SMACNA" DETAIL REQUIREMENTS.

ROOF PLAN GENERAL NOTES | NO SCALE | 6



LOW ROOF PLAN | 1/8" = 1'-0" | 1

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PROJECT #: N032023

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TDLR #: TABS2024011699

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LOW ROOF PLAN

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A2.10

ROOF WALKING PADS

STANDING SEAM ROOF SYSTEM OVER HIGH TEMP. MTL. ROOFING UNDERLAYMENT OVER 5" RIGID BOARD INSULATION ; RE: SPECS

TPO ROOF SYSTEM OVER 1/2" PER FT TAPERED INSULATION BOARD RE: SPECS

ROOF PLAN LEGEND | NO SCALE | 18

1. TPO ROOFING SYSTEM OVER 5" (R30) RIGID BOARD INSULATION
2. AVADEK CANOPY WITH STANDING SEAM METAL ROOF- ALL STEEL MEMBERS PAINTED
3. ROOF DRAIN, RE: 1/A8.51
4. ROOF OVERFLOW DRAIN, RE: 1/A8.51
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7. HORIZONTAL SUNSHADES
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9. O/A INTAKE; REF: MECH.
10. EXHAUST DUCT; REF: MECH.
11. EXHAUST FAN; REF: MECH.

ROOF PLAN KEY NOTES | NO SCALE | 12

1. REFER SHEET A8.50 AND A8.51 FOR TYPICAL ROOFING DETAILS
2. MINIMUM TOTAL SOLAR REFLECTANCE OF 0.70 AS TESTED PERONE OF THE FOLLOWING: ASTM C1549, ASTM E903, ASTM E1175, OR ASTM E1918
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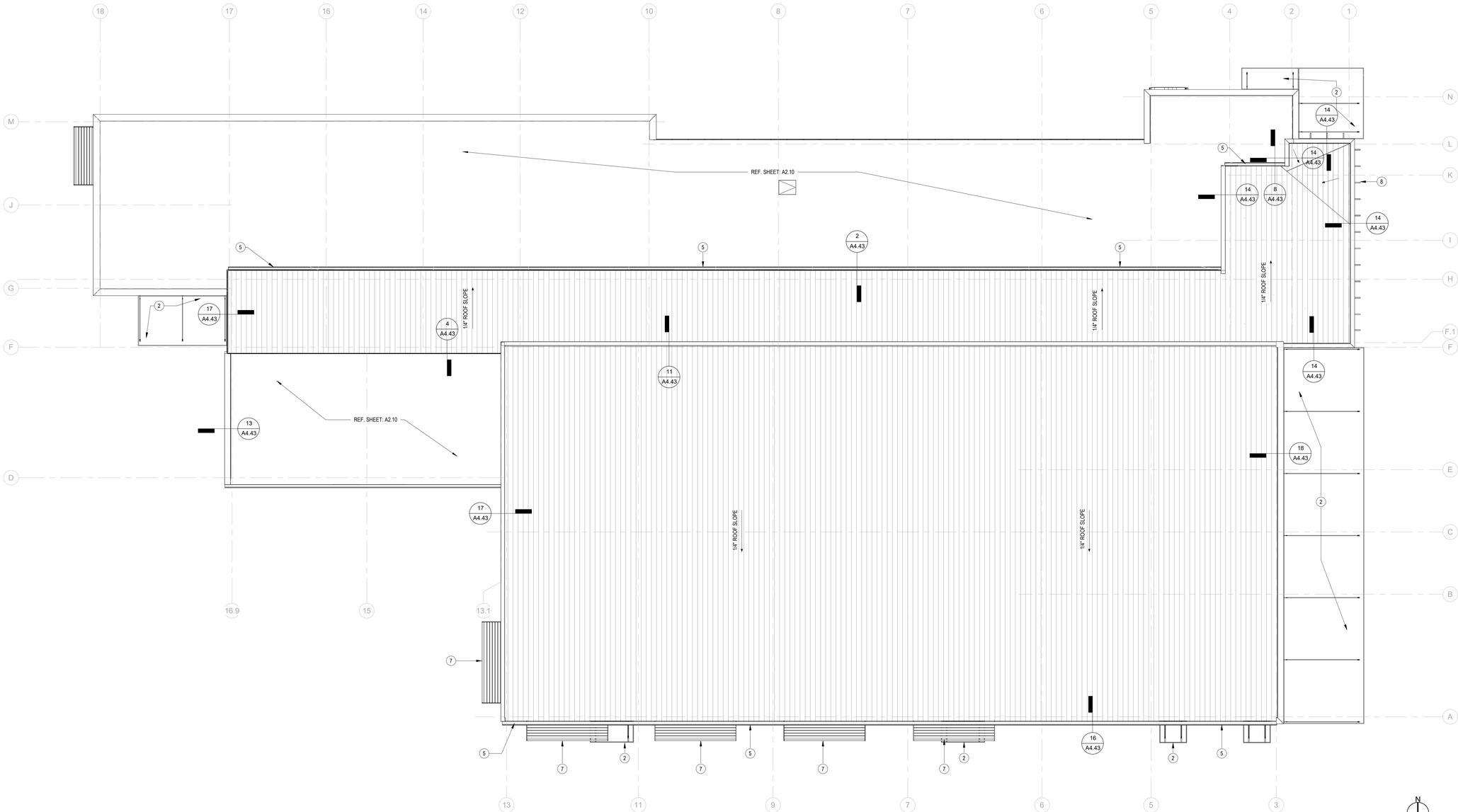
ROOF PLAN GENERAL NOTES | NO SCALE | 6



HIGH ROOF PLAN | 1/8" = 1'-0" | 1

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HIGH ROOF PLAN

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MATERIALS & FINISHES LEGEND

FINISH	MANUFACTURER	PRODUCT	PRODUCT #	COLOR	SIZE	INSTALLATION NOTES	SPECIFICATION SECTION
CEILINGS							
ACCOUSTIC CEILING TILE (ACT)							
ACT-1	ARMSTRONG	CALLA SQUARE LAY-IN SMOOTH TEXTURE	2820	WHITE	24" X 24"		095113
GYPSUM BOARD (GWB)							
GWB1	N/A	FLAT FINISH @ PAINTED GYPSUM CEILINGS	REF: PAINT FINISH (P1)	SCHEDULED PAINT (P1)			095113
WALLS							
FIBERGLASS REINFORCED PLASTIC (FRP)							
FRP-1	SEQUENTIA	TRADITIONAL WALL PANELS		IVORY 0084	4' X 10'		066400
PAINT (P)							
P1	SHERWIN WILLIAMS	SATIN PAINT	SW9165	GOSSAMER VEIL			099123
P2	SHERWIN WILLIAMS	SATIN PAINT	SW7602	INDIGO BATIK			099123
PORCELAIN/CERAMIC WALL TILE (CWT)							
CWT-1	AMERICAN OLEAN	COLOR STORY WALL		RESTORE 0058	4X16		093013
CWT-2	AMERICAN OLEAN	COLOR STORY WALL		MATTE CALM 0036	4X16		093013
MILLWORK							
PLASTIC LAMINATE (PL)							
PL1	LAB DESIGNS	PREMIUM HIGH PRESSURE PLASTIC LAMINATE	WW135LS	HORSESHOE WALNUT		WOOD GRAIN CABINETS TO HAVE VERTICAL GRAIN; CONTRACTOR TO PROVIDE MOCKUP OF CABINET SAMPLE FOR APPROVAL	064116
SOLID SURFACE (SS)							
SS-1	CORIAN	SOLID SURFACE		CLAM SHELL	1/2" X 144" X 30"		123661.16
BASE							
PORCELAIN/CERAMIC WALL BASE TILE (CWBT)							
CWBT-1	AMERICAN OLEAN	COLOR STORY WALL	S44D9	RESTORE 0058	4X16		093013
RUBBER BASE (RB)							
RB-1	TARKETT	TRADITIONAL WALL BASE	TG3	IRON MOUNTAIN CG	4"		096513
RB-2	TARKETT	TRADITIONAL WALL BASE	TG3	IRON MOUNTAIN CG	6"		096513
FLOORS							
CARPET (CPT)							
CPT-1	INTERFACE	SOFT GLOW CARPET	107268	TITANIUM LAGOON	25CM X 1M	INSTALLED IN HERRINGBONE PATTERN; REF: FINISH PLAN FOR PATTERN DIRECTION	096813
SEALED/STAINED CONCRETE (SC)							
SC-1	DIRECT COLORS	VIBRANCE DYE	DC-DYE-319	LIGHT SLATE		APPLY IN RANDOM PATTERN; CONTRACTOR TO COMPLETE SAMPLE KIT FOR APPROVAL	033543
SC-2	N/A	CONCRETE SEALER		CLEAR			099123
SC-3	DIRECT COLORS	EVERSTAIN ACID STAIN	DC-CAS-AZB	AZURE BLUE		ONE LAYER OF EVEN SPRAY; CONTRACTOR TO COMPLETE SAMPLE KIT FOR APPROVAL	033543
SPORTS FLOORING (SF)							
SF-1	GERFLOR	RECREATION 60		6062 CANADIAN MAPLE	0.23" X 4'11" X 86'6"		096566

MATERIAL & FINISH LEGEND | NO SCALE | 17

CPT-1 — CPT-1 CARPET FLOOR

SF-1 — SF-1 SPORTS FLOOR

SC-1 — SC-1 DYED CONCRETE

SC-2 — SC-2 SEALED CONCRETE

SC-3 — SC-3 ACID STAINED CONCRETE

ROOM FINISH TAG

CEILING
WALLS
BASE
FLOORS

★ DENOTES MULTIPLE FINISHES, REFER TO REFLECTED CEILING PLANS, FLOOR PATTERN PLANS AND/OR ELEVATIONS FOR INFORMATION.

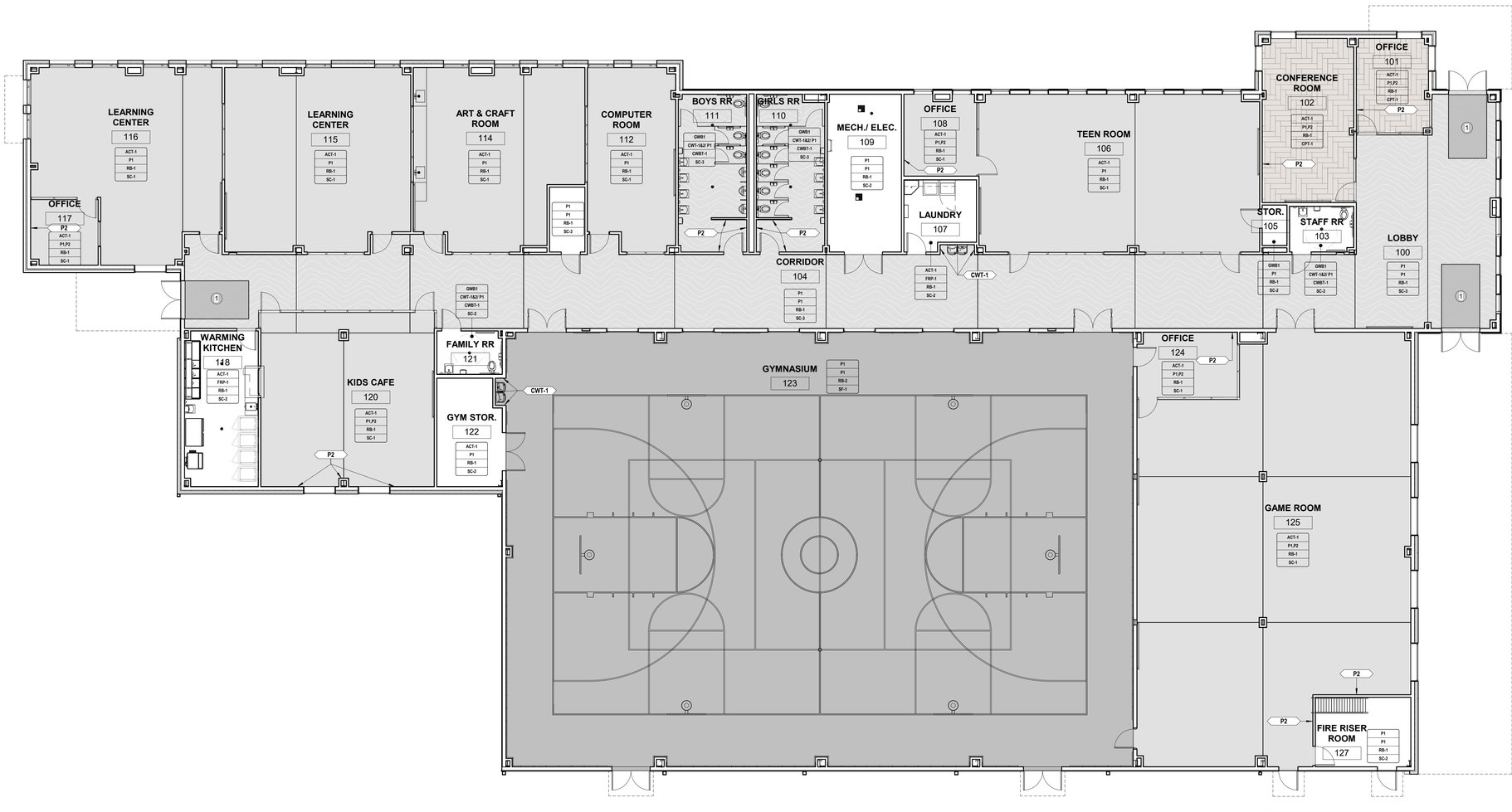
MATERIAL TAG

XY★ — COLOR / MATERIAL TYPE

FINISH PLAN LEGEND

- MATERIAL PATTERN DIRECTION
- EXPANSION JOINT
- XX-X — ACCENT FINISH TAG
- XX-X — ACCENT FINISH (ARROWS DENOTE FINISH TERMINATION) (XX-X) = ACCENT MATERIAL/FINISH (REF. MATERIALS LEGEND, ON 1/A3.10)

FINISH PLAN LEGEND | NO SCALE | 5



FINISH PLAN | 1/8" = 1'-0" | 7

1 — 10' WALKOFF MATT - HEAVY DUTY NEEDLEBOND HOBNAIL POLYESTER

FINISH PLAN KEY NOTES | NO SCALE | 3

1. ALL GYPSUM WALLS TO BE PAINTED, P1, U.N.O.
2. ALL FINISH FLOORS TO EXTEND UNDERNEATH ALL CASEWORK, SHELVING, AND FIXED EQUIPMENT, INCLUDING PERMANENTLY INSTALLED CASEWORK.
3. PROVIDE CORNER GUARDS AT ALL PAINTED GYPSUM BOARD OUTSIDE CORNERS TYP.,REF: SPECS.
4. ALL FLOOR FINISH CHANGES SHALL OCCUR AT THE CENTERLINE OF DOORS UNLESS NOTED OTHERWISE.

FINISH PLAN GENERAL NOTES | NO SCALE | 2

INTERIOR WALL & CEILING FINISH MINIMUM REQUIREMENTS BY OCCUPANCY			
GROUP	SPRINKLERED		
	EXIT ENCLOSURE & EXIT PASSAGEWAY	CORRIDORS	ROOM ENCLOSURE SPACES
E	B	C	C

FIRE CLASS REQUIRMENTS SCHED. OCCUP. | NO SCALE | 1

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FINISH PLAN & MATERIAL SCHEDULE

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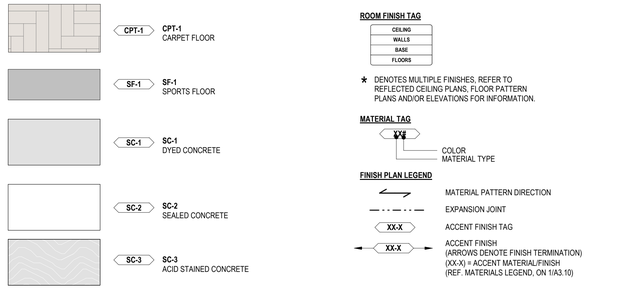
A3.10



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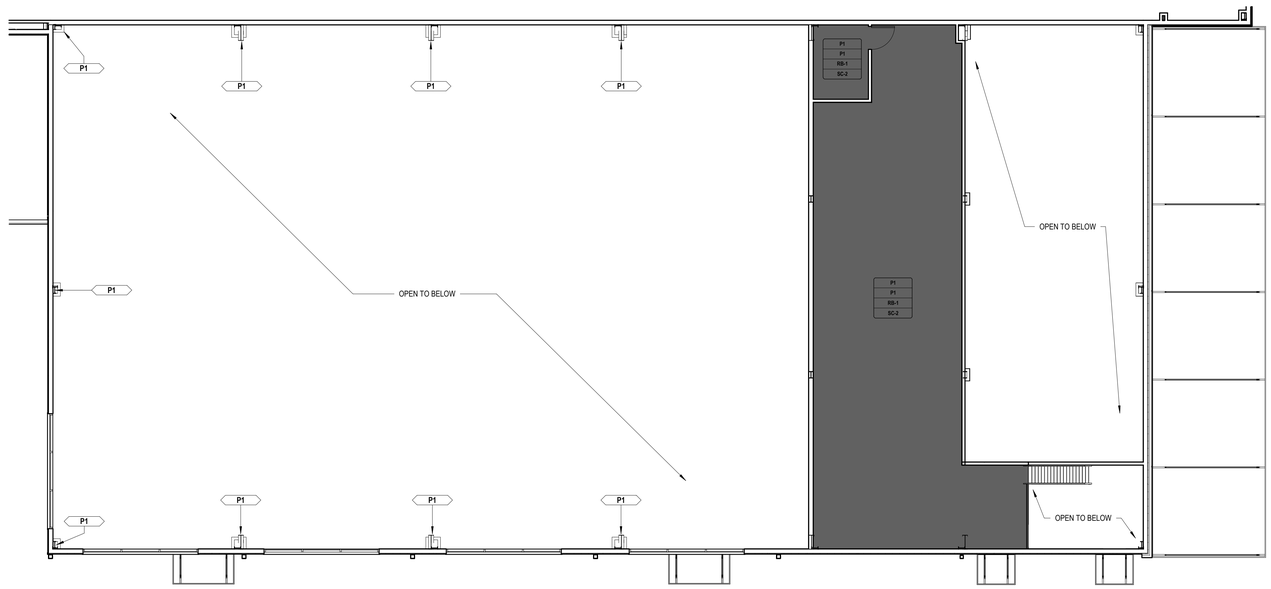
FINISH PLAN GENERAL NOTES | NO SCALE | 2



LOW ROOF PLAN | 1/8" = 1'-0" | 1

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FINISH PLAN – MEZZANINE

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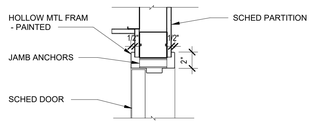
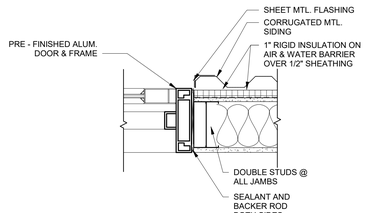
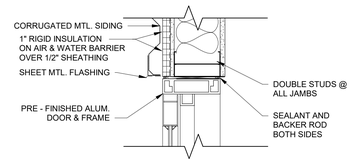
A3.11



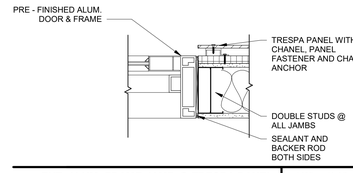
INTERIOR HM DOOR FRAME JAMB | 1 1/2" = 1'-0" | 30



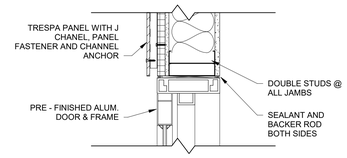
STOREFRONT DOOR JAMB @ METAL PANEL | 1 1/2" = 1'-0" | 24



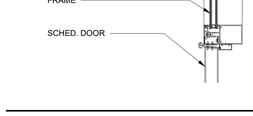
EXT. ALUM. FRAME HEADER @ MTL PANELS | 1 1/2" = 1'-0" | 18



EXT. ALUM. FRAME JAMB @ TRESPA PANEL | 1 1/2" = 1'-0" | 12

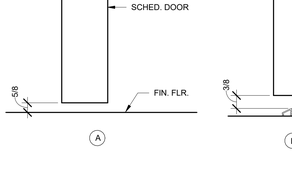


EXT. ALUM. FRAME HEADER @ TRESPA PANEL | 1 1/2" = 1'-0" | 6

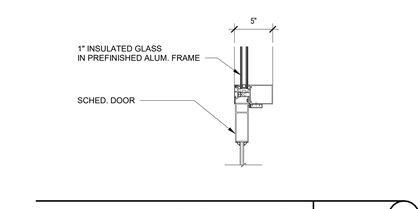


INTERIOR HM DOOR FRAME HEADER | 1 1/2" = 1'-0" | 29

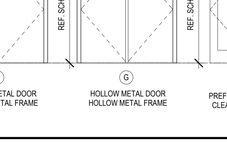
INTERIOR ALUM DOOR FRAME JAMB | 1 1/2" = 1'-0" | 23



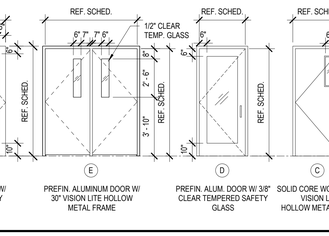
ROLLING OVERHEAD DOOR JAMB DETAIL | 1 1/2" = 1'-0" | 17



EXT HM DOOR FRAME JAMB @ METAL PANEL | 1 1/2" = 1'-0" | 28



INTERIOR ALUM DOOR FRAME HEADER | 1 1/2" = 1'-0" | 22

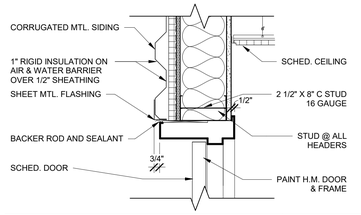


ROLLING OVERHEAD DOOR HEAD DETAIL | 1 1/2" = 1'-0" | 16

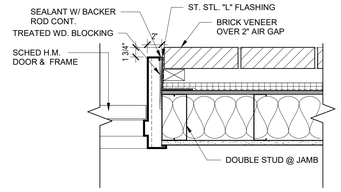
DOOR SCHEDULE

DOOR NUMBER	DOOR FINISH	FRAME FINISH	DOOR SIZE		DOOR THK.	DOOR/FRAME TYPE	HEAD	JAMB	SILL	HARDWARE	REMARKS
			WIDTH (W)	HEIGHT (H)							
100	AL/GL	CAA	3' - 0" (2)	7' - 0"	0' - 1 3/4"	F	6/A3.20	12/A3.20	C	R714AM	1
100A	AL/GL	CAA	3' - 0" (2)	7' - 0"	0' - 1 3/4"	F	6/A3.20	12/A3.20	C	R714AM	1
101	AL/GL	CAA	3' - 0"	7' - 0"	0' - 1 3/4"	D	25/A3.20	26/A3.20	B	103A	
102	AL/GL	CAA	3' - 0"	7' - 0"	0' - 1 3/4"	D	25/A3.20	26/A3.20	B	503A	
103	PL	P	3' - 0"	7' - 0"	0' - 1 3/4"	B	22/A3.20	23/A3.20	A	341	
104	AL/GL	CAA	3' - 0" (2)	7' - 0"	0' - 1 3/4"	F	18/A3.20	24/A3.20	C	714AM	
105	PL	P	3' - 0"	7' - 0"	0' - 1 3/4"	B	29/A3.20	30/A3.20	A	503	
106	AL/GL	CAA	3' - 0"	7' - 0"	0' - 1 3/4"	D	25/A3.20	26/A3.20	A	751	
106A	AL/GL	CAA	3' - 0"	7' - 0"	0' - 1 3/4"	D	25/A3.20	26/A3.20	A	751	
107	P	P	3' - 0"	7' - 0"	0' - 1 3/4"	A	22/A3.20	23/A3.20	A	503	
108	AL/GL	CAA	3' - 0"	7' - 0"	0' - 1 3/4"	D	25/A3.20	26/A3.20	E	103A	
109	P	P	3' - 0" (2)	7' - 0"	0' - 1 3/4"	H	29/A3.20	30/A3.20	A	210	
110	PL	P	3' - 0"	7' - 0"	0' - 1 3/4"	B	22/A3.20	23/A3.20	A	801L	
111	PL	P	3' - 0"	7' - 0"	0' - 1 3/4"	B	22/A3.20	26/A3.20	A	801L	
112	PL	P	3' - 0"	7' - 0"	0' - 1 3/4"	C	22/A3.20	26/A3.20	A	551H	
113	P	P	3' - 0"	7' - 0"	0' - 1 3/4"	A	29/A3.20	30/A3.20	A	201C	
114	PL	P	3' - 0"	7' - 0"	0' - 1 3/4"	C	22/A3.20	23/A3.20	A	551H	
115	PL	P	3' - 0"	7' - 0"	0' - 1 3/4"	C	22/A3.20	23/A3.20	A	551H	
116	PL	P	3' - 0"	7' - 0"	0' - 1 3/4"	C	22/A3.20	23/A3.20	A	551H	
117	AL/GL	CAA	3' - 0"	7' - 0"	0' - 1 3/4"	D	25/A3.20	26/A3.20	E	103A	
118	PL	P	3' - 0"	7' - 0"	0' - 1 3/4"	A	29/A3.20	30/A3.20	A	503AP	
118A	AL	SST	5' - 0"	6' - 0"	REF: SPECS	I	16/A3.20	17/A3.20	-	001	
120A	AL/GL	CAA	3' - 0"	7' - 0"	0' - 1 3/4"	D	25/A3.20	26/A3.20	A	551AH	
120B	AL/GL	CAA	3' - 0"	7' - 0"	0' - 1 3/4"	D	25/A3.20	26/A3.20	A	551AH	
121	PL	P	3' - 0"	7' - 0"	0' - 1 3/4"	B	22/A3.20	23/A3.20	A	341	
122	P	P	3' - 0" (2)	7' - 0"	0' - 1 3/4"	H	29/A3.20	30/A3.20	A	212S	
123	AL/GL	P	3' - 0" (2)	7' - 0"	0' - 1 3/4"	E	22/A3.20	23/A3.20	A	750M	
123A	AL/GL	P	3' - 0" (2)	7' - 0"	0' - 1 3/4"	E	22/A3.20	23/A3.20	A	750M	
123B	P	P	3' - 0" (2)	7' - 0"	0' - 1 3/4"	G	27/A3.20	28/A3.20	C	714M	
123C	P	P	3' - 0" (2)	7' - 0"	0' - 1 3/4"	G	27/A3.20	28/A3.20	C	714M	
123D	P	P	3' - 0"	7' - 0"	0' - 1 3/4"	A	22/A3.20	23/A3.20	A	503	
124	P	P	3' - 0"	7' - 0"	0' - 1 3/4"	A	22/A3.20	23/A3.20	A	103	
124A	AL/GL	CAA	3' - 0"	7' - 0"	0' - 1 3/4"	D	25/A3.20	26/A3.20	E	103A	
125	AL/GL	P	3' - 0" (2)	7' - 0"	0' - 1 3/4"	E	22/A3.20	23/A3.20	A	750M	
125A	P	P	3' - 0"	7' - 0"	0' - 1 3/4"	A	27/A3.20	28/A3.20	C	715	
127	P	P	3' - 0"	7' - 0"	0' - 1 3/4"	A	27/A3.20	28/A3.20	C	205	
127A	P	P	3' - 0"	7' - 0"	0' - 1 3/4"	A	22/A3.20	23/A3.20	A	203	
201	P	P	3' - 0"	7' - 0"	0' - 1 3/4"	A	29/A3.20	30/A3.20	A	205	

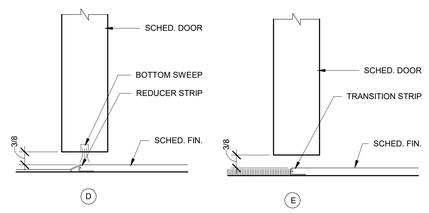
DOOR SCHEDULE | NO SCALE | 4

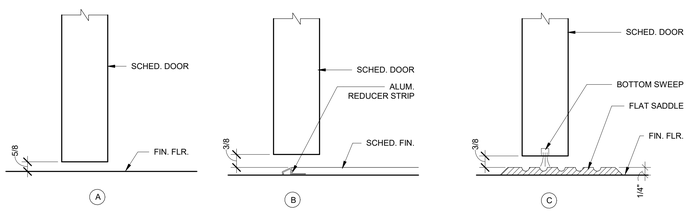


EXT HM DOOR FRAME HEADER @ METAL PANEL | 1 1/2" = 1'-0" | 27



EXT HM DOOR FRAME JAMB @ BRICK | 1 1/2" = 1'-0" | 21

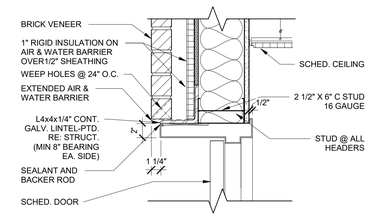




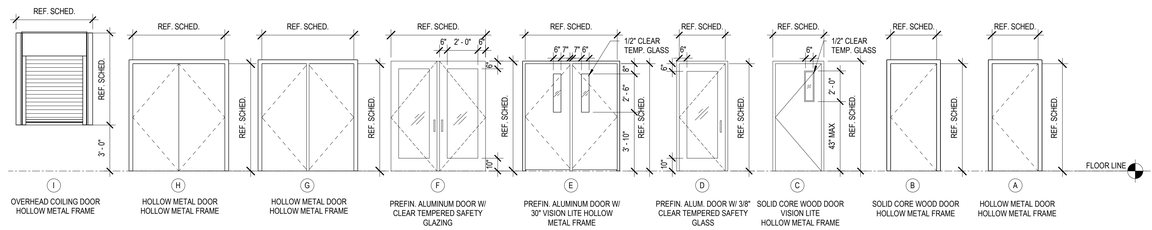
THRESHOLD DETAILS | 3" = 1'-0" | 8

STOREFRONT DOOR FRAME JAMB | 1 1/2" = 1'-0" | 26

DOOR FRAME HEADER | 1 1/2" = 1'-0" | 25



EXT HM DOOR FRAME HEADER @ BRICK | 1 1/2" = 1'-0" | 20



DOOR TYPES | NO SCALE | 7

1. COORDINATE FOR ACCESS CONTROL

REMARKS | NO SCALE | 2

HM	HOLLOW METAL
AL	ALUMINUM
PL	PLASTIC LAMINATE
WV	WOOD VENEER
W1	SOLID WOOD TRIM
GL	GLASS
CAA	COLOR ANODIZED ALUMINUM
P	PAINT
SST	STAINLESS STEEL

RE: 17/A3.10 FOR MATERIALS LEGEND

ABBREVIATIONS | NO SCALE | 1

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PROJECT #: N032023
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TDLR #: TABS2024011699

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FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

DOOR TYPE, SCHEDULE & DETAILS

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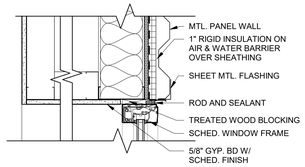
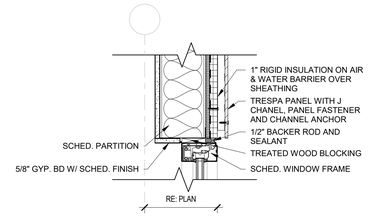
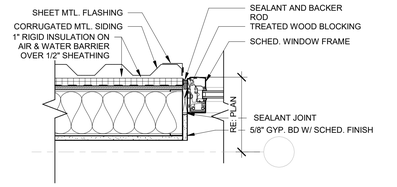
A3.20



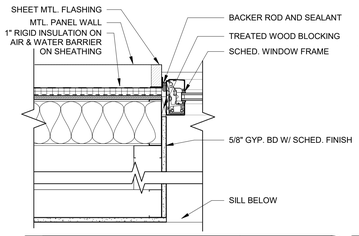
WINDOW HEAD DETAIL @ CLERESTORY | 1 1/2" = 1'-0" | 24



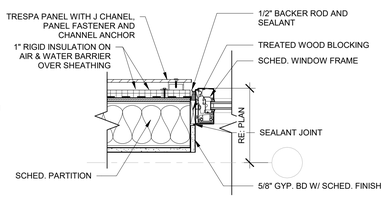
WINDOW HEAD DETAIL @ TRESPA PANEL | 1 1/2" = 1'-0" | 18



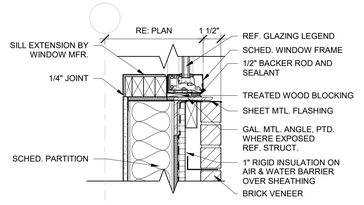
WINDOW JAMB DETAIL @ METAL PANEL | 1 1/2" = 1'-0" | 12



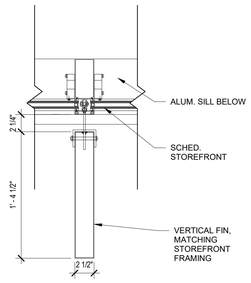
WINDOW JAMB DETAIL @ CLERESTORY | 1 1/2" = 1'-0" | 23



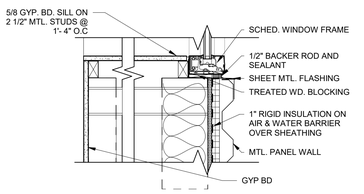
WINDOW JAMB DETAIL @ TRESPA PANEL | 1 1/2" = 1'-0" | 17



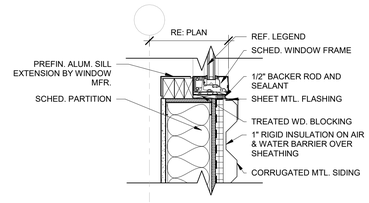
TYP. WINDOW SILL DETAIL @ BRICK | 1 1/2" = 1'-0" | 11



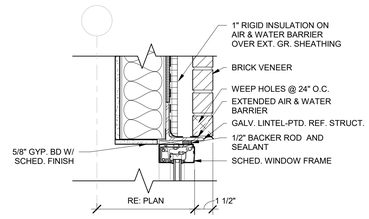
TYP. VERTICAL FIN DETAIL | 1 1/2" = 1'-0" | 28



WINDOW SILL DETAIL @ CLERESTORY | 1 1/2" = 1'-0" | 22



WINDOW SILL DETAIL @ METAL PANEL | 1 1/2" = 1'-0" | 16

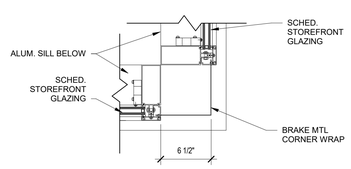


TYP. WINDOW HEAD DETAIL @ BRICK | 1 1/2" = 1'-0" | 10

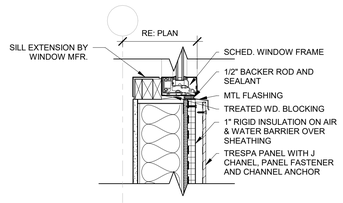
GL-01 : 1" INSULATED CLEAR GLAZING

GL-02 : 3/8" THICK CLEAR TEMPERED GLAZING

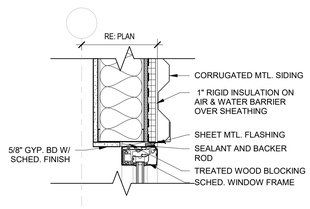
GLAZING LEGEND | NO SCALE | 4



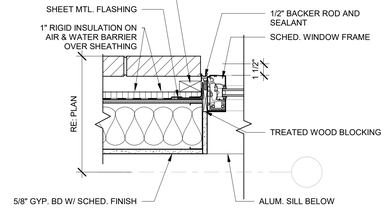
VERTICAL FINS CORNER DETAIL | 1 1/2" = 1'-0" | 27



WINDOW SILL DETAIL @ TRESPA PANEL | 1 1/2" = 1'-0" | 21



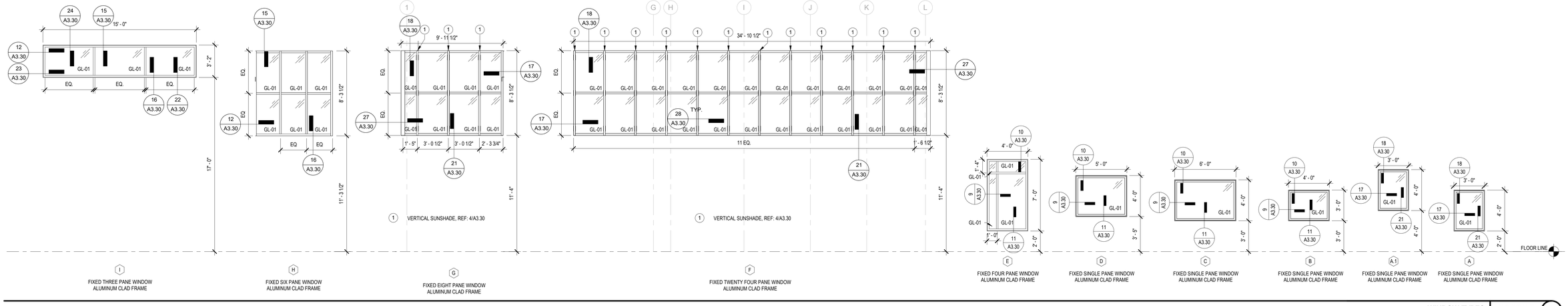
WINDOW HEAD DETAIL @ METAL PANEL | 1 1/2" = 1'-0" | 15



TYP. WINDOW JAMB DETAIL @ BRICK | 1 1/2" = 1'-0" | 9

1. ALL EXTERIOR AND INTERIOR WINDOWS TO BE PREFIN. ALUM. FRAMES, UNLESS NOTED OTHERWISE
2. PROVIDE TEMPERED GLASS WHERE REQUIRED BY THE INTERNATIONAL BUILDING CODE.
3. PROVIDE SILICONE SEALANT OVER BACKER ROD AROUND ALL FRAMES.
4. WINDOWS ARE OLD CASTLE SERIES 3000 THERMAL MULTIPLANE BACK SET OR EQUAL.
5. PROVIDE WINDOW COVERINGS FOR ALL PUNCHED WINDOWS, UNLESS OTHERWISE NOTED.
6. WINDOW SYSTEMS SHALL BE INSTALLED PRIOR TO THE BRICK VENEER.
7. ALL GLASS SHALL HAVE A MINIMUM U FACTOR OF 0.25 AND S.H.G.C OF 0.23

WINDOW GENERAL NOTES | NO SCALE | 3



WINDOW TYPES | NO SCALE | 1

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FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
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WINDOW TYPES & DETAILS

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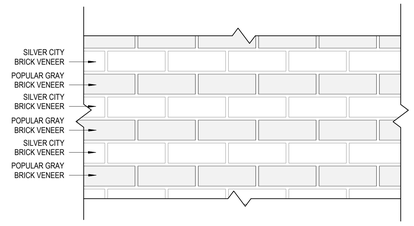
A3.30



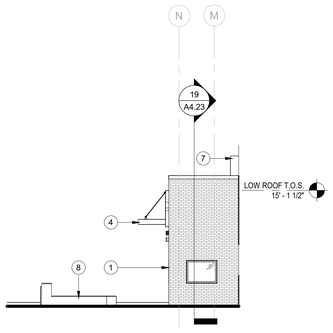
TYP. BRICK PATTERN | 1 1/2" = 1'-0" | 6

1. ALTERNATING BRICK VENEER: POPULAR GRAY AND SILVER CITY ACME BRICK COLORS WITH ROYAL UMBER MORTAR; REF: 6/A4.01
2. HIGH-PRESSURE LAMINATE PANELS: TRESPA METEON UNI COLORS; REF: 1/A4.02
3. SILVER METALLIC CORRUGATED METAL WALL PANELS: MBCI MASTERLINE 16
4. CANOPY: AVADEK
5. METAL SUNVISER: THEUT GLASS HORIZONTAL SUNSHADES B.O.D.
6. BRICK CONTROL JOINT
7. VERTICAL METAL SUNSHADES: THEUT GLASS CURTAIN WALL VERTICAL FINS B.O.D.
8. BOARD FORMED CONCRETE; REF: LANDSCAPE
9. ALUM. DOWNSPOUT
10. ALUM. GUTTER
11. ALUM LOUVERS; REF: MECH.
12. CAST DEDICATION PLAQUE; REF: 18/G1.11

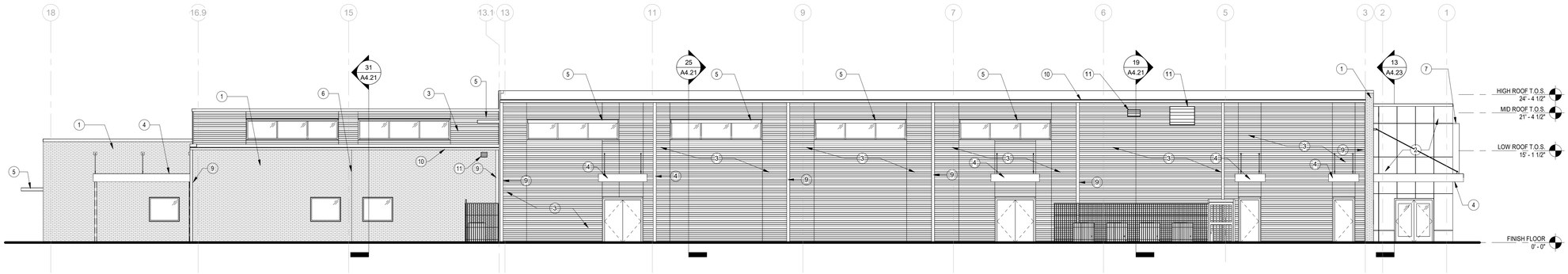
KEY NOTES | NO SCALE | 12

1. REFER TO A3.30 FOR WINDOW TYPES
2. REFER TO A1.00 FOR SITE PLAN NOTES

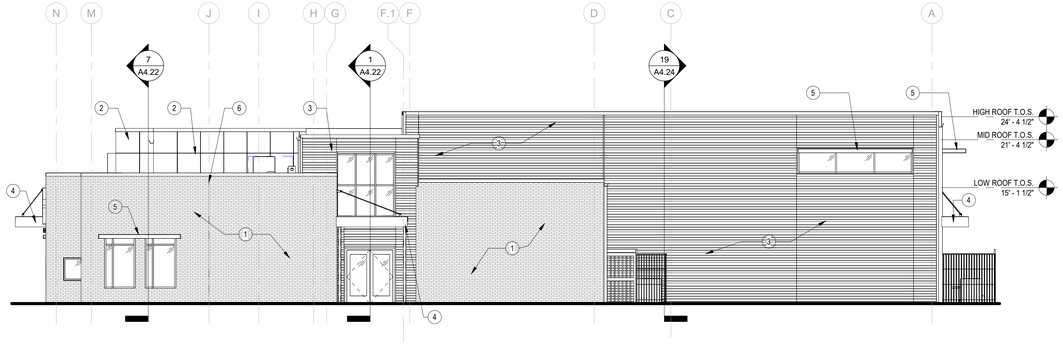
EXTERIOR ELEVATIONS GENERAL NOTES | NO SCALE | 6



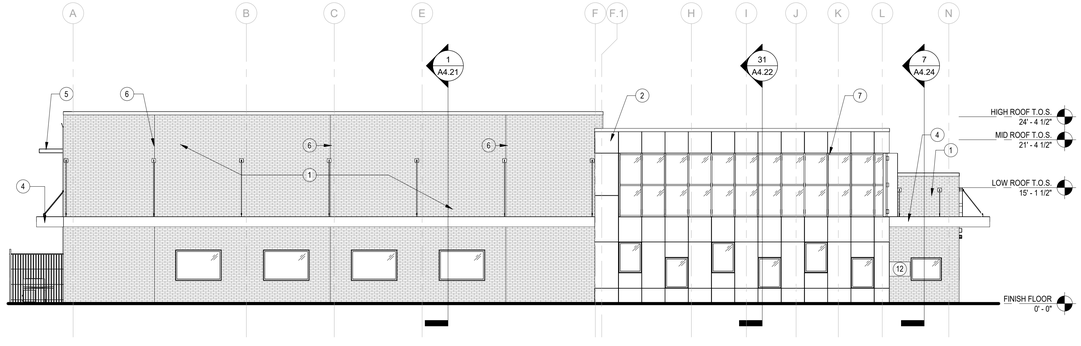
PARTIAL WEST ELEVATION | 1/8" = 1'-0" | 35



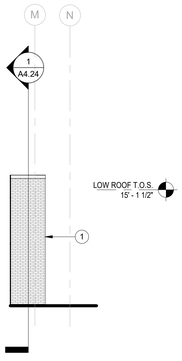
SOUTH ELEVATION | 1/8" = 1'-0" | 5



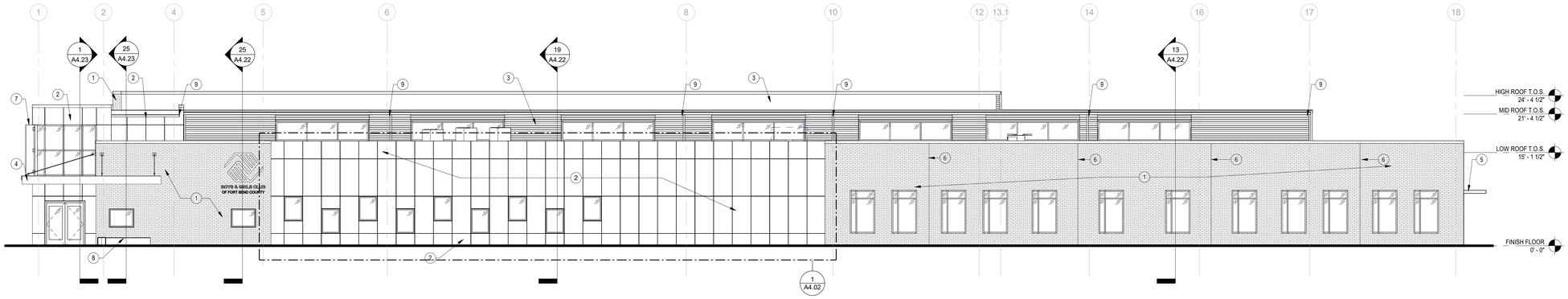
WEST ELEVATION | 1/8" = 1'-0" | 21



EAST ELEVATION | 1/8" = 1'-0" | 3



PARTIAL EAST ELEVATION | NO SCALE | 31



NORTH ELEVATION | 1/8" = 1'-0" | 1

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FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
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EXTERIOR ELEVATIONS

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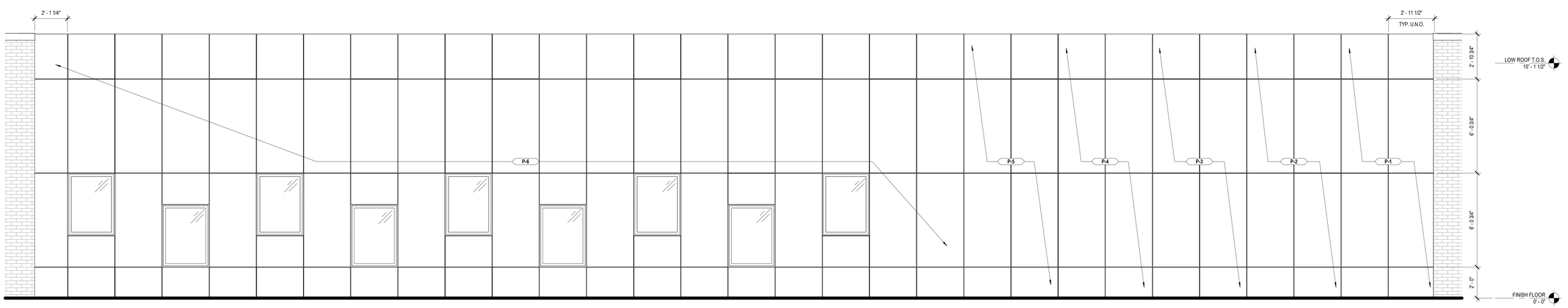
02.29.2024

A4.01

1. REFER TO A3.30 FOR WINDOW TYPES
2. ALL HIGH-PRESSURE LAMINATE PANELS TO BE PAINTED P-1, U.N.O.

EXTERIOR ELEVATIONS GENERAL NOTES | NO SCALE | 1



ENLARGED EXTERIOR ELEVATION | 3/8" = 1'-0" | 1

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ENLARGED EXTERIOR ELEVATIONS

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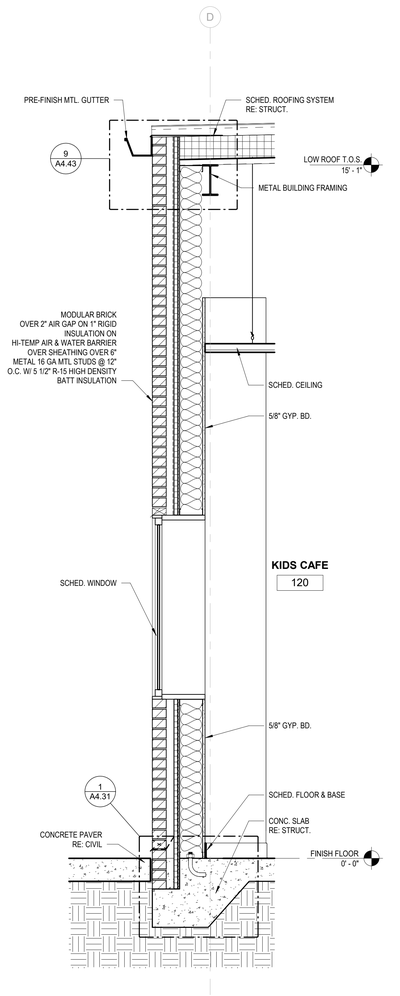
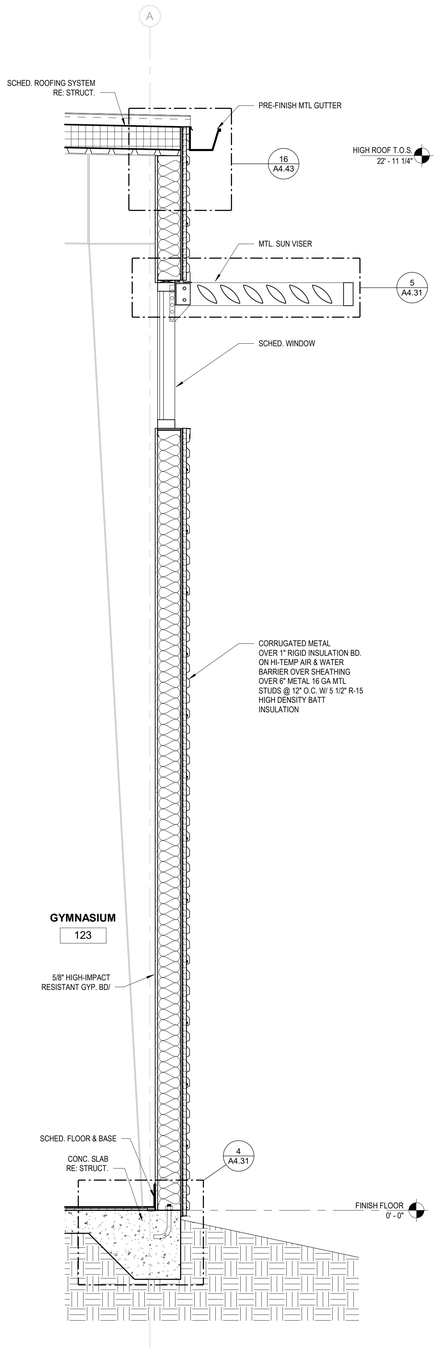
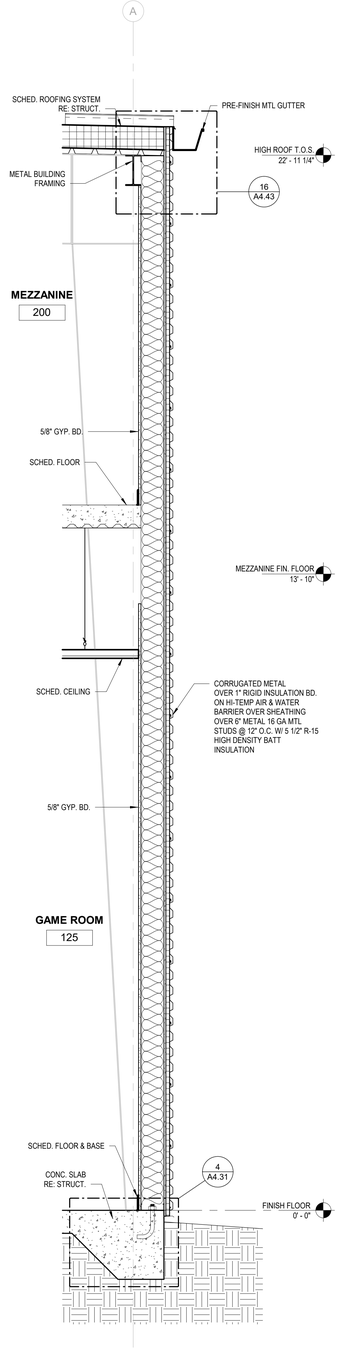
A4.02



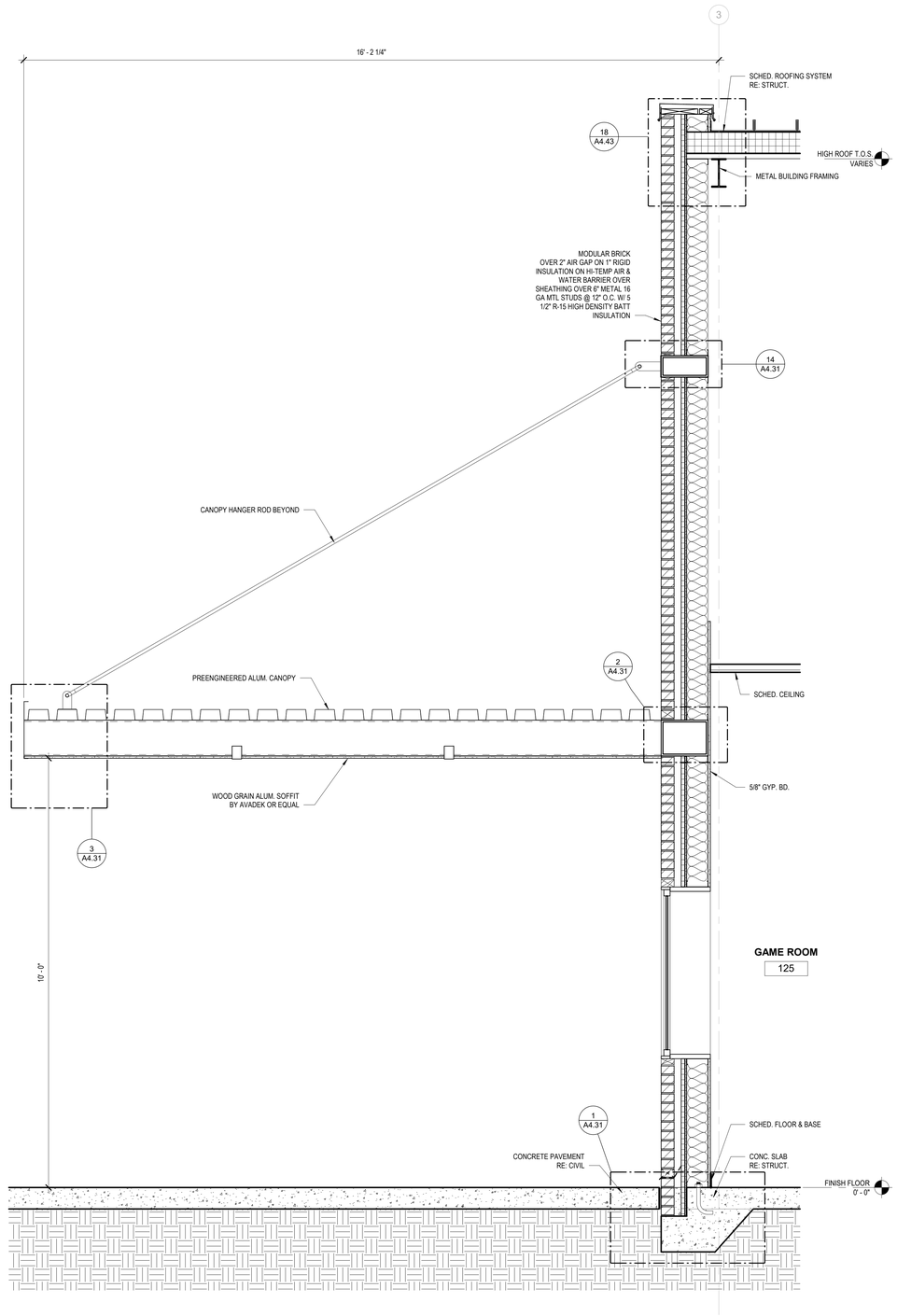
WALL SECTION | 3/4" = 1'-0" | 31



WALL SECTION | 3/4" = 1'-0" | 25



WALL SECTION | 3/4" = 1'-0" | 19



WALL SECTION | 3/4" = 1'-0" | 1

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SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE ASSOCIATES
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TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

WALL SECTIONS

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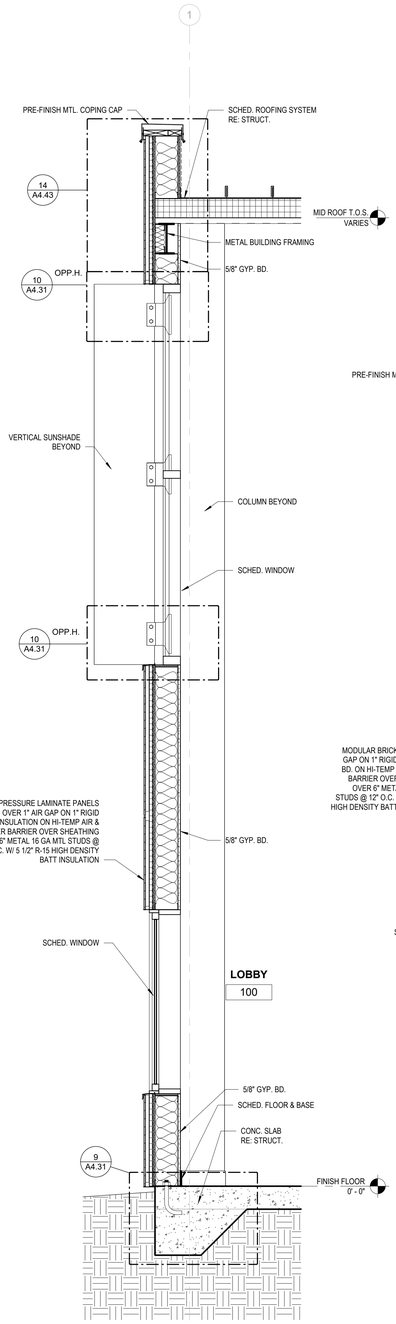
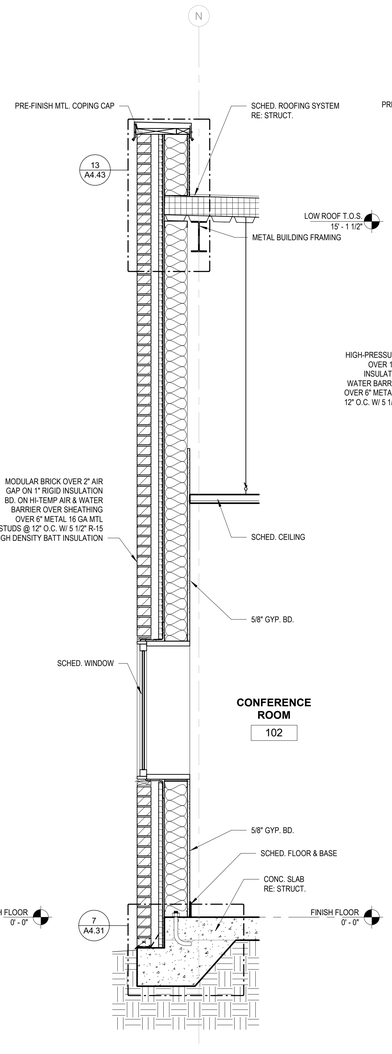
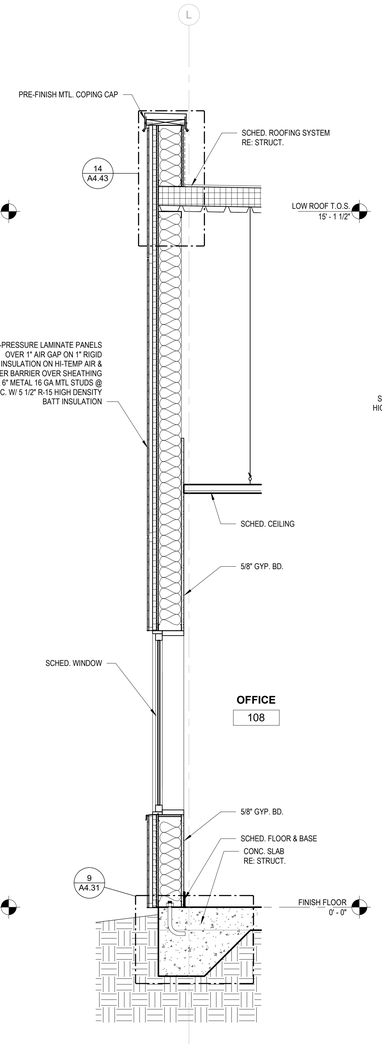


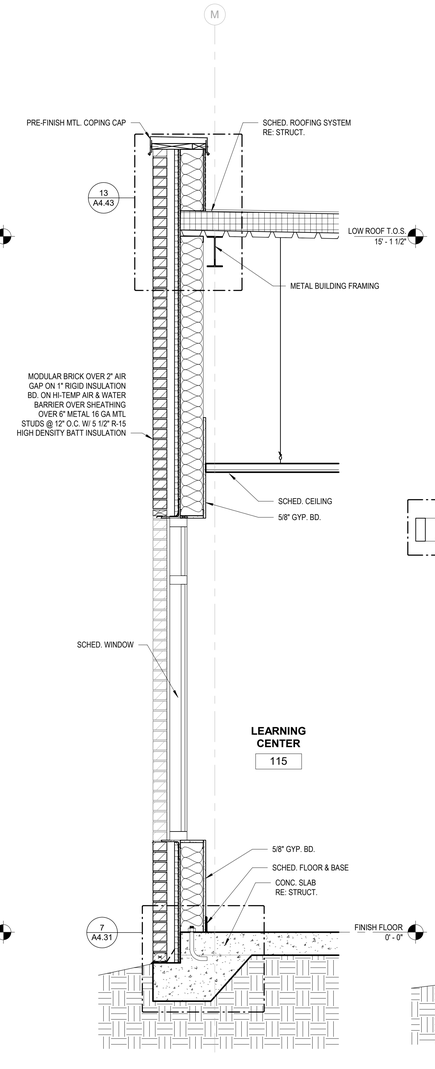
WALL SECTION | 3/4" = 1'-0" | 31



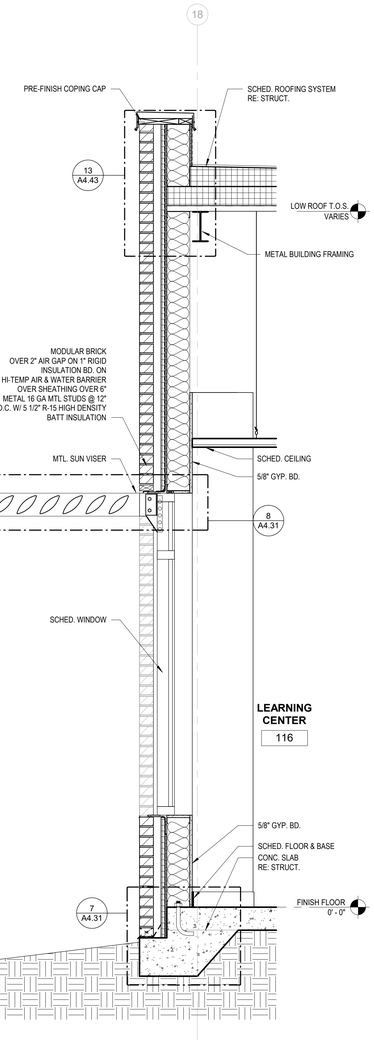
WALL SECTION | 3/4" = 1'-0" | 25



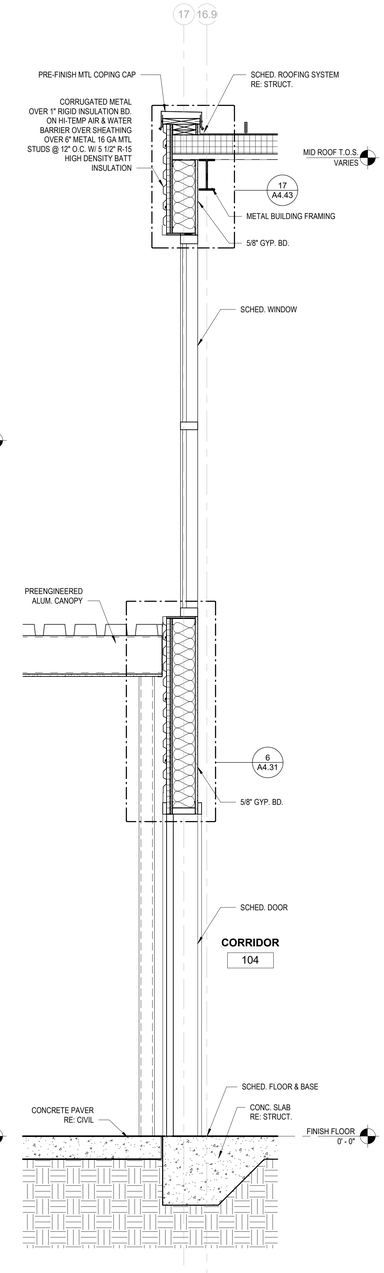
WALL SECTION | 3/4" = 1'-0" | 19



WALL SECTION | 3/4" = 1'-0" | 13



WALL SECTION | 3/4" = 1'-0" | 7



WALL SECTION | 3/4" = 1'-0" | 1

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WALL SECTIONS

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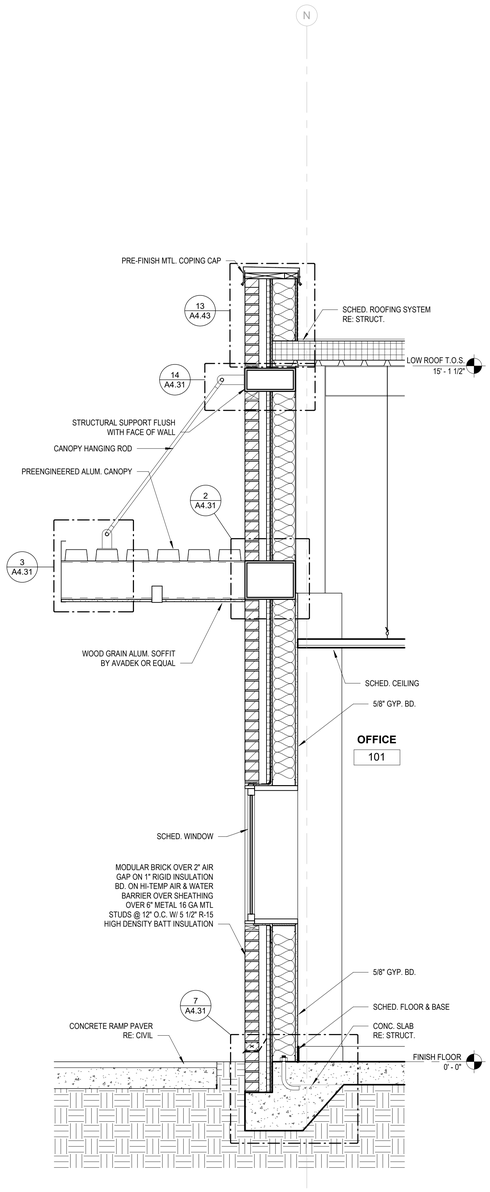
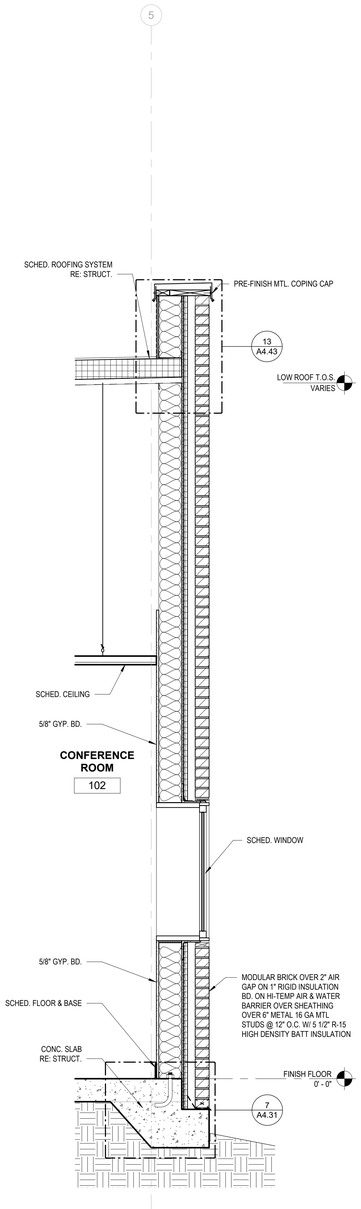
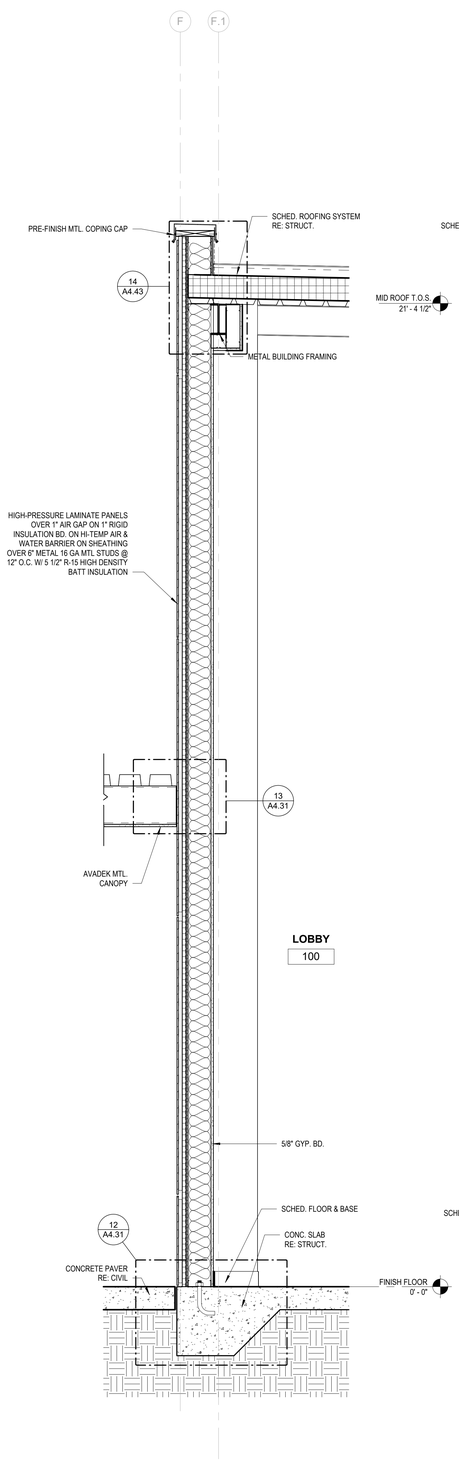


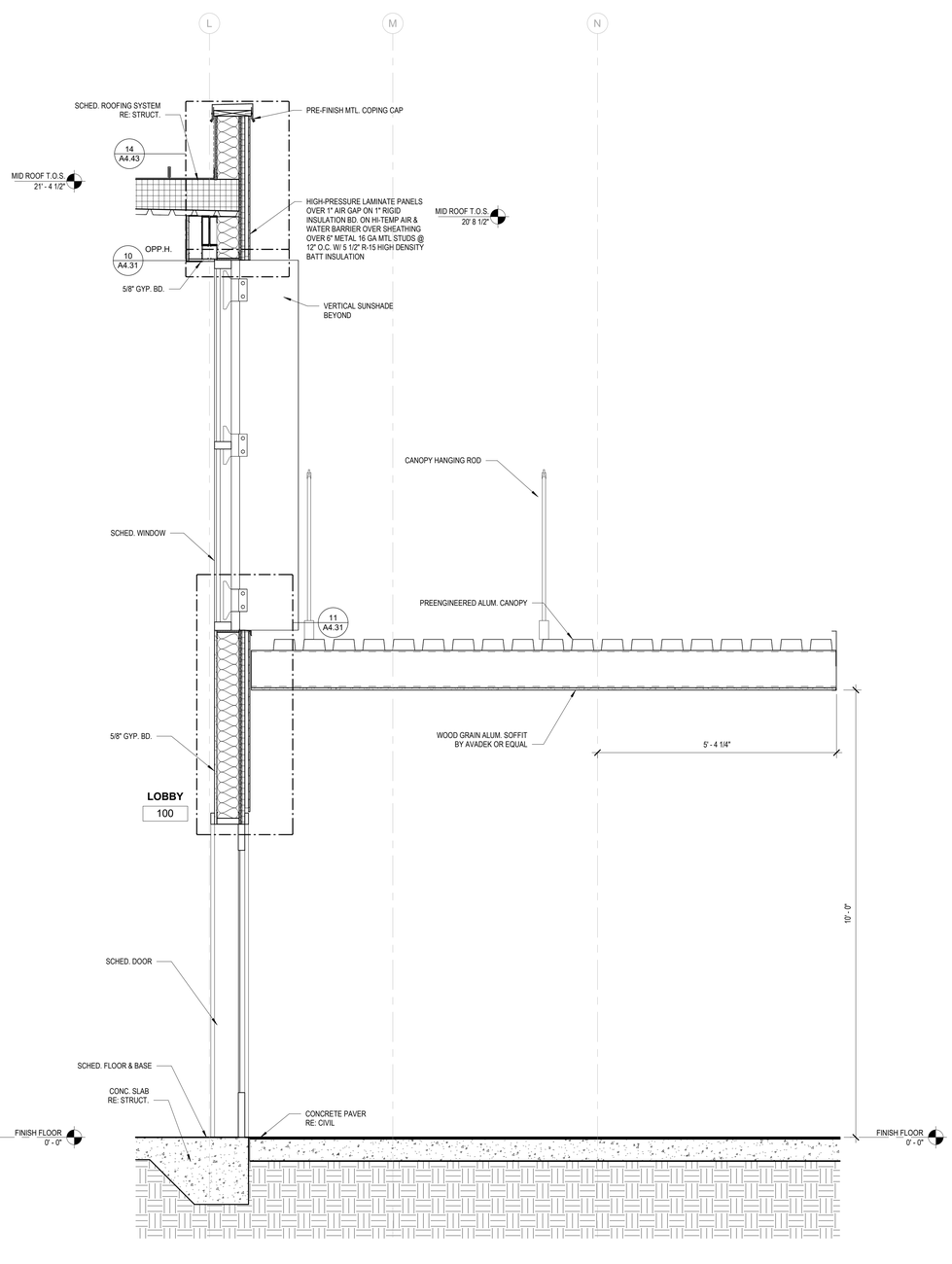
WALL SECTION | 3/4" = 1'-0" | 25



WALL SECTION | 3/4" = 1'-0" | 19



WALL SECTION | 3/4" = 1'-0" | 13



WALL SECTION | 3/4" = 1'-0" | 1

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WALL SECTIONS

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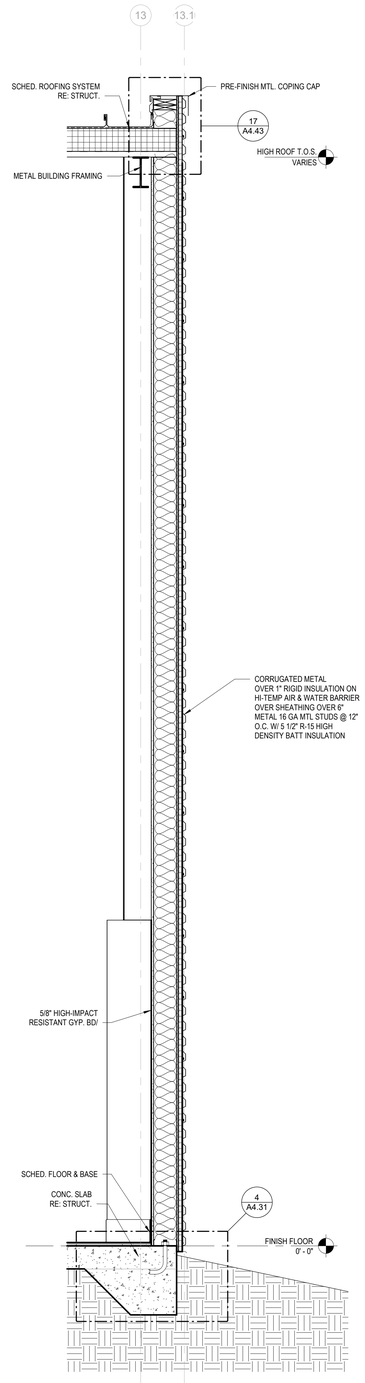
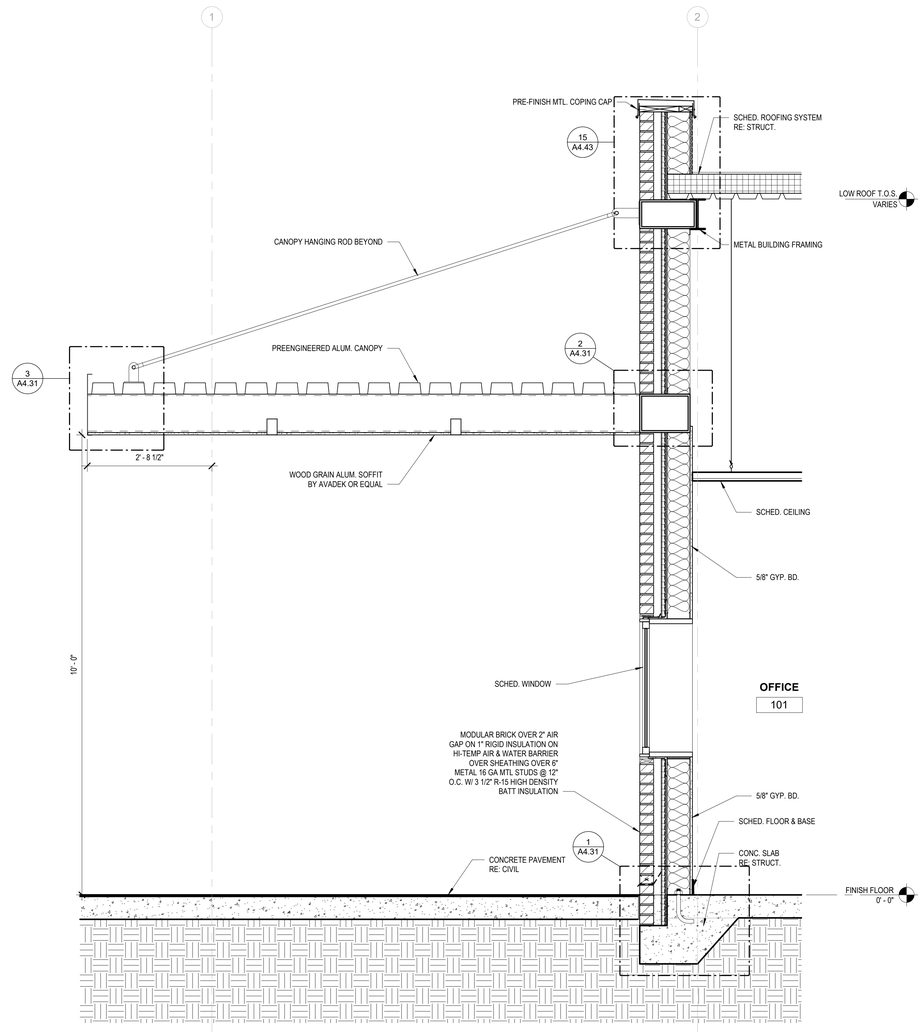
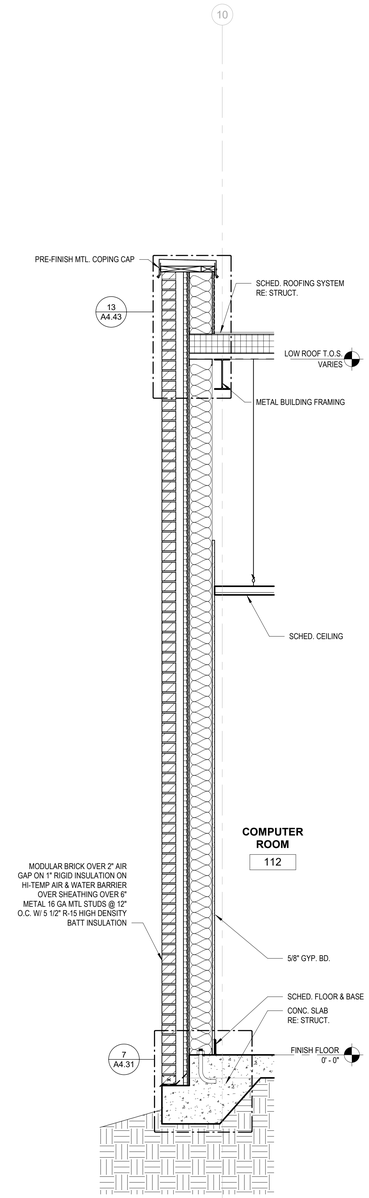


WALL SECTION | 3/4" = 1'-0" | 19



WALL SECTION | 3/4" = 1'-0" | 7



WALL SECTION | 3/4" = 1'-0" | 1

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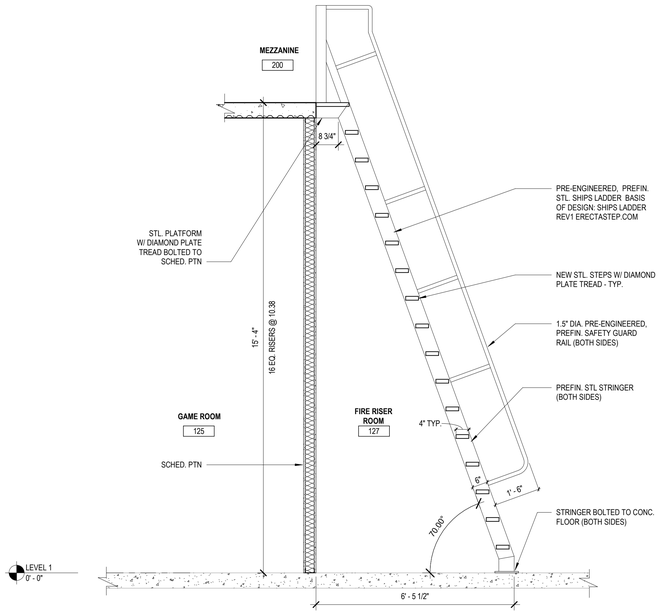
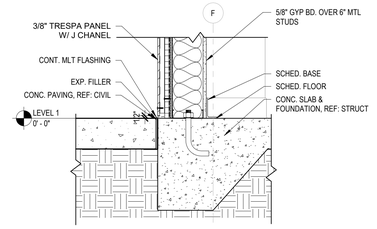
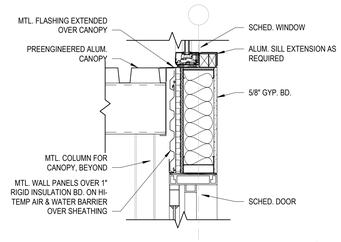


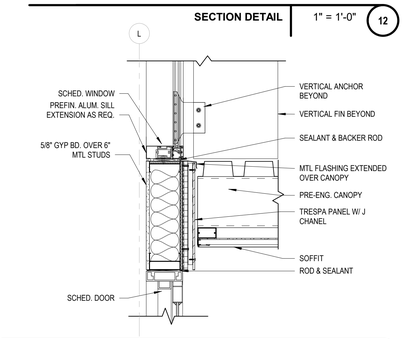
SHIPLADDER SECTION | 1/2" = 1'-0" | 15



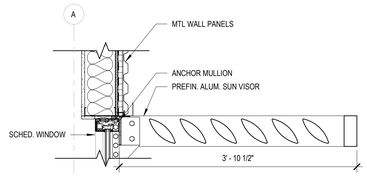
SECTION DETAIL | 1" = 1'-0" | 12



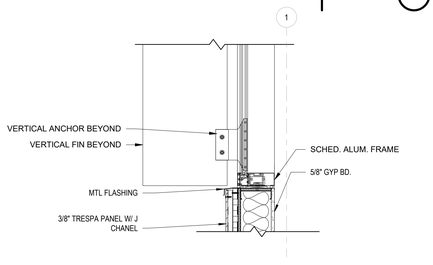
SECTION DETAIL | 1" = 1'-0" | 6



SECTION DETAIL | 1" = 1'-0" | 11



SECTION DETAIL | 1" = 1'-0" | 5



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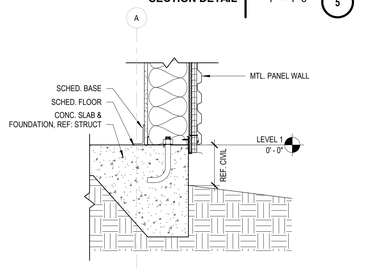
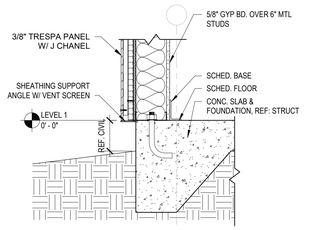
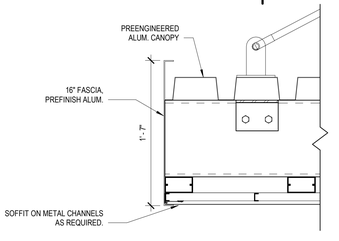


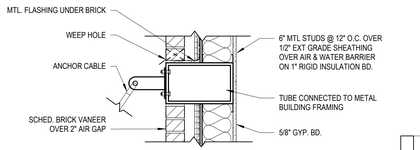
SECTION DETAIL | 1" = 1'-0" | 4



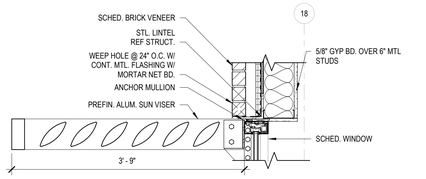
SECTION DETAIL | 1" = 1'-0" | 9



SECTION DETAIL | 1 1/2" = 1'-0" | 3



SECTION DETAIL | 1" = 1'-0" | 14



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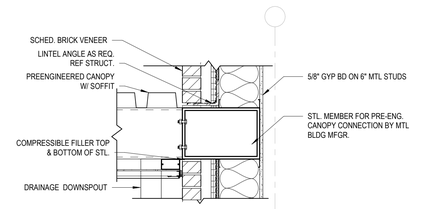
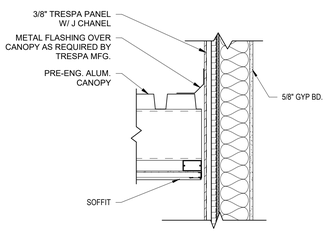
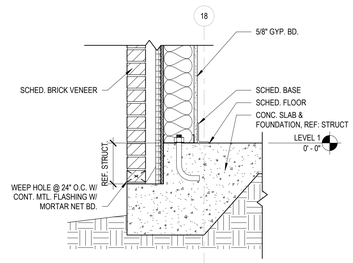


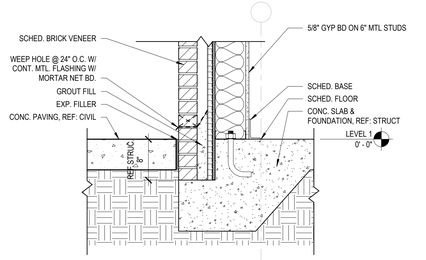
SECTION DETAIL | 1" = 1'-0" | 2



SECTION DETAIL | 1" = 1'-0" | 13



SECTION DETAIL | 1" = 1'-0" | 7



SECTION DETAIL | 1" = 1'-0" | 1

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1031 W SYCAMORE RD
FRESNO, TX 77545

SECTION DETAILS

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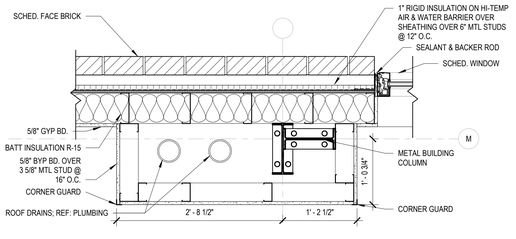
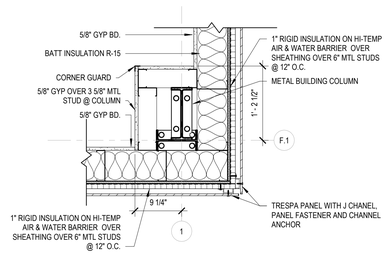


PLAN DETAIL | 1" = 1'-0" | 30



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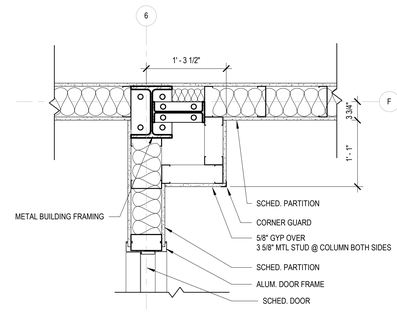

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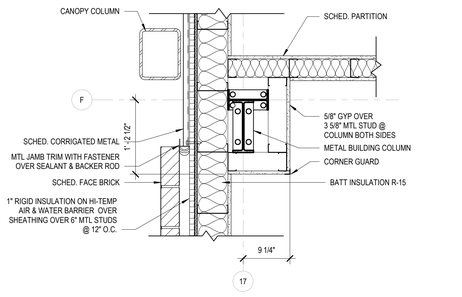
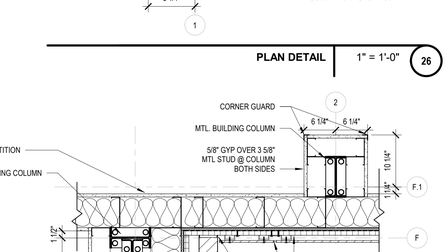
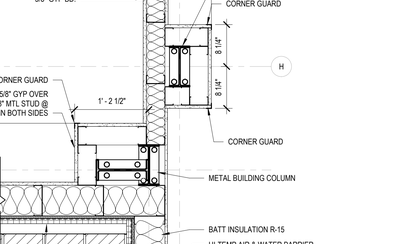


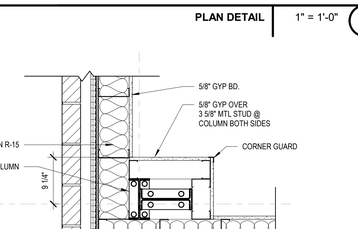
PLAN DETAIL | 1" = 1'-0" | 6



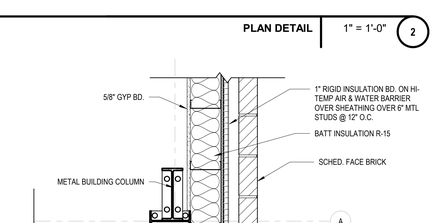
PLAN DETAIL | 1" = 1'-0" | 29



PLAN DETAIL | 1" = 1'-0" | 17



PLAN DETAIL | 1" = 1'-0" | 11



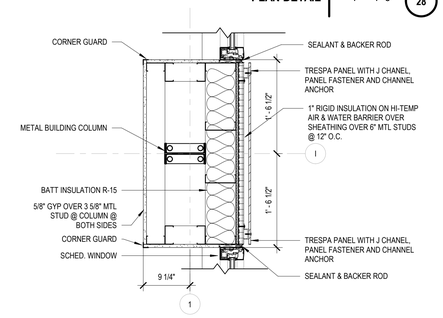
PLAN DETAIL | 1" = 1'-0" | 5

PLAN DETAIL | 1" = 1'-0" | 28

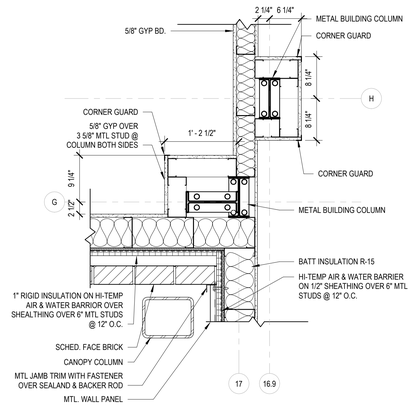
PLAN DETAIL | 1" = 1'-0" | 16

PLAN DETAIL | 1" = 1'-0" | 10

PLAN DETAIL | 1" = 1'-0" | 4

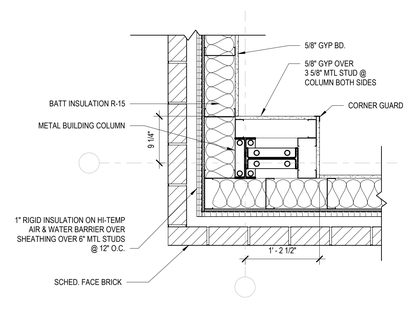


PLAN DETAIL | 1" = 1'-0" | 26



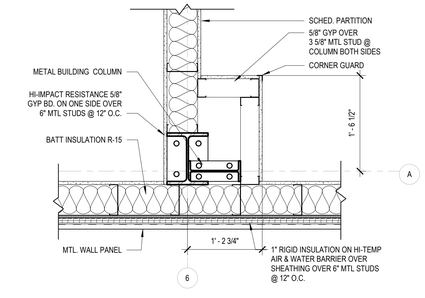
PLAN DETAIL | 1" = 1'-0" | 13

PLAN DETAIL | 1" = 1'-0" | 25



PLAN DETAIL | 1" = 1'-0" | 7

PLAN DETAIL | 1" = 1'-0" | 1



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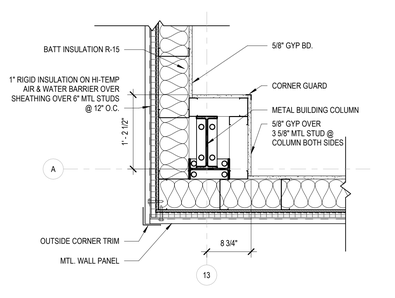

PLAN DETAIL | 1" = 1'-0" | 2

SMITH&COMPANY
ARCHITECTS

ARCHITECT
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STRUCTURAL ENGINEER
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HOUSTON, TX 77027

CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., #260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE ASSOCIATES
6117 RICHMOND AVE., SUITE 200
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

PLAN DETAILS

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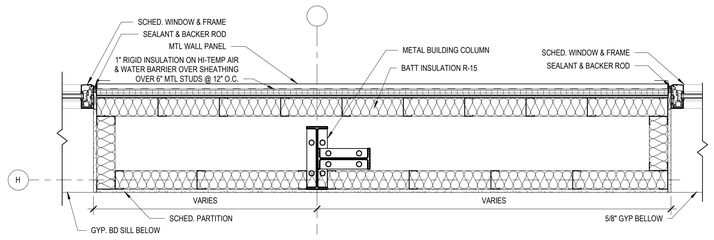
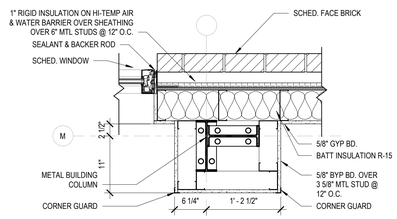
02.19.2024

A4.41



PLAN DETAIL | 1" = 1'-0" | 30



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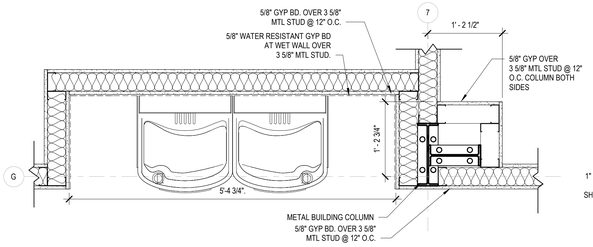

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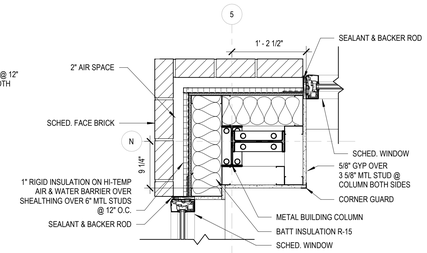

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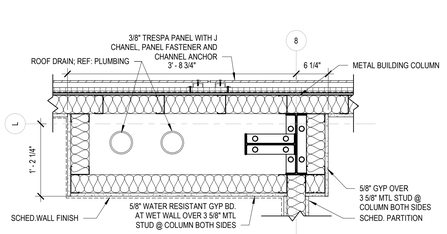

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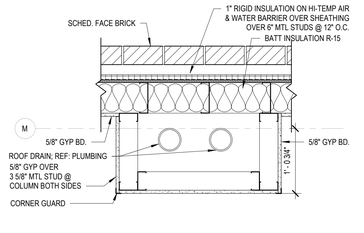

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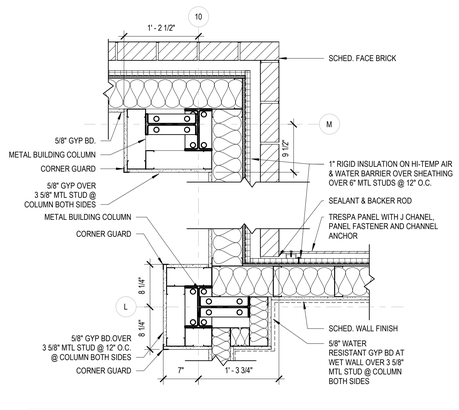

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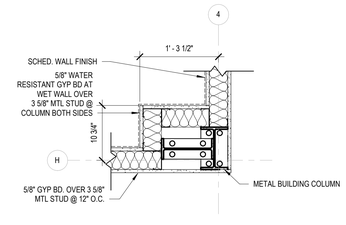

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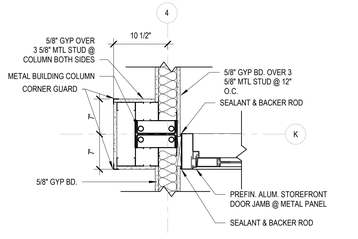

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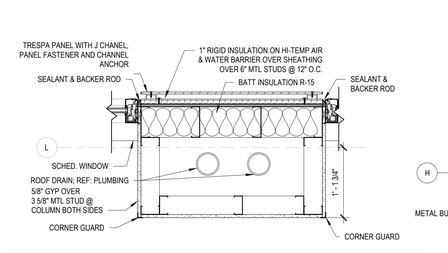

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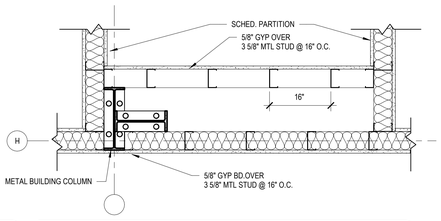

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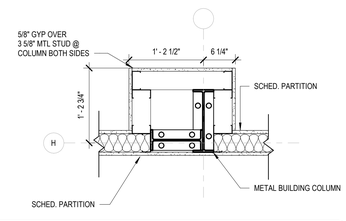

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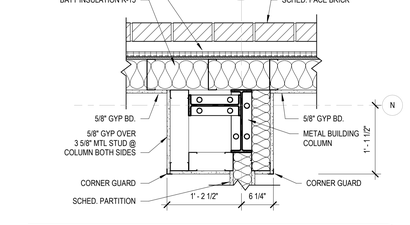
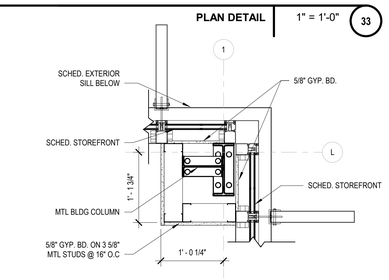


PLAN DETAIL | 1" = 1'-0" | 3



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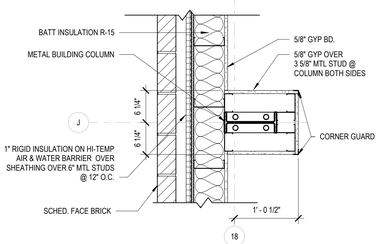

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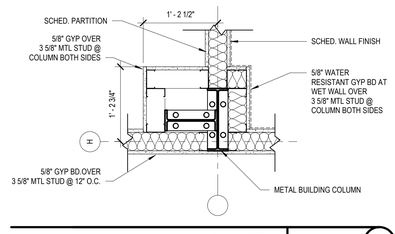

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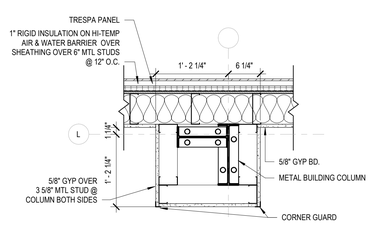
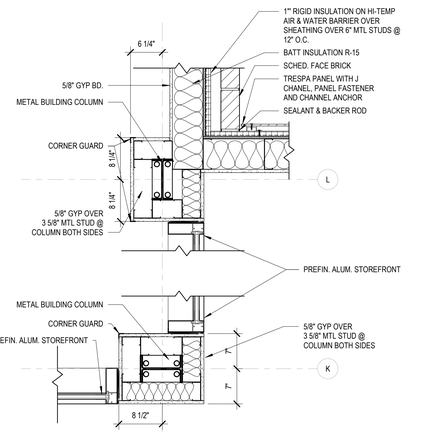


PLAN DETAIL | 1" = 1'-0" | 8



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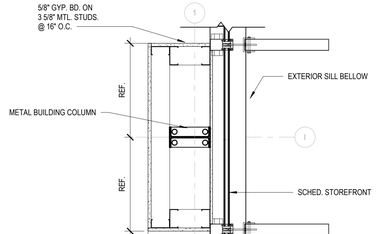

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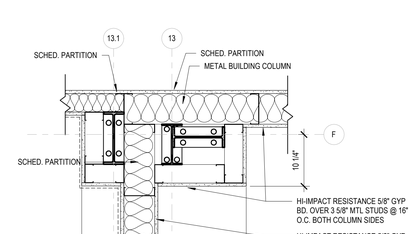
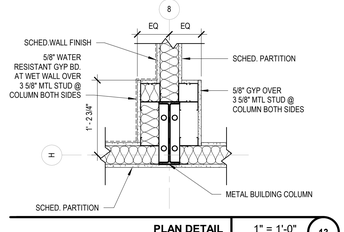
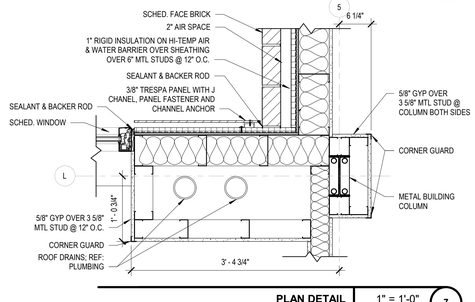


PLAN DETAIL | 1" = 1'-0" | 25



PLAN DETAIL | 1" = 1'-0" | 13



PLAN DETAIL | 1" = 1'-0" | 7

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SPRING, TX 77379

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INFRASTRUCTURE ASSOCIATES
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TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
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PROJECT #: N032023

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1031 W SYCAMORE RD
FRESNO, TX 77545

PLAN DETAILS

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02.19.2024

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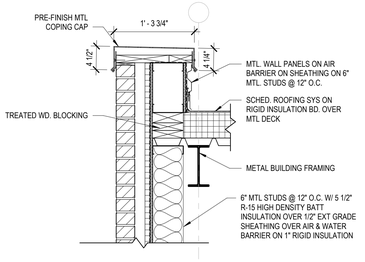
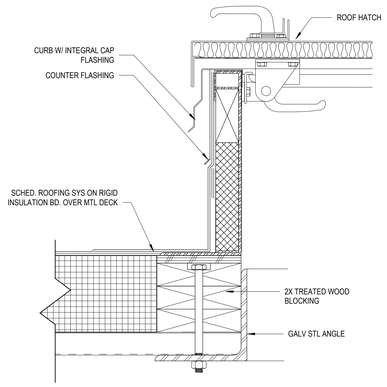
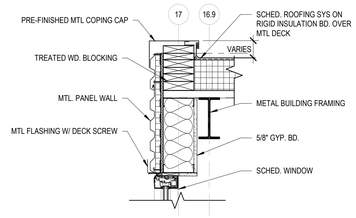


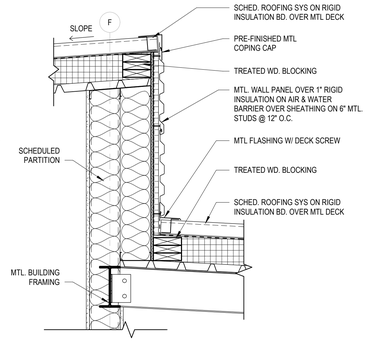
ROOF DETAIL 1" = 1'-0" **18**



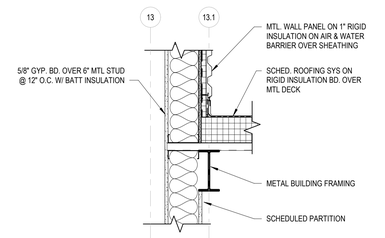
ROOF HATCH 3" = 1'-0" **23**



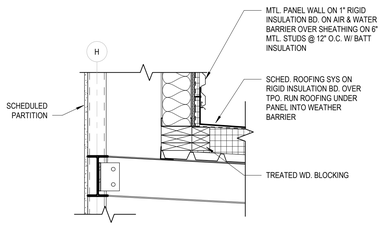
ROOF DETAIL 1" = 1'-0" **17**



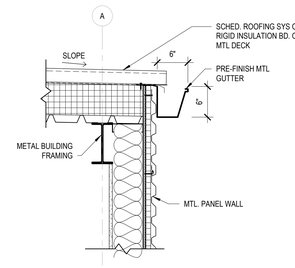
ROOF SECTION 1" = 1'-0" **11**



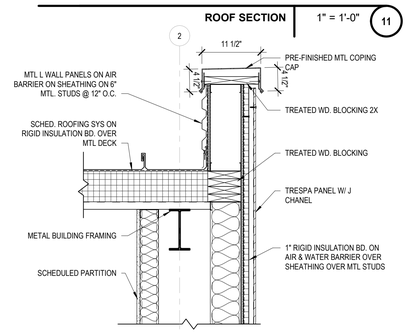
ROOF SECTION 1" = 1'-0" **5**



ROOF SECTION 1" = 1'-0" **22**



ROOF DETAIL 1" = 1'-0" **16**



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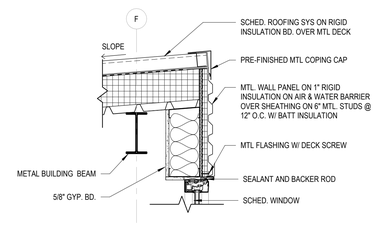

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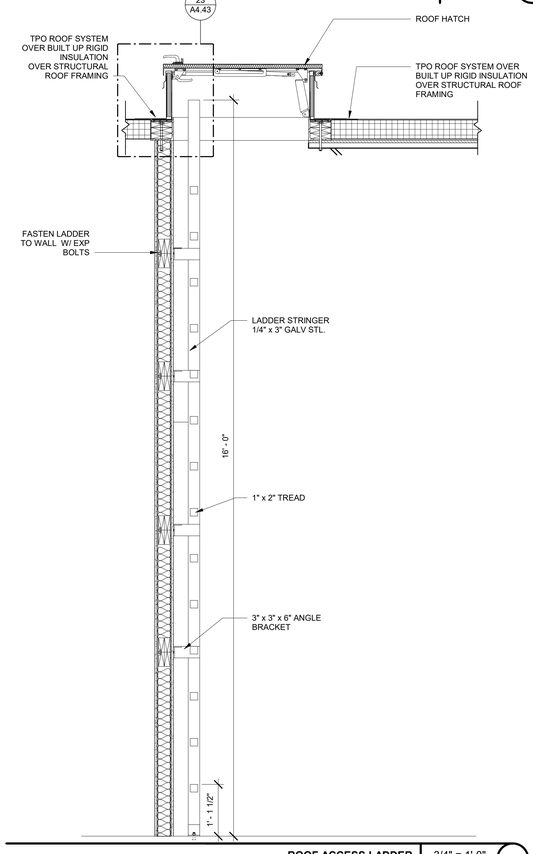
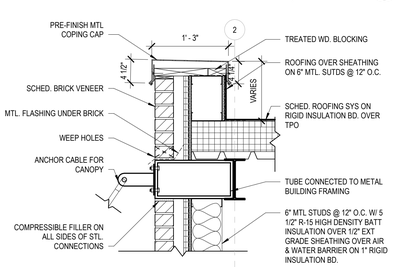
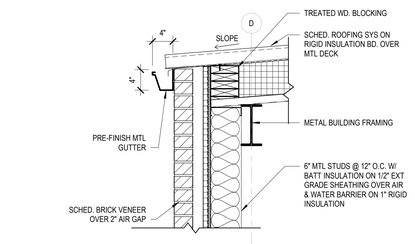


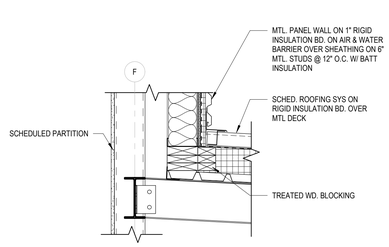
ROOF ACCESS LADDER 3/4" = 1'-0" **19**



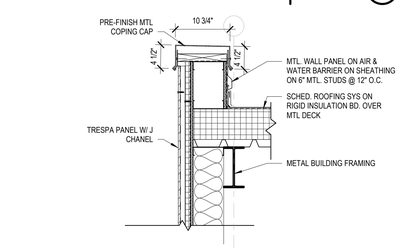
ROOF DETAIL 1" = 1'-0" **15**



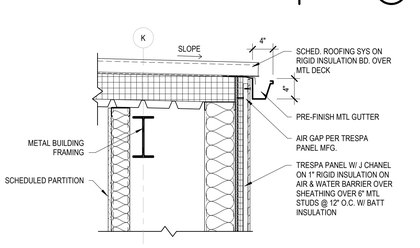
ROOF DETAIL 1" = 1'-0" **9**



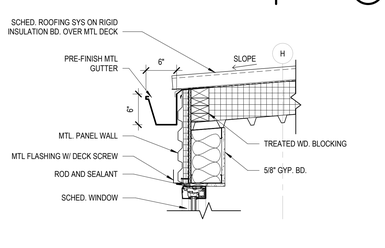
ROOF SECTION 1" = 1'-0" **3**



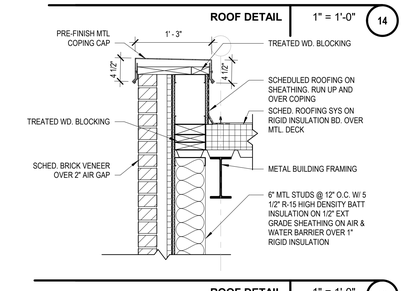
ROOF DETAIL 1" = 1'-0" **14**



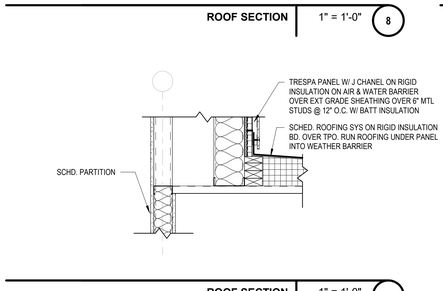
ROOF SECTION 1" = 1'-0" **8**



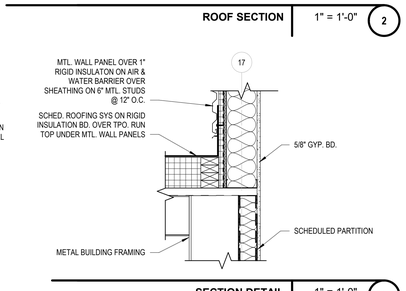
ROOF SECTION 1" = 1'-0" **2**



ROOF DETAIL 1" = 1'-0" **13**



ROOF SECTION 1" = 1'-0" **7**



SECTION DETAIL 1" = 1'-0" **1**

SMITH&COMPANY
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ARCHITECT
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ROOF DETAILS

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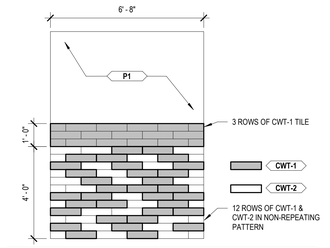
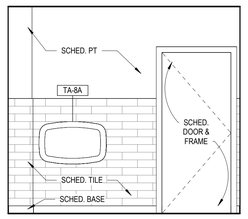
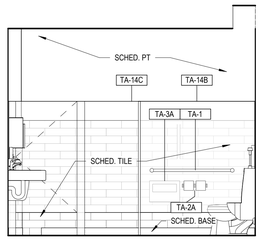


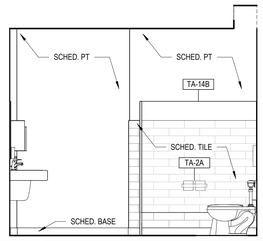
TYP. RESTROOM TILE PATTERN | 3/8" = 1'-0" | 30



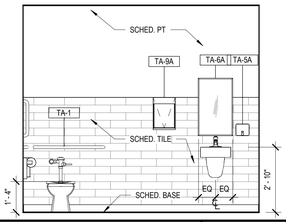
STAFF RR ELEV. C | 3/8" = 1'-0" | 24



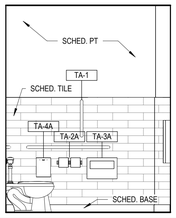
BOYS RESTROOM ELEV. B | 3/8" = 1'-0" | 18



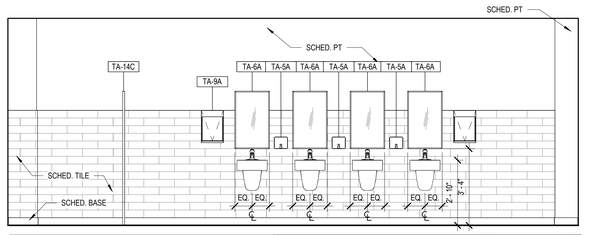
GIRLS RESTROOM ELEV. C | 3/8" = 1'-0" | 12



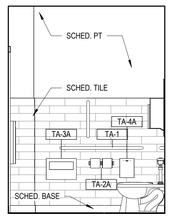
FAMILY RR ELEV. C | 3/8" = 1'-0" | 29



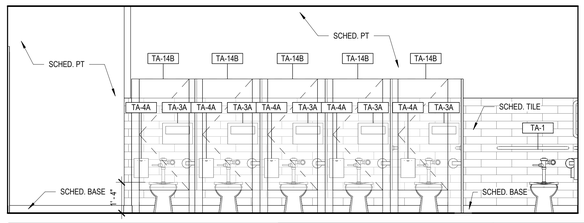
STAFF RR ELEV. B | 3/8" = 1'-0" | 23



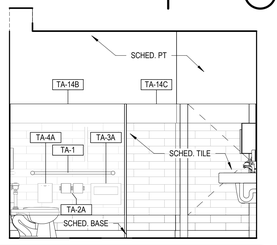
GIRLS RESTROOM ELEV. B | 3/8" = 1'-0" | 11



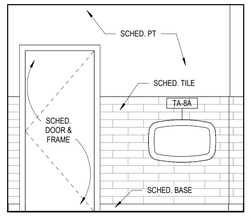
FAMILY RR ELEV. B | 3/8" = 1'-0" | 28



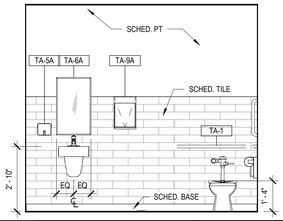
GIRLS RESTROOM ELEV. D | 3/8" = 1'-0" | 16



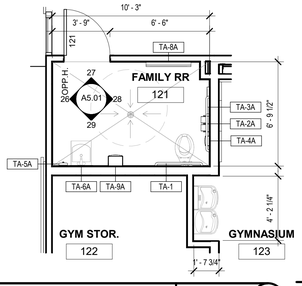
GIRLS RESTROOM ELEV. A | 3/8" = 1'-0" | 10



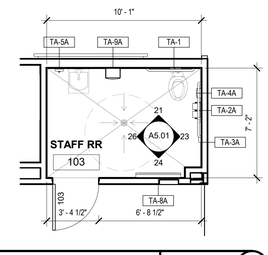
FAMILY RR ELEV. A | 3/8" = 1'-0" | 27



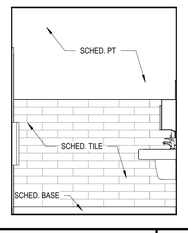
STAFF RR ELEV. A | 3/8" = 1'-0" | 21



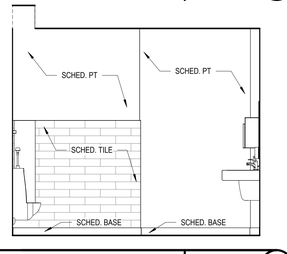
FAMILY RESTROOM PLAN | 1/4" = 1'-0" | 15



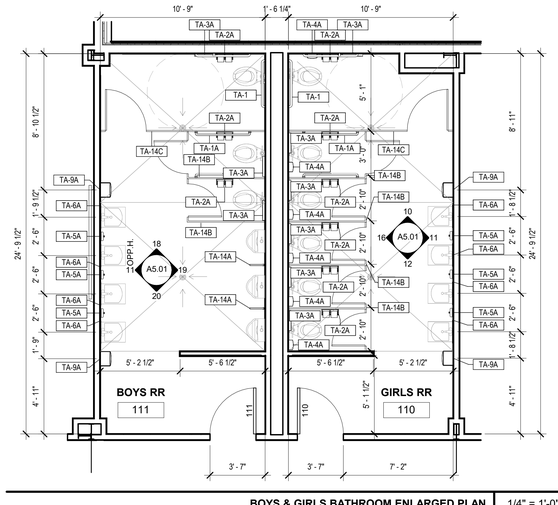
STAFF RESTROOM PLAN | 1/4" = 1'-0" | 9



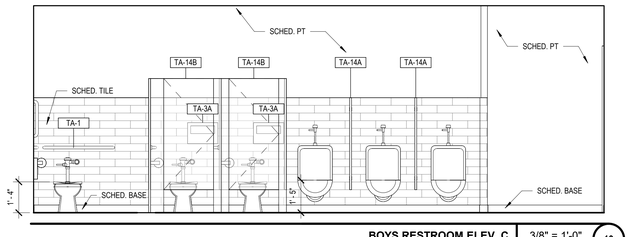
STAFF RR ELEV. D | 3/8" = 1'-0" | 26



BOYS RESTROOM ELEV. D | 3/8" = 1'-0" | 20



BOYS & GIRLS BATHROOM ENLARGED PLAN | 1/4" = 1'-0" | 7



BOYS RESTROOM ELEV. C | 3/8" = 1'-0" | 19

TOILET ACCESSORIES (TA)

KEY	DESCRIPTION	BASIS OF DESIGN	FINISH	QUANTITY	COMMENTS
TA-1	GRAB BARS 36" REAR, 42" SIDE, AND 18" VERTICAL	BOBRICK; B-5806 SERIES	SATIN STAINLESS	4	
TA-1A	42" SIDE GRAB BAR	BOBRICK; B-5806 SERIES	SATIN STAINLESS	4	
TA-2A	JUMBO ROLL TOILET PAPER DISPENSER, DOUBLE ROLL	CASCADES PRO; C380	GREY	11	O.F.C.I.
TA-3A	SURFACE MOUNTED SEAT COVER DISPENSER	BOBRICK; B-221	SATIN STAINLESS	11	
TA-4A	SURFACE MTD. SANITARY DISPOSAL	BOBRICK; B-270	SATIN STAINLESS	8	
TA-5A	SURFACE MOUNTED SOAP DISPENSER	NLL-043157, OCEAN MIST, 1000ML	BLACK	9	O.F.C.I.
TA-6A	FRAMED MIRROR	BOBRICK; B-165 SERIES	SATIN STAINLESS	10	
TA-8A	HORIZONTAL SURFACE MOUNTED BABY CHANGING STATION	KOALA KARE; KB200-00	SATIN STAINLESS	2	
TA-9A	MECHANICAL NO-TOUCH ROLL TOWEL DISPENSER	CASCADES PRO; C340	DARK GREY	7	O.F.C.I.
TA-11	UTILITY SHELF W/ MOP & BROOM HOLDER	BOBRICK; B-239	SATIN STAINLESS	1	
TA-14A	WALL MOUNTED URINAL SCREEN	BOBRICK; 1551	DANISH MAPLE	2	
TA-14B	TOILET PARTITIONS	BOBRICK; 1550	DANISH MAPLE	7	
TA-14C	ALCOVE HANDICAP TOILET PARTITION	BOBRICK; 1550	DANISH MAPLE	2	

TOILET ACCESSORIES | NO SCALE | 1

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TECHNOLOGY CONSULTANT
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WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

RESTROOMS – ENLARGED FLOOR PLANS & INTERIOR ELEVATIONS

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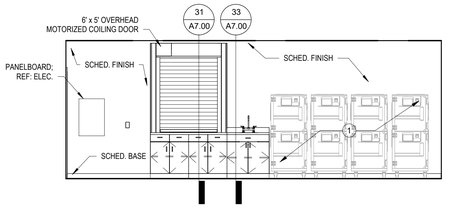
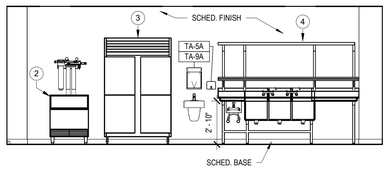
02.29.2024

A5.01



INT. ELEV. @ KITCHEN | 1/4" = 1'-0" | 12



INT. ELEV. @ KITCHEN | 1/4" = 1'-0" | 11

TOILET ACCESSORIES (TA)

KEY	DESCRIPTION	BASIS OF DESIGN	FINISH	QUANTITY	COMMENTS
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TA-1A	42" SIDE GRAB BAR	BOBRICK; B-5806 SERIES	SATIN STAINLESS	4	
TA-2A	JUMBO ROLL TOILET PAPER DISPENSER, DOUBLE ROLL	CASCADES PRO; C380	GREY	11	O.F.C.I.
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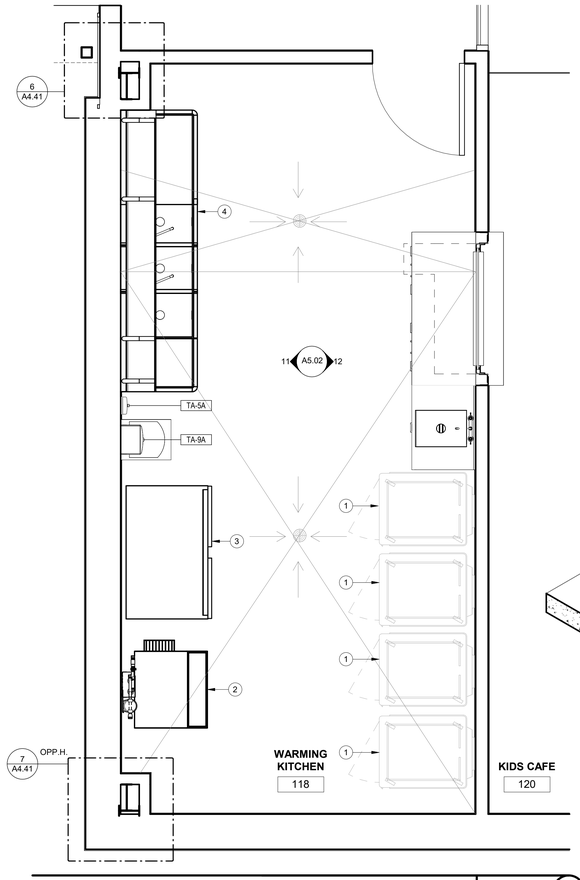
TA-14B	TOILET PARTITIONS	BOBRICK; 1550	DANISH MAPLE	7	
TA-14C	ALCOVE HANDICAP TOILET PARTITION	BOBRICK; 1550	DANISH MAPLE	2	

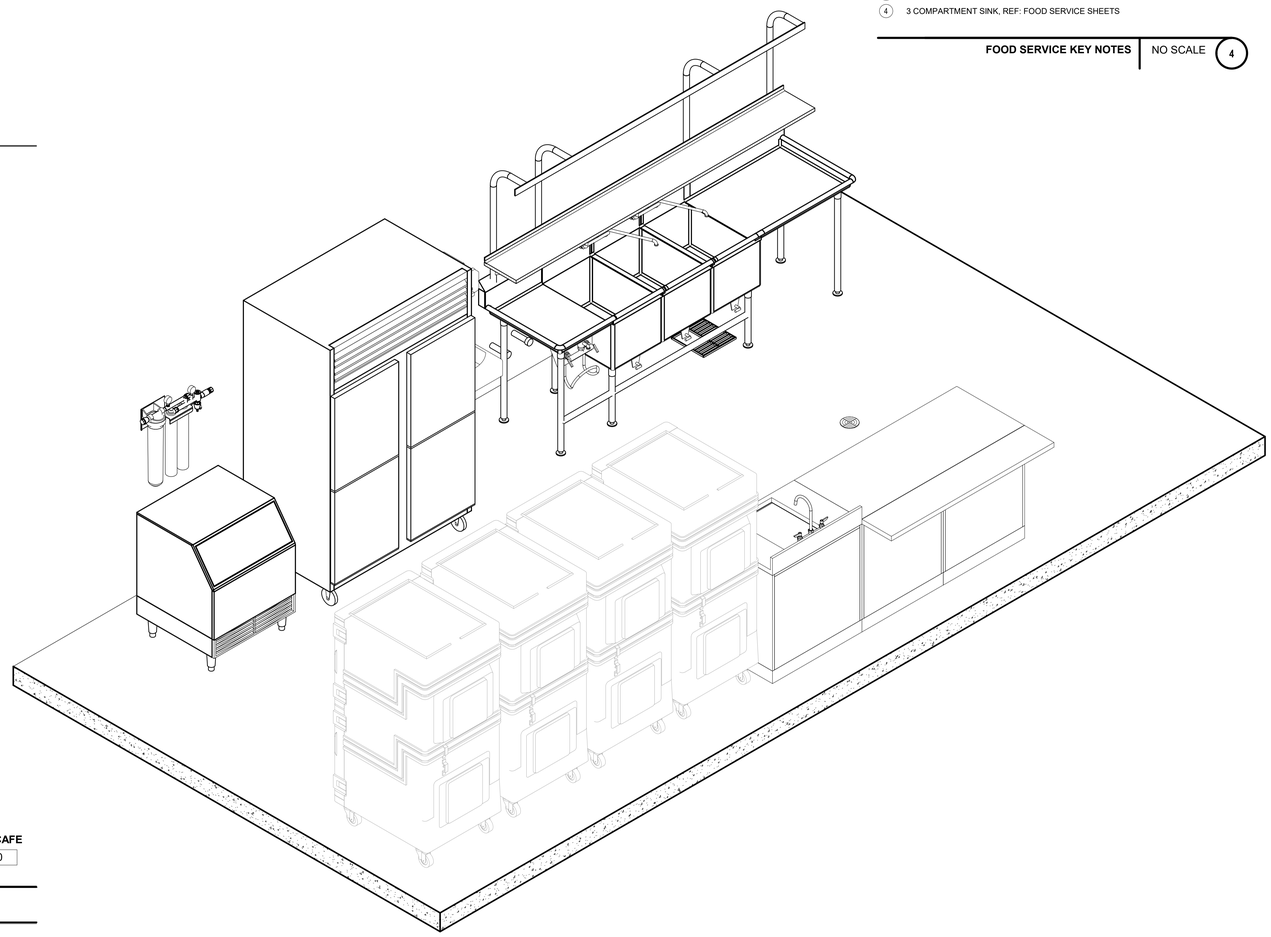
TOILET ACCESSORIES | NO SCALE | 5

1. NON-ELECTRIC FOOD HOLDING & TRANSPORT CABINETS; NOT IN SCOPE
2. ICE MAKER, REF: FOOD SERVICE SHEETS
3. DOUBLE REFRIGERATOR, REF: FOOD SERVICE SHEETS
4. 3 COMPARTMENT SINK, REF: FOOD SERVICE SHEETS

FOOD SERVICE KEY NOTES | NO SCALE | 4



FOOD SERVICE EQUIPMENT PLAN | 1/2" = 1'-0" | 19



FOOD SERVICE EQUIPMENT | 1

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CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., #260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE ASSOCIATES
6117 RICHMOND AVE., SUITE 200
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
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WACO, TX 76708

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FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

FOOD SERVICE ENLARGED PLAN

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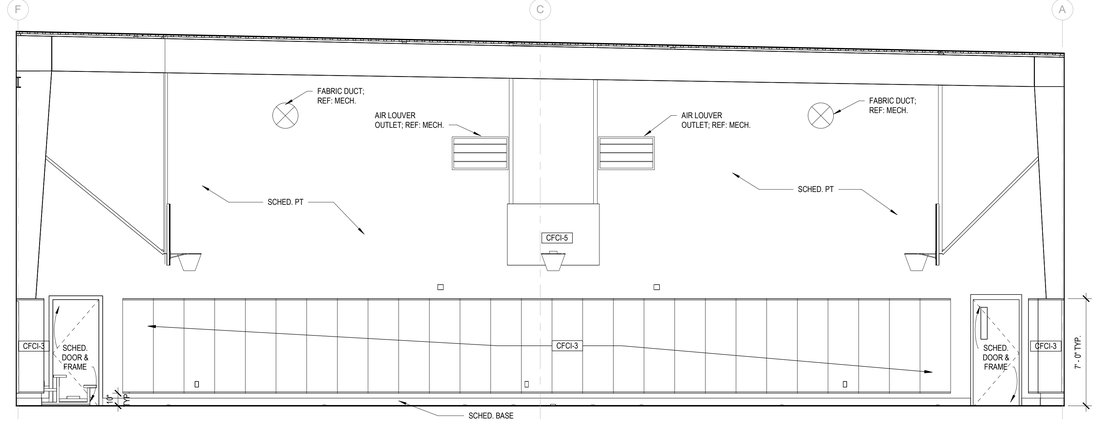
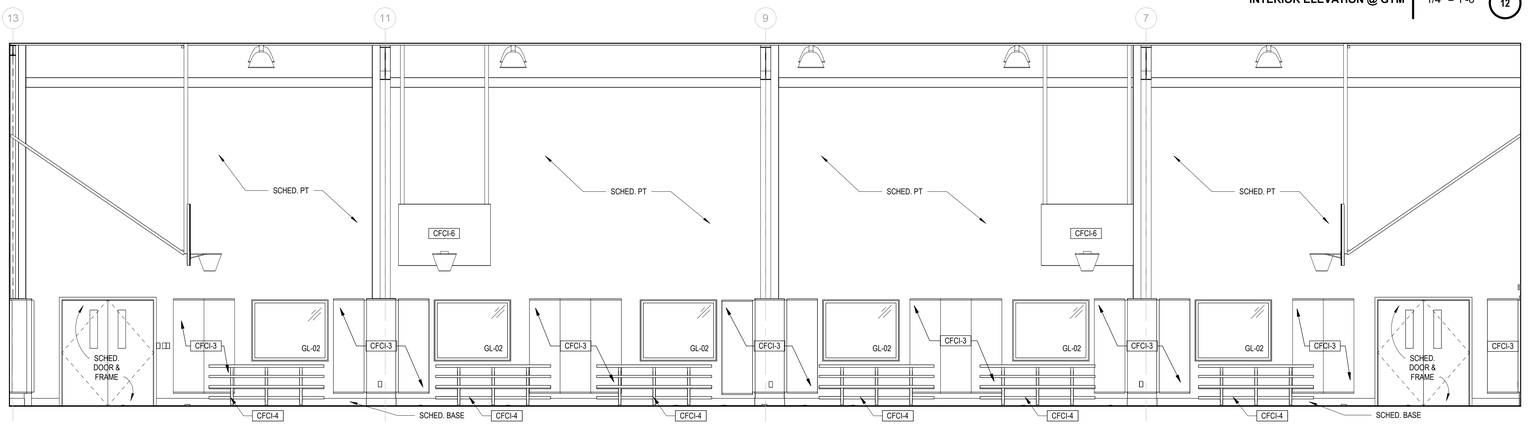
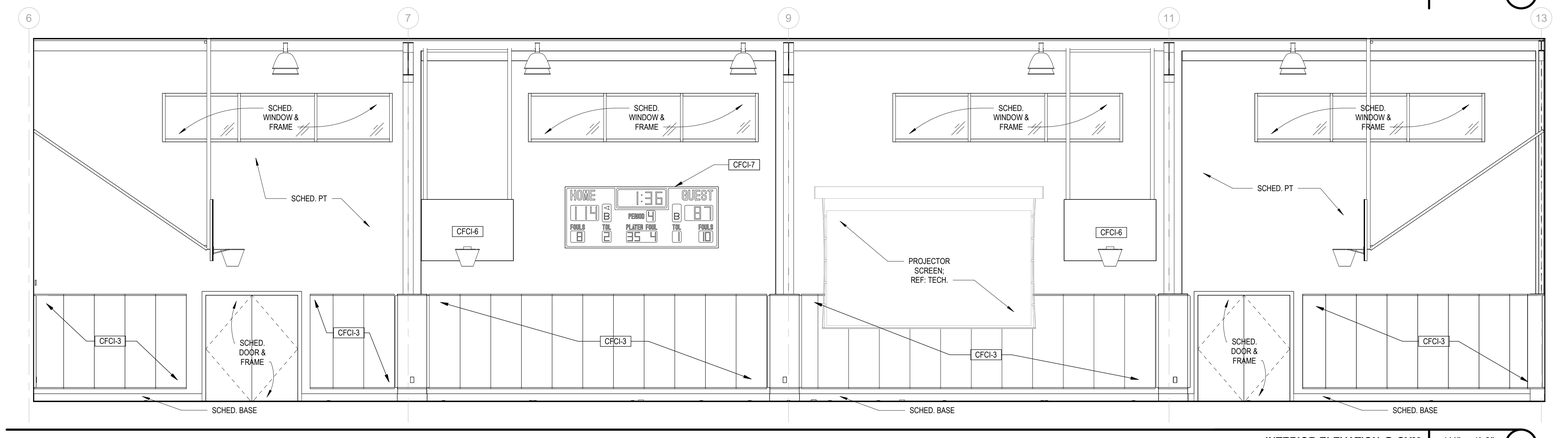


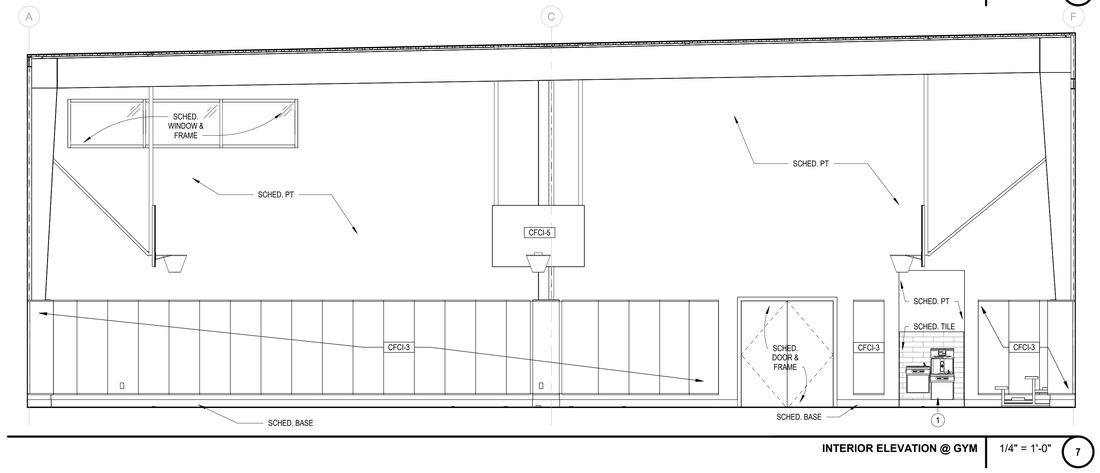
INTERIOR ELEVATION @ GYM | 1/4" = 1'-0" | 12



INTERIOR ELEVATION @ GYM | 1/4" = 1'-0" | 11



INTERIOR ELEVATION @ GYM | 1/4" = 1'-0" | 9



INTERIOR ELEVATION @ GYM | 1/4" = 1'-0" | 7

EQUIPMENT SCHEDULE

KEY	DESCRIPTION	BASIS OF DESIGN	MODEL #	QT.	INSTALATION NOTES
CFCI-1	TOP LOAD WASHER	WHIRLPOOL	CAE2795FG	1	
CFCI-2	DRYER	WHIRLPOOL	WED4950HW	1	
CFCI-3	WALL PAD	DRAPER	ECOVISION WALL PAD; DARK ROYAL BLUE	135	
CFCI-4	7'-6" TIP AND ROLL BLEACHERS	HUSSEYSEATING	MAXAM 1; 289 DARK BLUE/CLASSIC WOOD DECK	6	
CFCI-5	KEYED OPERABLE BASKETBALL GOAL	DRAPER	EZ FOLD TF-20S W/ 503285	2	
CFCI-6	HAND CRANKED OPERABLE BASKETBALL GOAL	DRAPER	EZ FOLD TF-20S W/ 503286	4	
CFCI-7	SCORE BOARD	SPECTRUM	5242T	1	PROVIDE WD. BLOCKING FOR MOUNTING
CFCI-8	VOLLEYBALL NET	DRAPER	SVS -500021	1	O.F.C.I.
CFCI-9	8' X 5' WHITEBOARD	CLARIDGE	ASP-58	1	
CFCI-10	WALL MOUNTED TV	SONY	FW-100BZ40J	11	O.F.C.I., PROVIDE WD. BLOCKING FOR MOUNTING

EQUIPMENT SCHEDULE | NO SCALE | 5

1. ELECTRIC DRINKING FOUNTAIN WITH BOTTLE FILLER, RE: PLUMBING AND SPECS
2. FIRE EXTINGUISHER & CABINET
3. NON-ELECTRIC FOOD HOLDING & TRANSPORT CABINETS; NOT IN SCOPE
4. AED DEFIBRILLATOR; PHILIPS HEARTSTART ONSITE AED, B.O.D.

INTERIOR ELEVATION KEY NOTES | NO SCALE | 2

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INFRASTRUCTURE ASSOCIATES
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TECHNOLOGY CONSULTANT
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3408 HILLCREST DR.
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FRESNO BOYS & GIRLS CLUB
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FRESNO, TX 77545

INTERIOR ELEVATIONS

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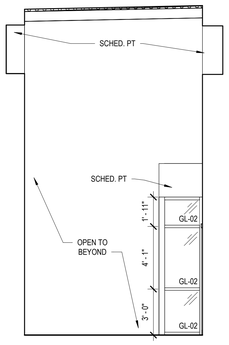
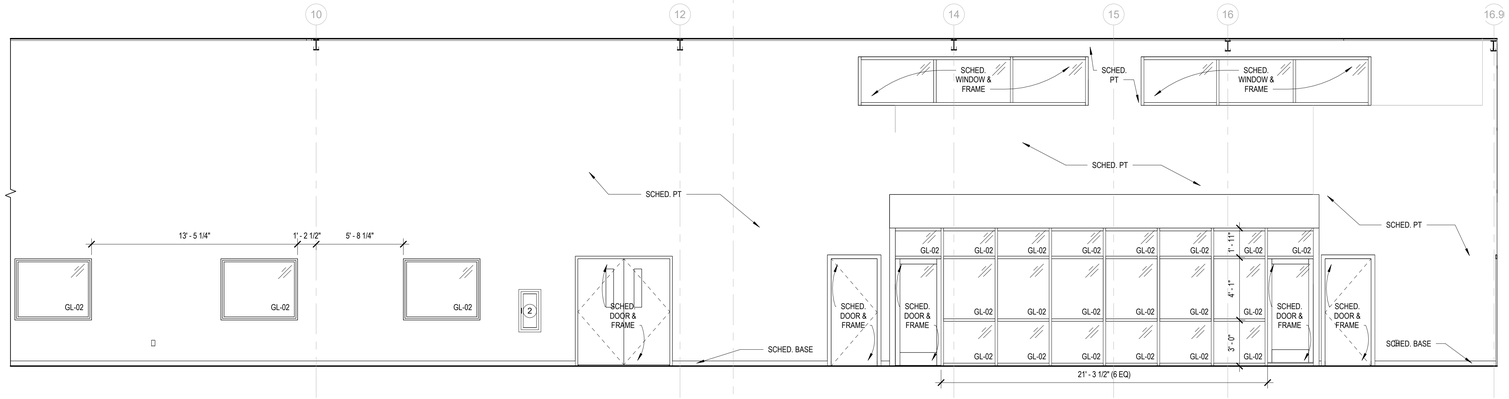
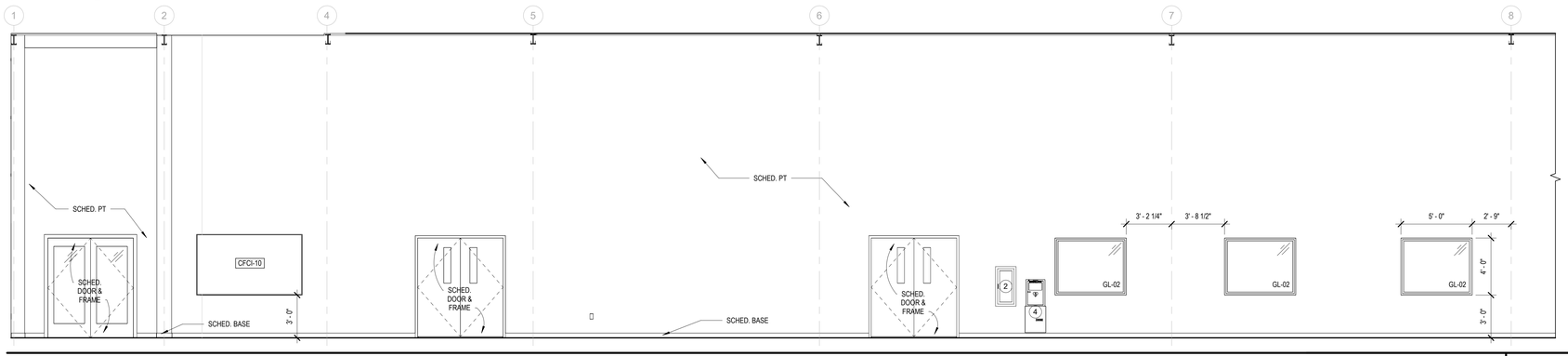


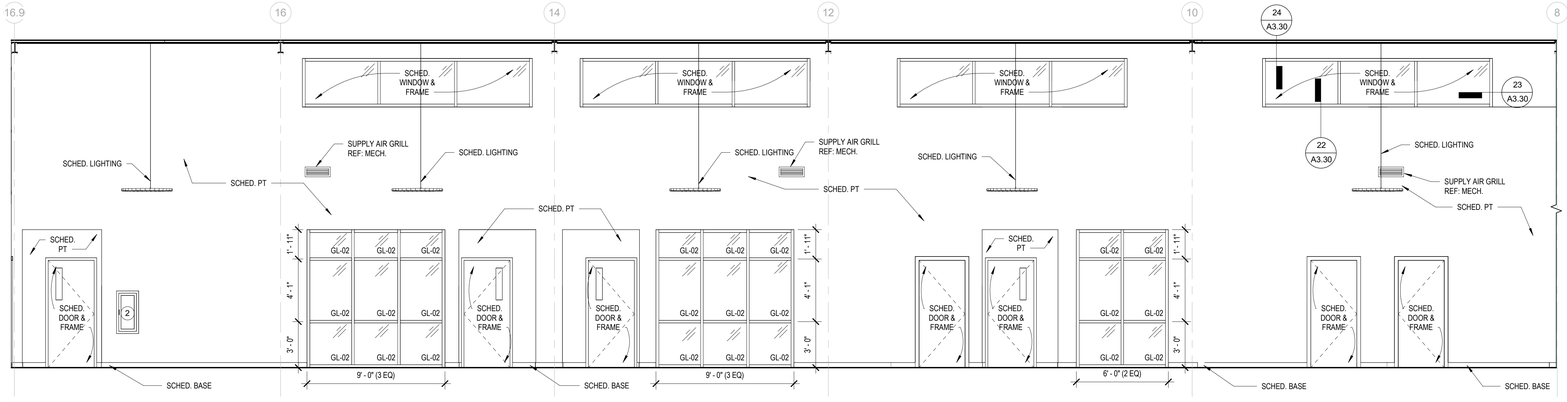
INTERIOR ELEV. @ KIDS CAFE | 1/4" = 1'-0" | 30



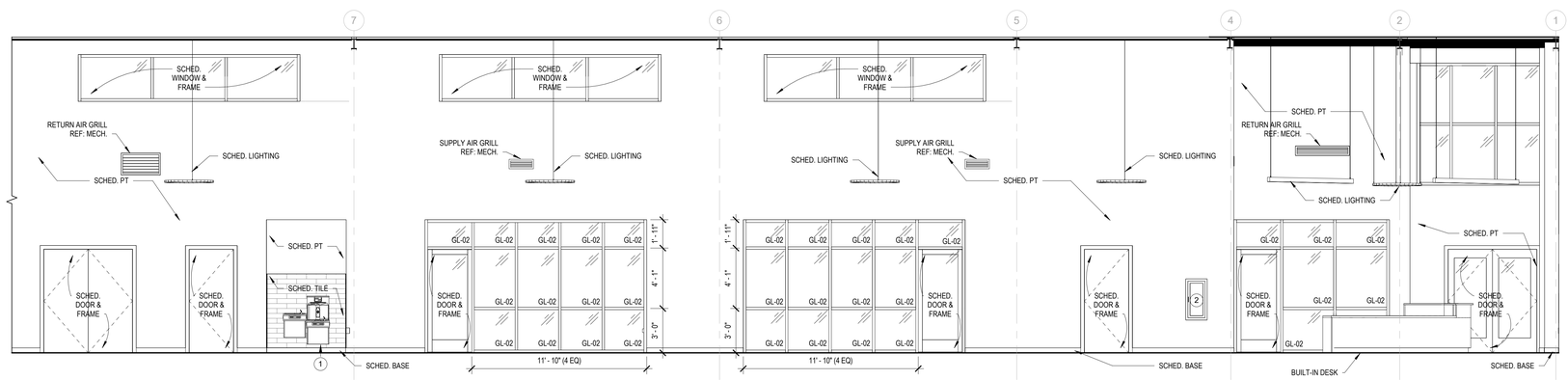
INTERIOR ELEV. @ CORRIDOR | 1/4" = 1'-0" | 6



INTERIOR ELEV. @ CORRIDOR | 1/4" = 1'-0" | 4



INTERIOR ELEV. @ CORRIDOR | 1/4" = 1'-0" | 9



INTERIOR ELEV. @ CORRIDOR | 1/4" = 1'-0" | 7

1. ELECTRIC DRINKING FOUNTAIN WITH BOTTLE FILLER, RE: PLUMBING AND SPECS
2. FIRE EXTINGUISHER & CABINET
3. NON-ELECTRIC FOOD HOLDING & TRANSPORT CABINETS; NOT IN SCOPE
4. AED DEFIBRILLATOR; PHILIPS HEARTSTART ONSITE AED, B.O.D.

INTERIOR ELEVATION KEY NOTES | NO SCALE | 2

1. REFER TO A3.10 FOR SCHEDULED MATERIALS & FINISHES
2. ALL SCHEDULED FLOOR FINISHES ARE TO BE INSTALLED BENEATH ALL SCHEDULED CASEWORK & EQUIPMENT, NO EXCEPTIONS.
3. FOR MOUNTING HEIGHTS AND DIMENSIONS REF: SHEET A0.11 & A0.12
4. REF: TO A3.20 FOR DOOR SCHEDULE & DOOR TYPES
5. REF: TO A3.30 FOR WINDOW TYPES

INTERIOR ELEVATION GENERAL NOTES | NO SCALE | 1

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FRESNO, TX 77545

INTERIOR ELEVATIONS

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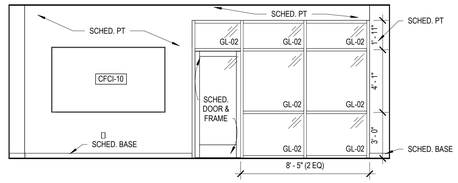
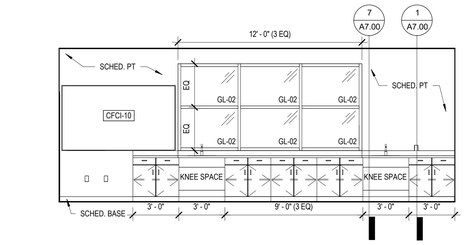
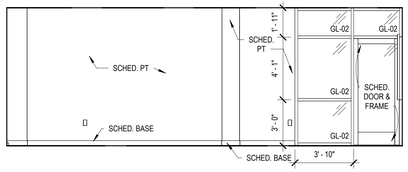
A5.13



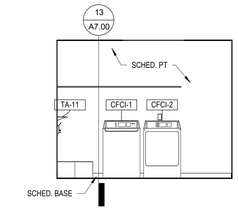
INT. ELEV. @ TEEN ROOM | 1/4" = 1'-0" | 12



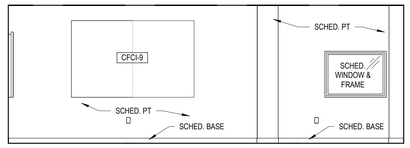
INT. ELEV. @ ARTS & CRAFTS | 1/4" = 1'-0" | 17



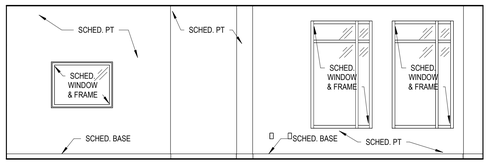
INT. ELEV. @ CONFERENCE ROOM | 1/4" = 1'-0" | 11



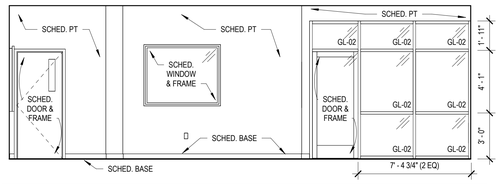
INT. ELEV. @ LAUNDRY | 1/4" = 1'-0" | 16



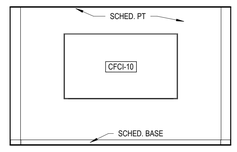
INT. ELEV. @ CONFERENCE ROOM | 1/4" = 1'-0" | 10



INT. ELEV. @ LEARNING CENTER | 1/4" = 1'-0" | 27



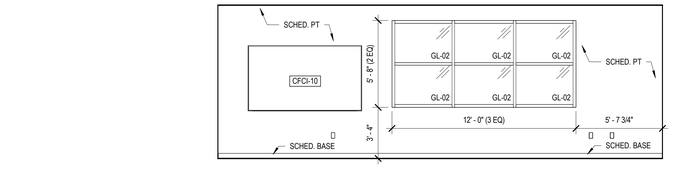
INT. ELEV. @ LEARNING CENTER | 1/4" = 1'-0" | 15



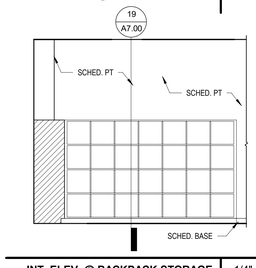
INT. ELEV. @ CONFERENCE ROOM | 1/4" = 1'-0" | 9

EQUIPMENT SCHEDULE					
KEY	DESCRIPTION	BASIS OF DESIGN	MODEL #	QT.	INSTALATION NOTES
CFCI-1	TOP LOAD WASHER	WHIRLPOOL	CAE2795FG	1	
CFCI-2	DRYER	WHIRLPOOL	WED4950HW	1	
CFCI-3	WALL PAD	DRAPER	ECOVISION WALL PAD, DARK ROYAL BLUE	135	
CFCI-4	7' -6" TIP AND ROLL BLEACHERS	HUSSEYSEATING	MAXAM 1; 289 DARK BLUE/CLASSIC WOOD DECK	6	
CFCI-5	KEYED OPERABLE BASKETBALL GOAL	DRAPER	EZ FOLD TF-20S W/ 503285	2	
CFCI-6	HAND CRANKED OPERABLE BASKETBALL GOAL	DRAPER	EZ FOLD TF-20S W/ 503286	4	
CFCI-7	SCORE BOARD	SPECTRUM	5242T	1	PROVIDE WD. BLOCKING FOR MOUNTING
CFCI-8	VOLLEYBALL NET	DRAPER	SVS -500021	1	O.F.C.I.
CFCI-9	8' X 5' WHITEBOARD	CLARIDGE	ASP-58	1	
CFCI-10	WALL MOUNTED TV	SONY	FW-100BZ40J	11	O.F.C.I., PROVIDE WD. BLOCKING FOR MOUNTING

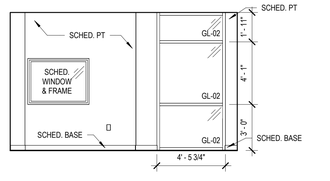
EQUIPMENT SCHEDULE | NO SCALE | 3



INT. ELEV. @ LEARNING CENTER | 1/4" = 1'-0" | 20



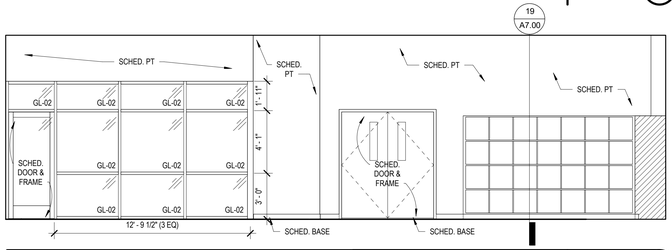
INT. ELEV. @ BACKPACK STORAGE | 1/4" = 1'-0" | 14



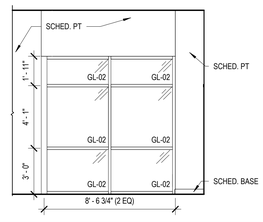
INT. ELEV. @ OFFICE | 1/4" = 1'-0" | 8

1. ELECTRIC DRINKING FOUNTAIN WITH BOTTLE FILLER, RE: PLUMBING AND SPECS
2. FIRE EXTINGUISHER & CABINET
3. NON-ELECTRIC FOOD HOLDING & TRANSPORT CABINETS; NOT IN SCOPE
4. AED DEFIBRILLATOR; PHILIPS HEARTSTART ONSITE AED, B.O.D.

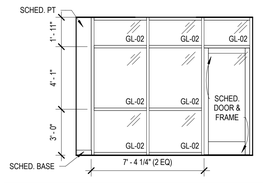
INTERIOR ELEVATION KEY NOTES | NO SCALE | 2



INT. ELEV. @ GRAME ROOM & BACKPACK STORAGE | 1/4" = 1'-0" | 19



INT. ELEV. @ GAME ROOM | 1/4" = 1'-0" | 13



INT. ELEV. @ OFFICE | 1/4" = 1'-0" | 7

1. REFER TO A3.10 FOR SCHEDULED MATERIALS & FINISHES
2. ALL SCHEDULED FLOOR FINISHES ARE TO BE INSTALLED BENEATH ALL SCHEDULED CASEWORK & EQUIPMENT, NO EXCEPTIONS.
3. FOR MOUNTING HEIGHTS AND DIMENSIONS REF: SHEET A0.11 & A0.12
4. REF: TO A3.20 FOR DOOR SCHEDULE & DOOR TYPES
5. REF: TO A3.30 FOR WINDOW TYPES

INTERIOR ELEVATION GENERAL NOTES | NO SCALE | 1

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PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

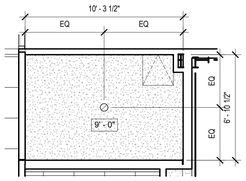
NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

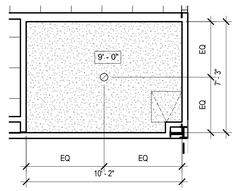
INTERIOR ELEVATIONS

100% Construction Document
02.29.2024

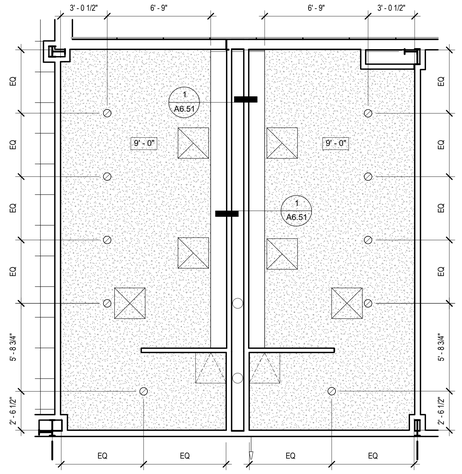
A5.14



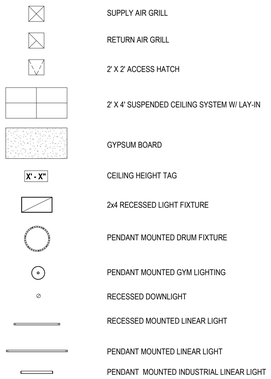
RCP FAMILY RESTROOM | 1/4" = 1'-0" | 36



RCP STAFF RESTROOM PLAN | 1/4" = 1'-0" | 30



RCP BOYS & GIRLS RESTROOM PLAN | 1/4" = 1'-0" | 24



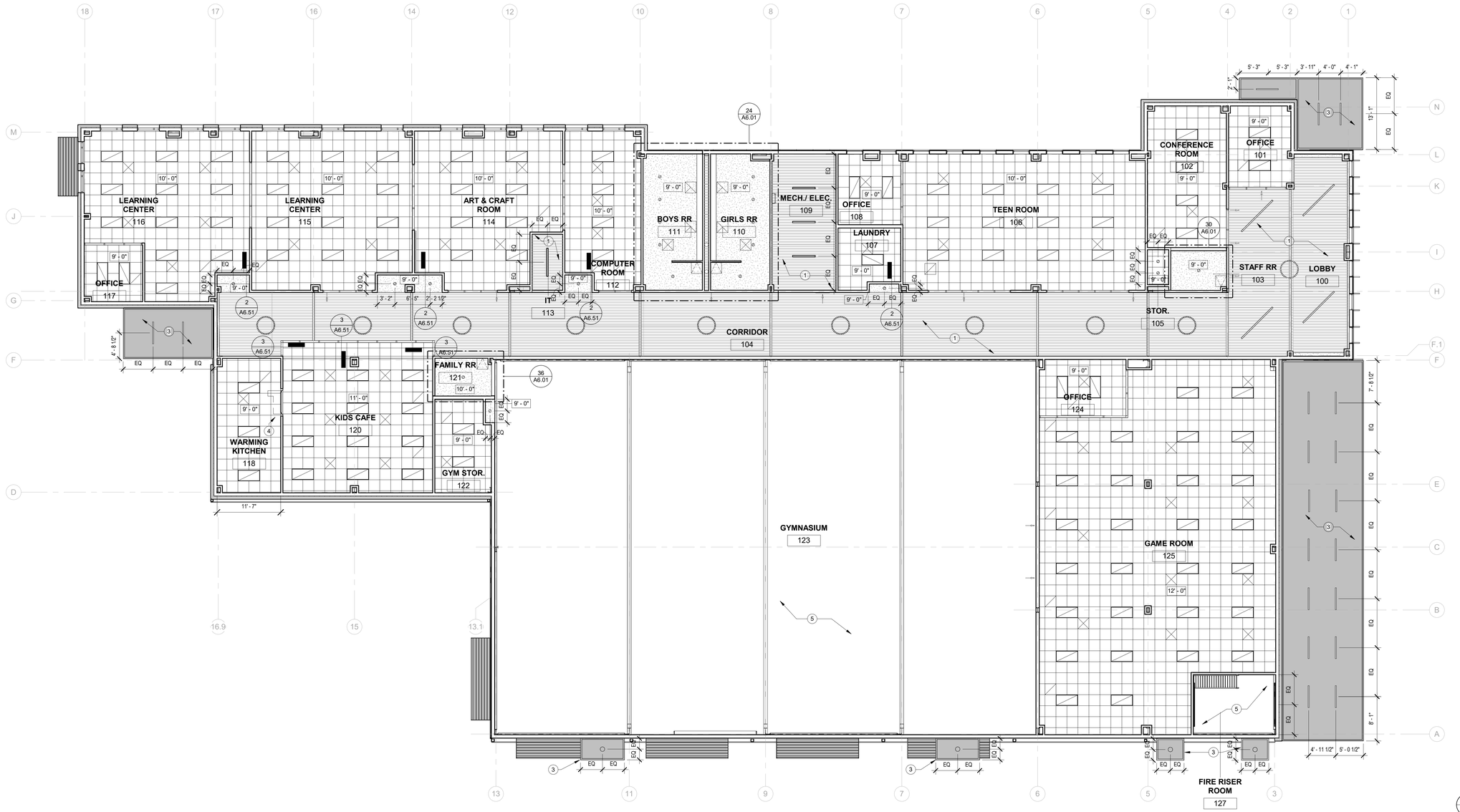
RCP LEGEND | NO SCALE | 17

1. NO CEILING, OPEN TO STRUCTURE
2. LED LIGHT FIXTURE RECESSED IN SOFFIT, RE: ELEC.
3. CANOPY ABOVE
4. OVERHEAD ROLLING DOOR
5. OPEN TO ABOVE, REF. TO SHEET A6.02

RCP KEY NOTES | NO SCALE | 12

1. NOTIFY THE ARCHITECT OF ANY DIFFERENCE BETWEEN ARCHITECTURAL REFLECTED CEILING PLANS AND MECHANICAL, ELECTRICAL OR SPECIAL SYSTEMS PLANS PRIOR TO COMMENCING WITH CONSTRUCTION.
2. ALL SCHEDULED CEILINGS AT 10' - 0" A.F.F., UNLESS NOTED OTHERWISE.
3. REFER TO MATERIALS SCHEDULE ON A3.11 FOR ALL CEILING FINISHES AND MATERIALS.
4. ALL PAINTED GYPSUM WALL BOARD (GWB) CEILINGS, ARE TO BE PAINTED (P1), UNLESS NOTED OTHERWISE.
5. REFER TO ELECTRICAL DRAWINGS FOR SCHEDULED LIGHT FIXTURES, DEVICES AND EQUIPMENT.
6. ALIGN & CENTER ALL SCHEDULED LIGHT FIXTURES & DIFFUSERS, UNLESS DIMENSIONED OR NOTED OTHERWISE ON RCP.
7. ALIGN CENTER ALL SCHEDULED CEILING MOUNTED SPEAKERS, SMOKE DETECTORS, CAMERAS, AND OCCUPANCY SENSORS, WHERE OCCURS, U.N.O.
8. ALL CEILING MOUNTED ACCESS DOORS, PANELS TO BE PAINTED (P1), U.N.O.

RCP GENERAL NOTES | NO SCALE | 6



REFLECTED CEILING PLAN | 1/8" = 1'-0" | 1

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REFLECTED CEILING PLAN

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02.29.2024

A6.01

SUPPLY AIR GRILL

RETURN AIR GRILL

2' X 2' ACCESS HATCH

2' X 4' SUSPENDED CEILING SYSTEM W/ LAY-IN

GYPSUM BOARD

X' - X" CEILING HEIGHT TAG

2x4 RECESSED LIGHT FIXTURE

PENDANT MOUNTED DRUM FIXTURE

PENDANT MOUNTED GYM LIGHTING

RECESSED DOWNLIGHT

RECESSED MOUNTED LINEAR LIGHT

PENDANT MOUNTED LINEAR LIGHT

PENDANT MOUNTED INDUSTRIAL LINEAR LIGHT

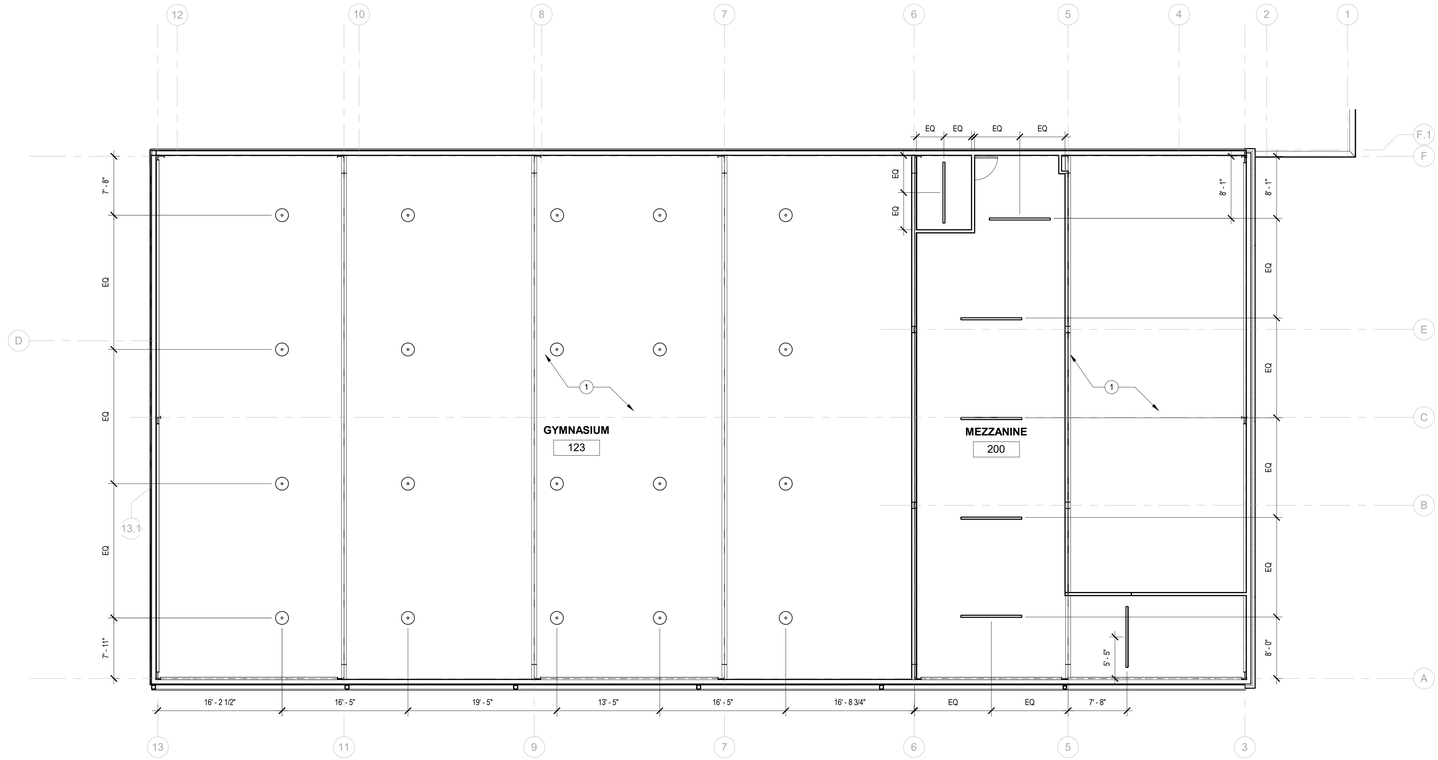
RCP LEGEND | NO SCALE | 17

1. NO CEILING, OPEN TO STRUCTURE
2. LED LIGHT FIXTURE RECESSED IN SOFFIT, RE: ELEC.
3. CANOPY ABOVE
4. OVERHEAD ROLLING DOOR
5. OPEN TO ABOVE, REF. TO SHEET A6.02

RCP KEY NOTES | NO SCALE | 12

1. NOTIFY THE ARCHITECT OF ANY DIFFERENCE BETWEEN ARCHITECTURAL REFLECTED CEILING PLANS AND MECHANICAL, ELECTRICAL OR SPECIAL SYSTEMS PLANS PRIOR TO COMMENCING WITH CONSTRUCTION.
2. ALL SCHEDULED CEILINGS AT 10' - 0" A.F.F., UNLESS NOTED OTHERWISE.
3. REFER TO MATERIALS SCHEDULE ON A3.11 FOR ALL CEILING FINISHES AND MATERIALS.
4. ALL PAINTED GYPSUM WALL BOARD (GWB) CEILINGS, ARE TO BE PAINTED (P1), UNLESS NOTED OTHERWISE.
5. REFER TO ELECTRICAL DRAWINGS FOR SCHEDULED LIGHT FIXTURES, DEVICES AND EQUIPMENT.
6. ALIGN & CENTER ALL SCHEDULED LIGHT FIXTURES & DIFFUSERS, UNLESS DIMENSIONED OR NOTED OTHERWISE ON RCP.
7. ALIGN CENTER ALL SCHEDULED CEILING MOUNTED SPEAKERS, SMOKE DETECTORS, CAMERAS, AND OCCUPANCY SENSORS, WHERE OCCURS, U.N.O.
8. ALL CEILING MOUNTED ACCESS DOORS, PANELS TO BE PAINTED (P1), U.N.O.

RCP GENERAL NOTES | NO SCALE | 6



REFLECTED CEILING PLAN - GYM & MEZZANINE | 1/8" = 1'-0" | 1

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1031 W SYCAMORE RD
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REFLECTED CEILING PLAN – GYM & MEZZANINE

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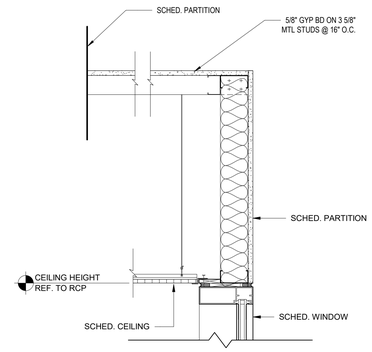
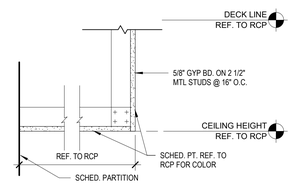
02.29.2024

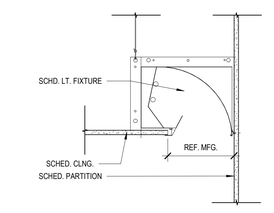
A6.02



RCP DETAIL 1 1/2" = 1'-0" 3



RCP DETAIL 1 1/2" = 1'-0" 2



RCP DETAIL 1 1/2" = 1'-0" 1

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RCP DETAILS

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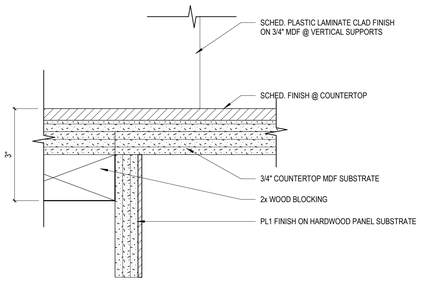
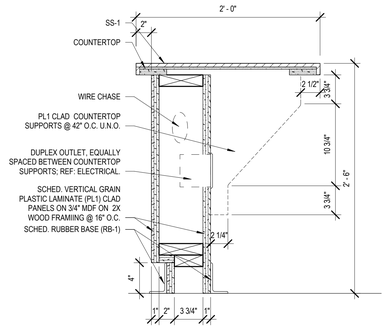
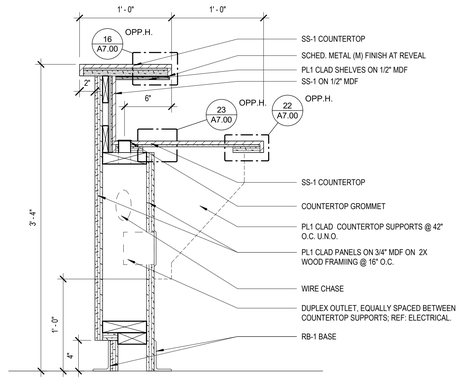
A6.51



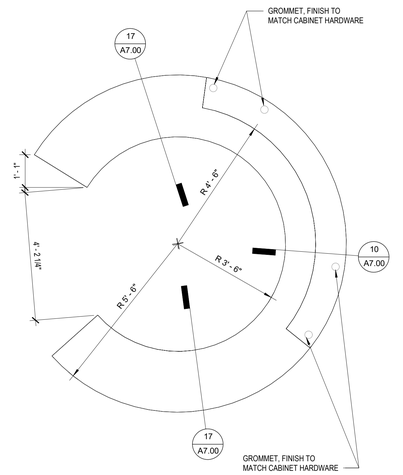
FRONT DESK COUNTER DETAIL 6" = 1'-0" (23)



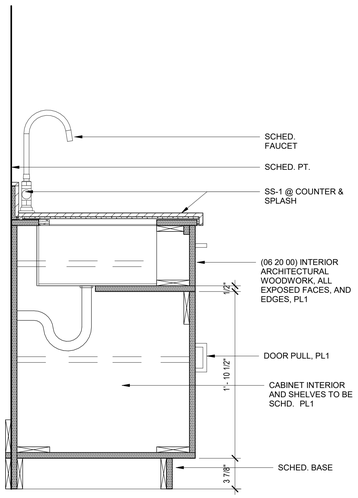
CASEWORK SECTION @ CIRCULATION DESK 1 1/2" = 1'-0" (17)



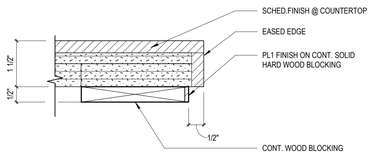
CASEWORK SECTION @ CIRCULATION DESK 1 1/2" = 1'-0" (10)



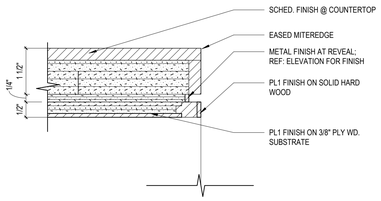
ENLARGED CIRCULATION DESK PLAN 1/2" = 1'-0" (4)



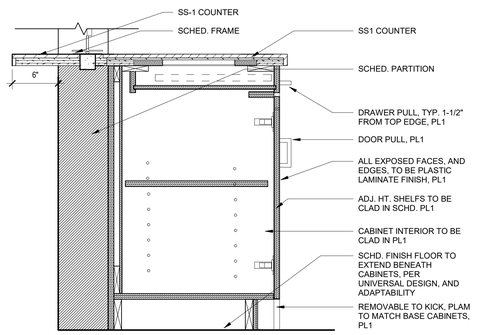
CASEWORK SECTION @ SINK 1 1/2" = 1'-0" (33)



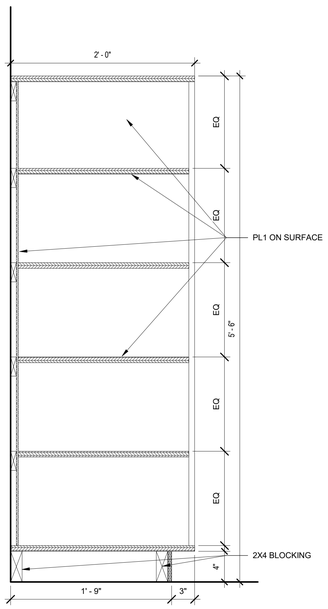
FRONT DESK COUNTER DETAIL 6" = 1'-0" (22)



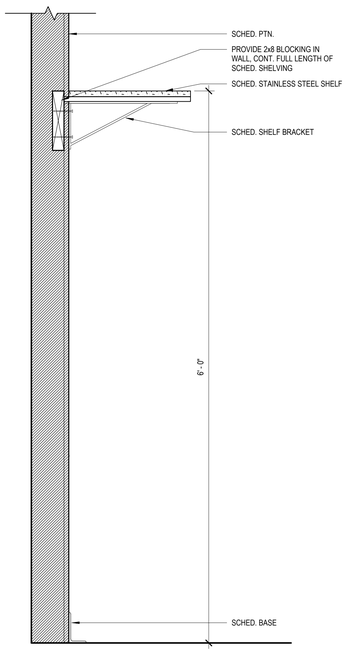
FRONT DESK COUNTER DETAIL 6" = 1'-0" (16)



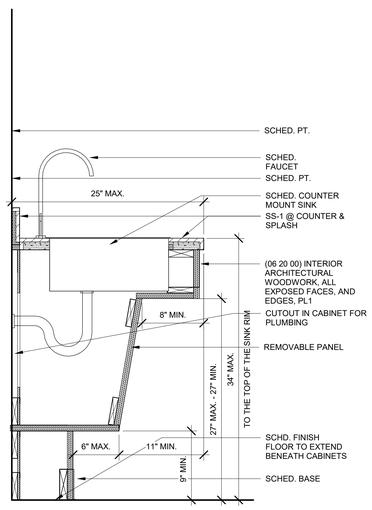
CASEWORK SECTION @ BASE CABINET @ WALL OPENING 1 1/2" = 1'-0" (31)



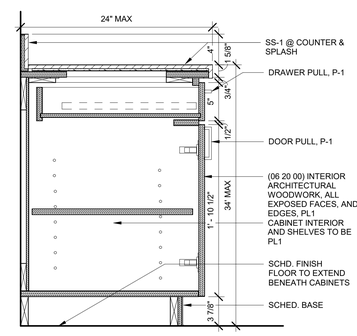
CASEWORK SECTION @ TALL SHELVES 1 1/2" = 1'-0" (19)



CASEWORK SECTION @ SHELF 1 1/2" = 1'-0" (13)



CASEWORK SECTION @ TYP. SINK CASEWORK 1 1/2" = 1'-0" (7)



CASEWORK SECTION @ TYP. BASE CABINET 1 1/2" = 1'-0" (1)

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TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
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WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

MILLWORK DETAILS

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A7.00

EQUIPMENT SCHEDULE

KEY	DESCRIPTION	BASIS OF DESIGN	MODEL #	QT.	INSTALATION NOTES
CFCI-1	TOP LOAD WASHER	WHIRLPOOL	CAE2795FG	1	
CFCI-2	DRYER	WHIRLPOOL	WED4950HW	1	
CFCI-3	WALL PAD	DRAPER	ECOVISION WALL PAD; DARK ROYAL BLUE	135	
CFCI-4	7' -6" TIP AND ROLL BLEACHERS	HUSSEYSEATING	MAXAM 1; 289 DARK BLUE/CLASSIC WOOD DECK	6	
CFCI-5	KEYED OPERABLE BASKETBALL GOAL	DRAPER	EZ FOLD TF-20S W/ 503285	2	
CFCI-6	HAND CRANKED OPERABLE BASKETBALL GOAL	DRAPER	EZ FOLD TF-20S W/ 503286	4	
CFCI-7	SCORE BOARD	SPECTRUM	5242T	1	PROVIDE WD. BLOCKING FOR MOUNTING
CFCI-8	VOLLEYBALL NET	DRAPER	SVS -500021	1	O.F.C.I.
CFCI-9	8' X 5' WHITEBOARD	CLARIDGE	ASP-58	1	
CFCI-10	WALL MOUNTED TV	SONY	FW-100BZ40J	11	O.F.C.I., PROVIDE WD. BLOCKING FOR MOUNTING

EQUIPMENT SCHEDULE | NO SCALE | 24

(1) RECESSED FLOOR SOCKET FLOAT PLATE FOR VOLLEYBALL NET; DRAPER FLOOR COVER PLATES: B.O.D.

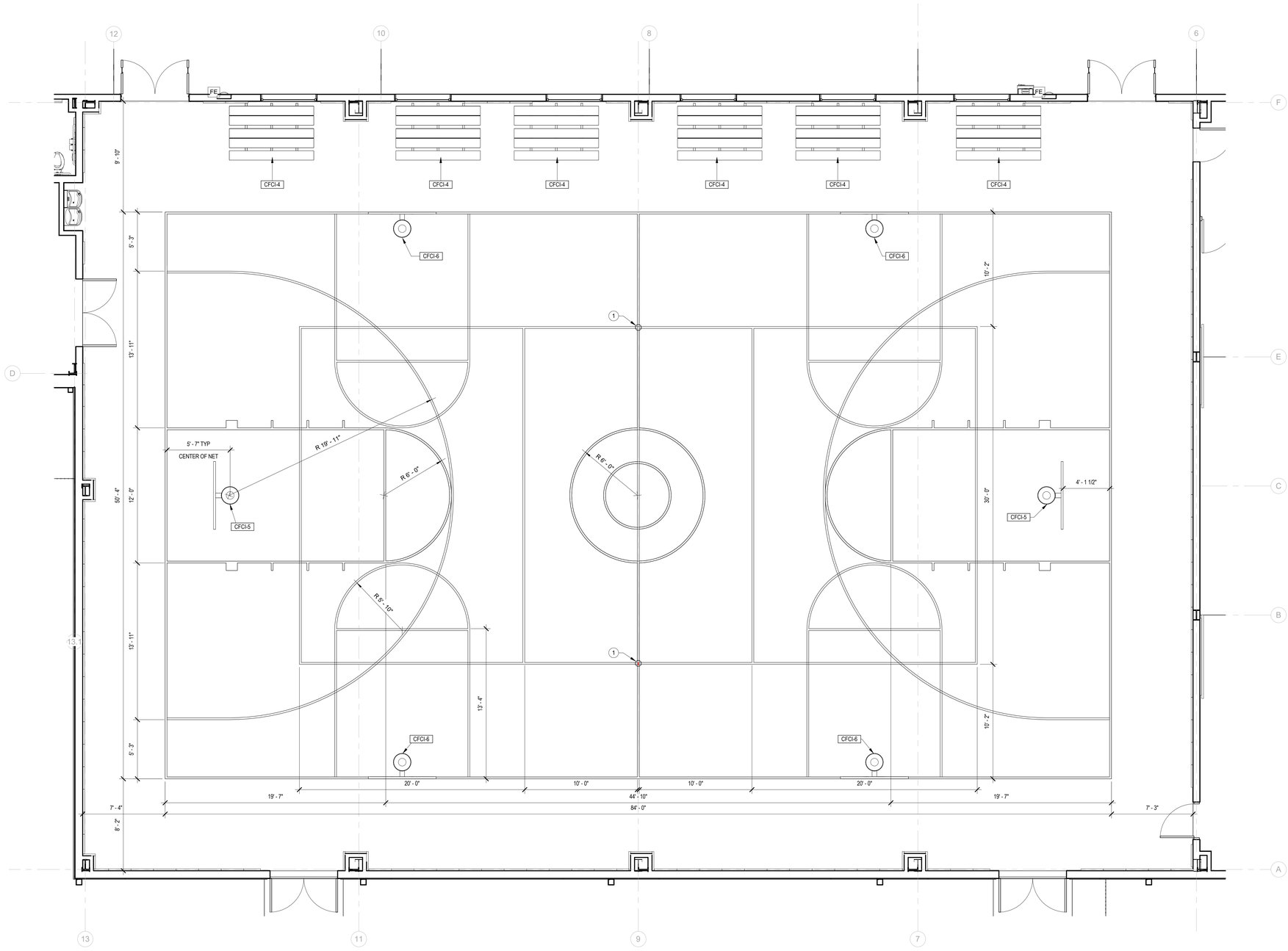
COURT LAYOUT KEY NOTES | NO SCALE | 18

DISCIPLINE	LINE PRIORITY	COLOR	LINE THICKNESS
REC BASKETBALL	1	DARK BLUE	2"
VOLLEYBALL	2	WHITE	2"

FLOOR STRIPING PLAN LEGEND | NO SCALE | 12

1. CONFIRM ALL DIMENSIONS AND STRIPING LAYOUT WITH OWNER PRIOR TO INSTALLATION
2. ALL DIMENSIONS ARE TO OUTSIDE OF LINE, U.N.O.
3. IF LINES OVERLAP, LINE SHALL BE BLACK.
4. INCLUDE BOYS & GIRLS CLUB LOGO IN CENTER COURT AS NOTED, FINAL DESIGN TO BE CONFIRMED BY OWNER

FLOOR STRIPING NOTES | NO SCALE | 6



COURT LAYOUT PLAN | 1/4" = 1'-0" | 1

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COURT LAYOUT PLAN

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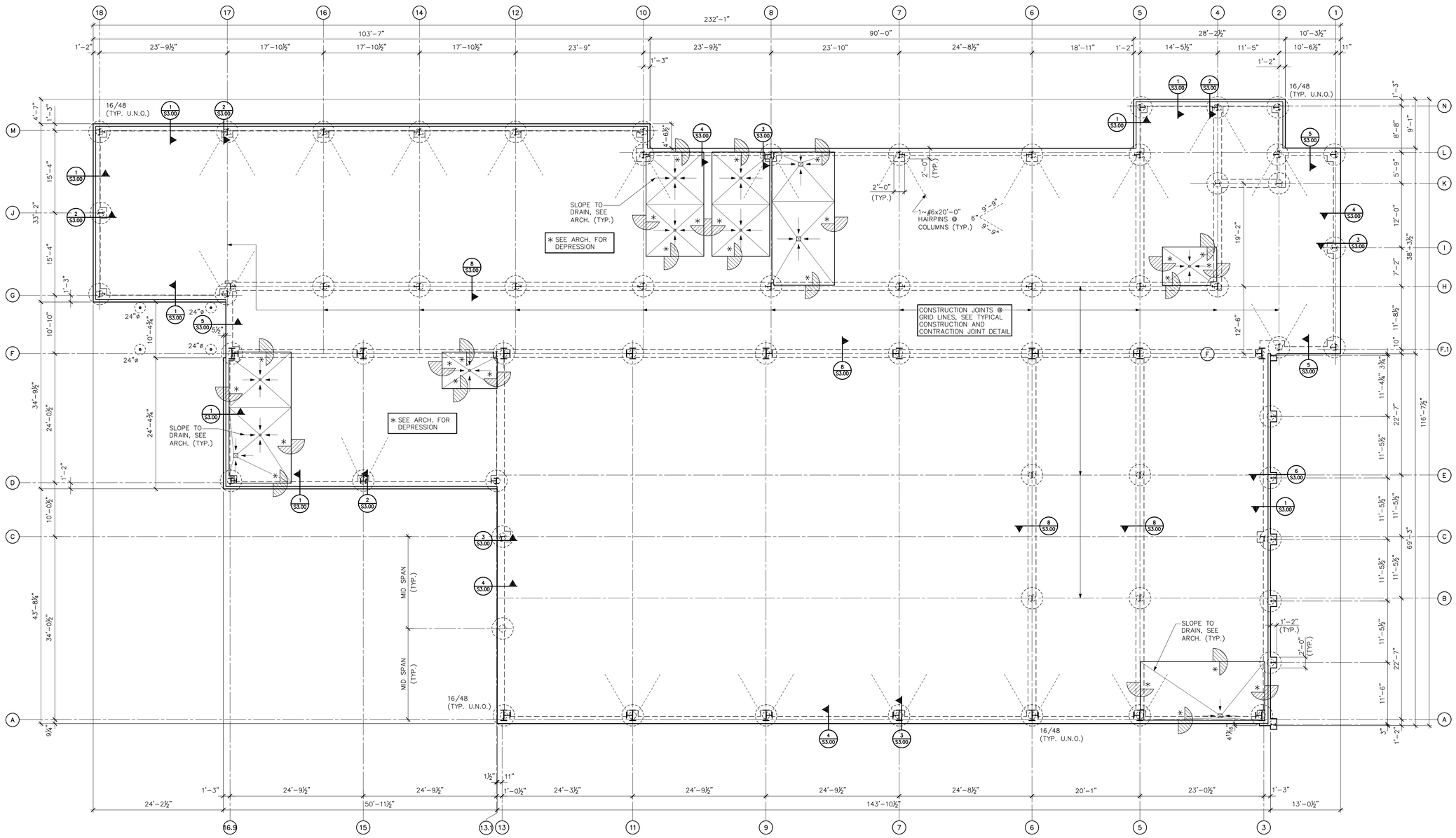
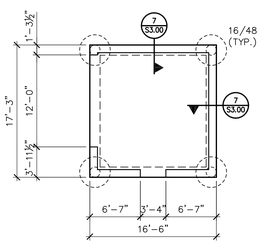


FOUNDATION PLAN
SCALE1: 1/8"=1'-0"



DUMPSTER FOUNDATION PLAN
SCALE1: 1/8"=1'-0"

DESIGN CRITERIA

ROOF LIVE LOAD:	20 PSF
MECH. ROOM LIVE LOAD:	40 PSF + WEIGHT OF EQUIPMENT
CLASSROOM LIVE LOAD:	40 PSF
CORRIDOR ASSEMBLY LIVE LOAD:	100 PSF
WIND LOAD:	148 MPH (ULTIMATE, AMENDED 2018 IBC, ASCE 7-16)
EXPOSURE:	B
RISK CATEGORY:	III
SITE SOIL CLASS:	D
SEISMIC DESIGN CATEGORY:	A
S_S= 0.065	F_A = 1.6
S_1 = 0.037	F_V = 2.4
S_{01} = 0.06	PGA_M = 0.051
T_L = 12	F_{PGA} = 1.6
S_{DS}=0.07	Ie = 1.25
	Cv = 0.7
ALLOWABLE BEARING CAPACITY:	4500 psf @ 12' BELOW EXIST GRADE (SEE ATL REPORT #G23-161)

STRUCTURAL SYSTEMS SUMMARY

GRAVITY:	PRE-ENGINEERED METAL FRAMES BY OTHERS.
LATERAL:	PRE-ENGINEERED METAL FRAMES BY OTHERS.
WIND-BEARING WALLS:	STEEL STUD CURTAIN WALLS BY OTHERS.
FOUNDATIONS:	GRADE BEAMS ON UNDERREAMED PIERS W/ SLAB ON GRADE.

SLAB NOTE

6" CONC. SLAB ON 10 MIL POLY FILM ON 2" MAX. SAND FILL. REINFORCE WITH #4 @ 18"c.c. IN CENTER OF SLAB. PREPARE BENEATH THE SLAB AT LEAST A 2-FOOT THICK BUFFER OF PROPERLY COMPACTED SELECT FILL. EXTEND BUFFER 5' BEYOND BUILDING PERIMETER. FOR SUBGRADE PREPARATION REFER TO GEOTECHNICAL INVESTIGATION BY ASSOCIATED TESTING LABORATORIES, REPORT #G23-161.

SLAB SIDEWALK SLAB NOTE

4" CONC. SLAB ON 2" MAX. SAND FILL. REINF. W/ #3 @ 18"c.c. IN CENTER OF SLAB.

FOOTING/COLUMN NOTE

FOOTINGS SHALL BE CENTERED UNDER COLS AND CENTERED UNDER GRADE BEAMS WHERE THERE ARE NO COLUMNS UNLESS NOTED OTHERWISE.

FIELD VERIFICATION NOTE

1. CONTRACTOR SHALL VERIFY ALL DIMENSIONS WITH ARCHITECTURAL DRAWINGS PRIOR TO FABRICATION OR CONSTRUCTION.
2. CONTRACTOR SHALL VERIFY AND NOTIFY ENGINEER OF EXISTING CONDITIONS IN NEED OF REVIEW AND POSSIBLE MODIFICATION PRIOR TO FABRICATION.

NOTE:
APPROPRIATE LOAD COMBINATIONS PER 2018 IBC SHALL BE APPLIED IN DETERMINING LOADS.

GENERAL NOTES

1. ALL CONCRETE SHALL TEST 4000 PSI AT 28 DAYS.
2. ALL CONCRETE REINFORCING BARS SHALL CONFORM TO ASTM A615 GRADE 60.
3. DETAILING AND FABRICATION OF CONCRETE REINFORCEMENT AND ACCESSORIES SHALL BE IN ACCORDANCE WITH ACI-315 LATEST EDITION.
4. LAP ALL CONTINUOUS REINFORCING BARS 50 DIAMETERS AT SPLICES, TEES, AND CORNERS.
5. THE USE OF HEAT TO FACILITATE THE BENDING OF REINFORCING BARS WILL NOT BE PERMITTED.
6. NO ENGINEERING DRAWING MAY BE REPRODUCED FOR USE AS SHOP DRAWINGS.
7. CONTRACTOR SHALL COORDINATE ALL LOCATIONS OF ALL ANCHOR BOLTS AND OPENINGS FOR MECHANICAL, PIPING, AND ELECTRICAL EQUIPMENT WITH THE RESPECTIVE ENGINEERING AND VENDOR DRAWINGS.

METAL BUILDING NOTES

1. METAL BUILDING MANUFACTURER SHALL PROVIDE FOOTING REACTIONS TO ENGINEER FOR REVIEW.
2. ENGINEER WILL REVIEW FOOTING DESIGN AND REVISE IF REQUIRED BASED ON THE LOAD REACTIONS PROVIDED.
3. METAL BUILDING SHALL BE DESIGNED TO LATERALLY SUPPORT ITSELF. LATERAL BUILDING DRIFT SHALL NOT EXCEED H/500.
4. WIDTH OF COLUMN FLANGES IS LIMITED TO 8"

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FOUNDATION PLAN

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LOUIS A. HAMILTON 81477 REGISTERED PROFESSIONAL ENGINEER STATE OF TEXAS

Feb 29, 2024

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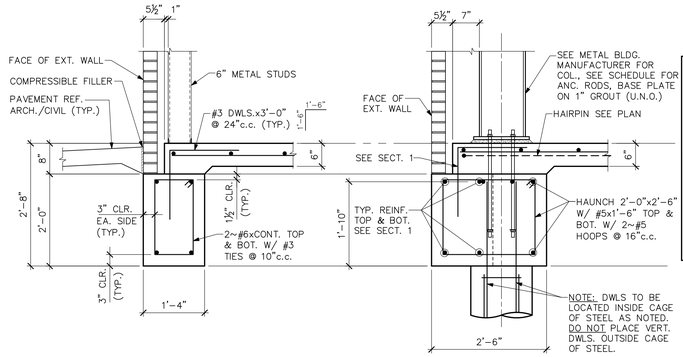
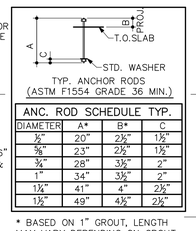


1 SECTION W/ BRICK
SCALE: 3/4"=1'-0"

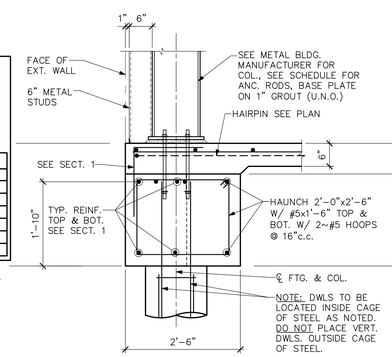
2 SECTION @ COL. W/ BRICK
SCALE: 3/4"=1'-0"



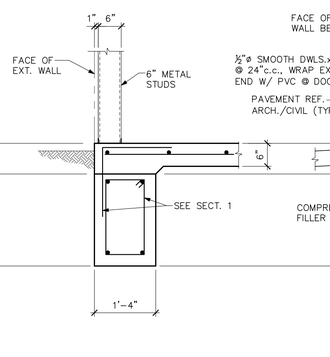
TYP. ANCHOR RODS
(ASTM F1554 GRADE 36 MIN.)

ANC. ROD SCHEDULE TYP.			
DIAMETER	A*	B*	C
½"	20"	2½"	1½"
⅞"	23"	2½"	1½"
¾"	28"	3½"	2"
1"	34"	3½"	2"
1¼"	41"	4"	2½"
1½"	49"	4½"	2½"

* BASED ON 1" GROUT, LENGTH MAY VARY DEPENDING ON GROUT & BASE ℄ THICKNESS.

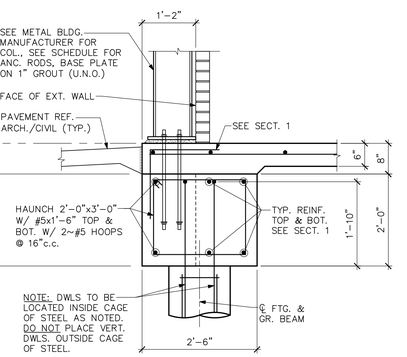


3 WALL SECTION @ COL. W/O BRICK
SCALE: 3/4"=1'-0"

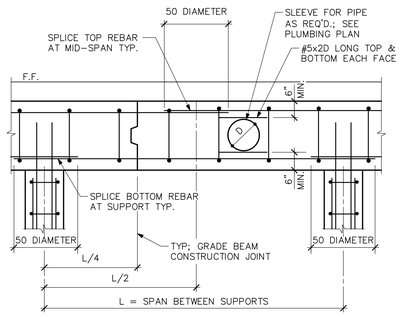


4 WALL SECTION W/O BRICK
SCALE: 3/4"=1'-0"

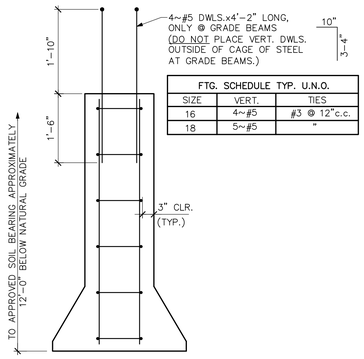
5 SECTION @ DOOR
SCALE: 3/4"=1'-0"



6 SECTION @ OUTSIDE COL.
SCALE: 3/4"=1'-0"

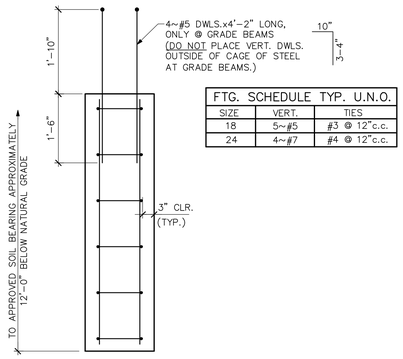


TYPICAL GRADE BEAM BAR SPLICE
SCALE: N.T.S.



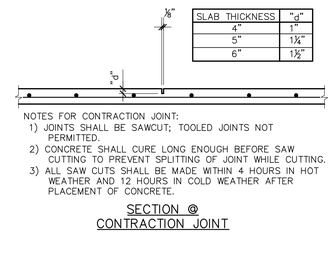
FTG. SCHEDULE TYP. U.N.O.		
SIZE	VERT.	TIES
16	4~#5	#3 @ 12"c.c.
18	5~#5	"

TYPICAL FOOTING DETAIL (U.N.O.)
SCALE: N.T.S.



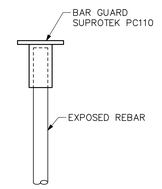
FTG. SCHEDULE TYP. U.N.O.		
SIZE	VERT.	TIES
18	5~#5	#3 @ 12"c.c.
24	4~#7	#4 @ 12"c.c.

TYPICAL STRAIGHT SHAFT DETAIL (U.N.O.)
3/8"=1'-0"



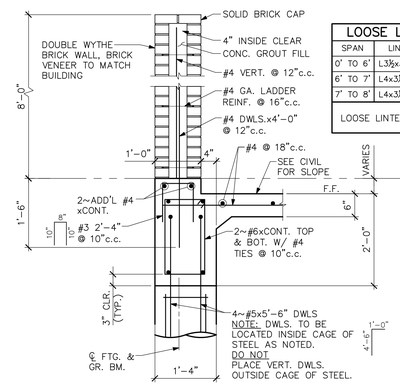
SLAB THICKNESS	"D"
4"	1"
5"	1¼"
6"	1½"

TYPICAL CONSTRUCTION AND CONTRACTION JOINT
SCALE: 3/4"=1'-0"



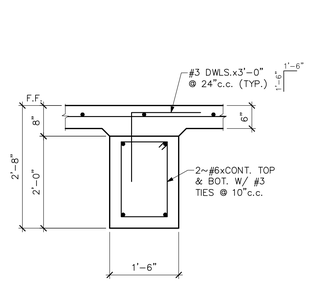
CONTRACTOR SHALL COVER ALL EXPOSED REBAR DURING CONSTRUCTION.

TYPICAL REBAR CAP DETAIL
SCALE: N.T.S.

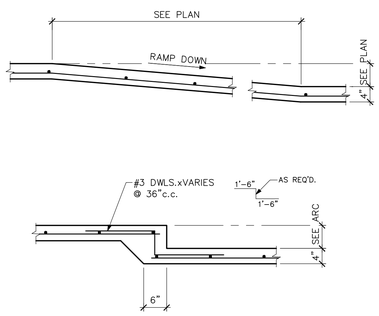


LOOSE LINTEL SCHEDULE			
SPAN	LINTEL	SPAN	LINTEL
0' TO 6'	L3½x3½x¼	8' TO 9'	L5x3½x5/16
6' TO 7'	L4x3½"x¼	9' TO 10'	L6x3½x5/16
7' TO 8'	L4x3½x5/16	10' TO 12'	L7x4x⅜
LOOSE LINTEL MIN. BEARING OF 8".			

7 SECTION @ DUMSTER
SCALE: 3/4"=1'-0"



8 SECTION
SCALE: 3/4"=1'-0"



TYPICAL SLAB DEPRESSION & RAMP
SCALE: N.T.S.

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SECTIONS AND DETAILS

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E-MAIL: INFO@SSHINC.NET 0997-0008

MECHANICAL GENERAL NOTES

1. SEE ARCHITECTURAL PLANS FOR TYPE OF CEILING. FOR LOCATIONS OF WALL MOUNTED DEVICES AND LOCATION HEIGHTS COORDINATE WITH ARCH.
2. DO NOT OPERATE AIR HANDLERS, FAN COIL UNITS, OR EXHAUST FANS UNTIL ALL INTERIOR CLEANING AND PAINTING IS COMPLETE. THE CLEANING OF FOULED COILS OR FAN ASSEMBLIES DUE TO PAINT OR CONSTRUCTION DEBRIS WILL BE THE RESPONSIBILITY OF THE HVAC CONTRACTOR.
3. RECTANGULAR, OR ROUND DUCT SIZES INDICATED ARE ACTUAL SHEET METAL DIMENSIONS IN INCHES ALL ROUND DUCT SIZES INDICATE NET FREE INSIDE DIAMETER AND DO NOT ACCOUNT FOR ANY INSULATION. ROUND DUCTS ARE EXTERNALLY INSULATED PER SPECIFICATIONS.
4. SCHEDULED MANUFACTURERS ARE BASIS OF DESIGN. SEE SPECIFICATIONS FOR OTHER ACCEPTABLE MANUFACTURERS.
5. MAJOR EQUIPMENT SHOWN ON THE PLANS AND ELEVATIONS ILLUSTRATE THE GENERAL ARRANGEMENT AND SPACE ALLOCATION. VERIFY THE SPACE REQUIREMENTS FOR EACH SYSTEM COMPONENT USING MANUFACTURER CERTIFIED SHOP DRAWINGS AND MAKE THE NECESSARY ADJUSTMENTS IN EQUIPMENT PLACEMENT AND CONNECTIONS IN ORDER TO ACCOMMODATE THE EXACT EQUIPMENT TO BE INSTALLED.
6. REFER TO SPECIFICATIONS FOR SUPPORTS, ANCHOR BOLTS AND HANGERS FOR ALL EQUIPMENT. OTHER MISCELLANEOUS STEEL BRACING, SUPPORTS, AND REINFORCING STEEL REQUIRED TO SUPPORT EQUIPMENT SHALL BE FURNISHED AS PART OF THE SCOPE OF WORK OF DIVISION 23.
7. INSTALL SMOKE DETECTORS IN CONFORMANCE WITH 2015 INTERNATIONAL MECHANICAL CODE (IMC).
8. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH ALL APPLICABLE CODES, STANDARDS AND AUTHORITIES HAVING JURISDICTION.
9. ALL SUPPLY AND RETURN AIR DUCTS LOCATED IN UNCONDITIONED ATTICS OR OUTSIDE SHALL BE INSULATED (R-5 UNCONDITIONED AND R-8 OUTSIDE BUILDINGS).
10. FLEX DUCTS SHALL BE SAME SIZE AS DIFFUSER NECKS.
11. SEAL ALL PENETRATIONS OF FLOORS, SMOKE WALLS, FIRE WALLS, LAB WALLS, AND EXTERIOR WALLS.
12. ARCHITECT SHALL APPROVE ALL THERMOSTAT OR TEMPERATURE SENSOR LOCATIONS.
13. DO NOT RUN DUCT OR PIPE OVER ELECTRICAL PANELS.
14. COORDINATE EXACT LOCATION OF EQUIPMENT, DUCTWORK, AIR DEVICES, AND THERMOSTATS WITH ARCHITECTURAL, STRUCTURAL AND REFLECTED CEILING PLANS.
15. ALL PENETRATIONS IN RATED WALLS SHALL BE SEALED WITH AN APPROVED FIRE RETARDENT SEALANT.
16. ALL DUCT RUN-OUTS TO SUPPLY AND EXHAUST, DIFFUSERS AND REGISTERS, SHALL HAVE MANUAL BALANCING DAMPERS. PROVIDE YOUNG REGULATORS WHERE CEILING IS INACCESSIBLE.
17. ALL DUCTWORK SHALL BE IN ACCORDANCE WITH LATEST SMACNA STANDARDS.
18. SECURE ALL PERMITS AND PROVIDE ANY REQUIRED TEMPORARY UTILITIES.
19. GUARANTEE LABOR AND MATERIAL FOR 1 YEAR AND PER DIV.1.
20. PROVIDE AUTOMATIC AIR VENTS ON ALL HIGH POINTS OF PIPING SYSTEMS AND DRAIN VALVED CONNECTIONS AT ALL LOW POINTS OF PIPING SYSTEMS.
21. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION ON SCOPE OF WORK AND REQUIRED INSTALLATION.
22. VERIFY FINAL LOCATION OF THERMOSTATS WITH ARCHITECT AND BUILDING ENGINEER PRIOR TO ANY INSTALLATION WORKS AND FURNITURE LAYOUTS.
23. ALL FLEXIBLE DUCT SHALL BE UL 181, CLASS 1 AIR DUCT BLACK LINER. MAXIMUM LENGTH OF FLEXIBLE DUCT SHALL NOT EXCEED 5'-0". PROVIDE RIGID ROUND INSULATED AIR DUCT RUNOUT AS REQUIRED. FLEXIBLE DUCT SHALL HAVE THE EQUIVALENT OF ONLY TWO 90 DEG. ELBOWS MAXIMUM. FLEXIBLE DUCT SIZE SHALL MATCH THE DIFFUSER NECK SIZE.
24. THE AIR QUANTITIES SHOWN ON THE DRAWINGS FOR INDIVIDUAL OUTLETS MAY BE CHANGED TO OBTAIN UNIFORM TEMPERATURE WITHIN EACH SPACE OR ZONE, BUT THE TOTAL AIR QUANTITY SHOWN FOR EACH ZONE MUST BE OBTAINED.
25. PROVIDE SMOKE DETECTOR FOR ALL UNITS WITH CAPACITY OF 2000 CFM AND HIGHER AS REQUIRED BY CODE. COORDINATE WITH 2015 IMC SECTION 601.
26. PROVIDE AND INSTALL FIRE/SMOKE DAMPERS ON ALL DUCT PENETRATIONS THROUGH VERTICAL SHAFTS.
27. HOT WATER PIPE INSULATION SHALL BE MINIMUM 1.5" IF THE PIPE DIAMETER IS LESS THAN 1-1/2", 2" IF THE PIPE DIAMETER IS BIGGER THAN 1-1/2". CHILLED WATER PIPE INSULATION SHALL BE MINIMUM 2" FOR ALL PIPE SIZES.
28. THE CONTRACTOR TO ENSURE THAT ALL DUCTWORK EITHER STORED ON SITE OR INSTALLED IN THE BUILDING IS THOROUGHLY, SEALED TO PROTECT AGAINST DIRT AND MOISTURE UNTIL SUCH TIME THAT THE BUILDING IS DEEMED BY THE OWNER TO BE ADEQUATELY CLEAN TO ALLOW FOR START-UP OF THE ASSOCIATED AIR HANDLING EQUIPMENT. IF DUCTWORK ARE NOT BE SEALED AS SPECIFIED, THEN THE CONTRACTOR TO HAVE SUCH DUCTWORK PROFESSIONALLY CLEANED TO AN AS-NEW CONDITION AT NO COST TO THE OWNER.
29. NO PORTION OF THE TOTAL CONTRACT WILL BE DECLARED SUBSTANTIALLY COMPLETE UNTIL THE AUTOMATIC TEMPERATURE CONTROL SYSTEM HAS BEEN DEMONSTRATED TO BE COMPLETE AND FUNCTIONING AS INTENDED AND BUILDING COMMISSIONING IS COMPLETED. THE TEMPERATURE CONTROL SYSTEM WILL BE COMPLETE AND FUNCTIONING AS INTENDED WHEN ALL OF THE SPACE TEMPERATURES ARE MAINTAINED AT PLUS OR MINUS TWO DEGREES OF SET POINT.
30. LOCATE VALVES WITHIN 18" OF CEILING SO THAT THEY ARE WITHIN REACH.
31. ALL EXPOSED PIPING INTERIOR AND EXTERIOR SHALL BE PAINTED. INTERIOR COLOR SHALL BE ACCORDING TO THE ADOPTED COLOR CODES AND SHALL BE APPROPRIATELY LABELED AT INTERVIEWS IN SPECIFIED HEIGHT LETTERS. PIPING EXPOSED TO VIEW SHALL BE PAINTED TO COMPLY TO COLOR SCHEME PER SPECIFICATIONS. PIPING ON ROOF/EXTERIOR SHALL BE PAINTED WITH EPOXY POLYURETHANE INDUSTRIAL COATING.
32. INSTALL OUTDOOR AIR FLOW MONITORING STATIONS AT APPROPRIATE LOCATIONS WITH MANUFACTURER'S SUGGESTED CLEARANCE.
33. SUPPORT ALL PIPING, DUCTWORK AND EQUIPMENT FROM BUILDING STRUCTURE.
34. SINGLE TOILET EXHAUST FAN SHALL BE OPERATED BY INDIPENDENT TOGGLE SWITCH. GROUP RESTROOM EXHAUST FANS SHALL BE CONTROLLED BY BAS VIA TIME CLOCK.

ABBREVIATIONS LEGEND

ACRONYM	DESCRIPTION	ACRONYM	DESCRIPTION
°F	FAHRENHEIT	FAS	FIRE ALARM SYSTEM
AC	AIR CONDITIONING	FCU	FAN COIL UNIT
AHU	AIR HANDLING UNIT	FPM	FEET PER MINUTE
AI	ANALOG INPUT	FPT	FAN POWER TERMINAL
ALT	ALTITUDE	GPM	GALLON PER MINUTE
AO	ANALOG OUTPUT	HP	HORSE POWER
APPROX	APPROXIMATE	HVAC	HEATING VENTILATION AND AIR COND
ATM	ATMOSPHERE	HWR	HOT WATER RETURN
AVG	AVERAGE	HWS	HOT WATER SUPPLY
B	BOILER	ISP	INTERNAL STATIC PRESSURE
BARO	BAROMETER (-TRIC)	Kw	KILOWATT
BAS	BUILDING AUTOMATION SYSTEM	LAT	LEAVING AIR TEMPERATURE
BHP	BRAKE HORSE POWER	LHG	LATENT HEAT GIANT
BI	BINARY INPUT	LWT	LEAVING WATER TEMPERATURE
BO	BINARY OUTPUT	MUA	MAKEUP AIR UNIT
BTU	BRITISH THERMAL UNIT	MX	MIXING AIR
BTUH	BRITISH THERMAL UNIT/HOURS	NA	NOT APPLICABLE
CFM	CUBIC FEET PER MINUTE	NO.	NUMBER
CHWP	CHILL WATER PUMP	O/A	OUTSIDE AIR
CHWR	CHILL WATER RETURN	OAHU	OUTSIDE AIR HANDLING UNIT
CHWS	CHILL WATER SUPPLY	PSI	POUNDS PER SQUARE INCH
COEFF	COEFFICIENT	RA	RETURN AIR
CRAC	COMPUTER AIR CONDITIONER	REV	REVOLUTIONS
CT	COOLING TOWER	RTU	ROOF TOP UNIT
CU	CONDENSING UNIT	S/A	SUPPLY AIR
CV	CONSTANT VOLUME	SG	SPECIFIC GRAVITY
CWP	CONDENSER WATER PUMP	SHG	SENSIBLE HEAT GAIN
CWR	CONDENSER WATER RETURN	SP	STATIC PRESSURE
CWS	CONDENSER WATER SUPPLY	SPEC	SPECIFICATION
DB	DRY BULB	TCH	THERMOSTAT/ CO2 SENSOR/ HUMIDISTAT
DI	DIGITAL INPUT	T-STAT	THERMOSTAT
DO	DIGITAL OUTPUT	TYP.	TYPICAL
EAT	ENTERING AIR TEMPERATURE	UH	UNIT HEATER
EMC	ELECTRONICALLY COMMUTATED MOTOR	VAV	VARIABLE AIR VOLUME
ESP	EXTERNAL STATIC PRESSURE	VFD	VARIABLE FREQUENCY DRIVE
EWT	ENTERING WATER TEMPERATURE	WB	WET BULB
EX	EXHAUST AIR		

GENERAL NOTES:
1. SYMBOL LEGEND MAY CONTAIN SYMBOLS THAT ARE NOT USED ON ALL DRAWINGS.
2. ABBREVIATION DEFINITIONS ARE NOT COMPREHENSIVE, AND NOT ALL ABBREVIATIONS MAY APPLY TO ALL DRAWINGS. SUBMIT FORMAL REQUEST FOR INFORMATION WHEN ENCOUNTERING CONFLICTS OR AMBIGUOUS SYMBOLS OR ABBREVIATIONS, AS THESE WILL NOT CONSTITUTE DISMISSAL OF CONTRACTOR RESPONSIBILITY.

MECHANICAL SYMBOLS LEGEND

	SUPPLY AIR DUCT UP (PLAN)	(A) X CFM	DIFFUSER TYPE AND CFM
	SUPPLY AIR DUCT DOWN (PLAN)	(T)	THERMOSTAT – MOUNT 48" AFF UNO
	RETURN OR OUTSIDE AIR DUCT UP (PLAN)	(H)	HUMIDISTAT
	RETURN OR OUTSIDE AIR DUCT DOWN (PLAN)	(F)	FIRESTAT
	EXHAUST AIR DUCT UP (PLAN)	SD	SMOKE DETECTOR
	EXHAUST AIR DUCT DOWN (PLAN)		CONNECT NEW DUCT/PIPING TO EXISTING
	RETURN AIR/TRANSFER AIR BOOT		PIPE UP
	CEILING SUPPLY AIR DEVICE		PIPE DOWN
	SIDEWALL SUPPLY/EXHAUST REGISTER		CAP
	CEILING RETURN AIR / EXHAUST REGISTER		90° ELBOW
	RETURN AIR GRILLE WITH BOOT		45° ELBOW
	BRANCH DUCT TAP		45° ELBOW DOWN (OGEE)
	DUCT SPLIT WITHOUT VANES		TEE
AD	ACCESS DOOR		TEE UP
	TRANSITION IN DUCT		TEE DOWN
	DUCT WITH SPIN-IN CONNECTOR		TOP CONNECTION
AP	FLEXIBLE DUCT CONN. TO RECTANGULAR ACCESS PANEL		CROSS
	DUCT ELBOW WITH TURNING VANES		UNION (SCREWED)
	DUCT ELBOW WITHOUT VANES		UNION (FLANGED)
	FLEXIBLE CONNECTION, FLEXIBLE DUCT	T	DUCT MOUNTED TEMPERATURE SENSOR
VD	VOLUME DAMPER	P	DUCT MOUNTED PRESSURE SENSOR
M	MOTORIZED VOLUME DAMPER	SD	DUCT MOUNTED SMOKE DETECTOR
F	FIRE DAMPER		PIPE BREAK
SD	SMOKE DAMPER		CONCENTRIC REDUCER
FS	COMBINATION FIRE/SMOKE DAMPER		ECCENTRIC REDUCER
AFMS	AIR FLOW MONITORING STATION		END SUCTION PUMP
APD	AIR PRESSURE DIFFERENTIAL SWITCH	OR	BALL VALVE
α	RISE IN DUCT ELEVATION		BUTTERFLY VALVE
α	DROP IN DUCT ELEVATION		ISOLATION VALVE
SD DIM	SPLITTER DAMPER – DIMENSION AS NOTED ON DRAWING		GATE VALVE WITH QUICK DISCONNECT
BDD	BACK DRAFT DAMPER		TWO-WAY VALVE
UCD 1"	UNDERCUT DOOR 1"		THREE-WAY VALVE
RE: 1/M-7	REFER TO DETAIL #1 ON DRAWING M-7		BALANCING VALVE
FM	FLOW METER	MPS	MEDIUM PRESSURE STEAM SUPPLY
CO2	CO2 SENSOR	REF	REFRIGERANT PIPE

GENERAL NOTES:
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PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

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NOTES AND LEGEND

100% Construction Documents
02.29.2024

STATE OF TEXAS
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PROFESSIONAL ENGINEER
2024-02-29 #F-4506

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DIFFUSER NECK-DUCT SIZE SCHEDULE

SUPPLY AIR (CFM)	DIFFUSER NECK AND BRANCH DUCT SIZE (DIAMETER)
0 - 100	6"
101 - 200	8"
201 - 300	10"
301 - 400	12"
401 - 500	14"

AIR OUTLET SCHEDULE

MARK	MAKE	TYPE	MODEL	FACE SIZE (INCH)	NECK SIZE	MATERIAL	MOUNTING	REMARKS
A	TITUS	SUPPLY	OMINI-AA	24"X24"	SEE NECK SCHEDULE	ALUMINUM	CEILING	1,2,3
B	TITUS	RETURN	45F	24"X24"	22"X22"	ALUMINUM	CEILING	1,2,3,4
C	TITUS	EXHAUST	50F	12"X12"	SEE NECK SCHEDULE	ALUMINUM	CEILING	1,2,3
D	TITUS	SUPPLY	272FS	REFER PLANS	SAME AS DIFFUSER FACE	ALUMINUM	SIDE WALL/DUCT	1,2,3
E	TITUS	RETURN	350FL	REFER PLANS	SAME AS DIFFUSER FACE	ALUMINUM	SIDE WALL/DUCT	1,2,3

NOTES:
1. PROVIDE ROUND NECK ADAPTER FOR ALL SUPPLY, RETURN, AND EXHAUST AIR DIFFUSERS WHERE NECESSARY.
2. REFER TO PLANS FOR AIR FLOW RATE.
3. COORDINATE FINISH WITH ARCHITECT PLANS.
4. PROVIDE BOOT. REFER 5/M301 FOR INSTALLATION DETAIL.

FAN SCHEDULE

TAG	LOCATION	SERVICE	AIRFLOW (CFM)	ESP (IN WG)	DRIVE TYPE	MOTOR POWER	POWER (V/P/HZ)	FAN RPM	FAN TYPE	MANUFACTURE	MODEL	NOTE
EF-1	ROOF	RESTROOM	600	0.5	DIRECT	1/4	115/1/60	1,725	CENTRIFUGAL	GREENHECK	GB-VG	ALL
EF-2	CEILING	RESTROOM	100	0.5	DIRECT	1/10	115/1/60	940	CEILING MOUNTED	GREENHECK	VG	ALL
EF-3	CEILING	RESTROOM	100	0.5	DIRECT	1/10	115/1/60	940	CEILING MOUNTED	GREENHECK	VG	ALL

NOTES
1. PROVIDE FAN WITH ECM MOTOR.
2. PROVIDE BACK DRAFT DAMPER WITH THE FANS.
3. PROVIDE FANS WITH HANGING BRACKETS.
4. INTERLOCK FAN WITH OCCUPANCY SENSOR LIGHT SWITCH.

DUCTLESS MINI SPLIT DX SYSTEM SCHEDULE

MARK	SERVING	NOMINAL CFM	EAT DB/WB	LAT DB/WB	TOTAL. CAP. BTU/HR	SENSIBLE. CAP. BTU/HR	FAN COIL MAKE-MODEL	CONDENSING UNIT TAG	CONDENSING UNIT MAKE-MODEL	CONDENSING UNIT			NOTES
										POWER	MCA	MOCP	
FCU-A	IT 25	382	75/62	55/54	12,000	10,800	CARRIER	CU-A	CARRIER	208/1/60	7	15	ALL
FCU-D	IT 201	382	75/62	55/54	12,000	10,800	CARRIER	CU-D	CARRIER	208/1/60	7	15	ALL

NOTES:
1. PROVIDE CONDENSATE DRAIN, TRAP AND RUN TO THE NEAREST DRAIN OUTLET AS INDICATED ON DRAWINGS.
2. PROVIDE CONDENSATE PUMP WITH THE UNIT.
3. PROVIDE MATCHING CONDENSING UNIT AS INDICATED.
4. MANUFACTURES SHALL RECONFIRM ALL REFRIGERANT LINES, SIZES INDICATED AND SUBMIT A PART OF EQUIPMENT SUBMITTAL.
5. PROVIDE WASHABLE FILTER WITH THE UNIT.
6. UNIT EER MUST COMPLY WITH LATEST IECC REQUIREMENTS.
7. INDOOR UNIT SHALL RECEIVE ITS POWER FROM OUTDOOR UNIT.
8. PROVIDE UNIT WITH LOCAL DIGITAL THERMOSTAT.
9. PROVIDE UNIT WITH REFRIGERANT R410A.

SPLIT DX SYSTEM SCHEDULE

MARK	SERVING	TYPE	SUPPLY AIR (CFM)	OUTSIDE AIR (CFM)	FAN POWER (HP)	FAN E.S.P. (IN-WC)	EAT DB/WB (°F)	LAT DB/WB (°F)	TOTAL. CAP. (BTU/HR)	SENSIBLE. CAP. (BTU/HR)	ELECTRICAL RE-HEAT COIL CAPACITY (KW)	AIR HANDLING UNIT			FAN COIL MAKE-MODEL	CONDENSING UNIT TAG	CONDENSING UNIT MAKE-MODEL	CONDENSING UNIT			NOTES
												POWER	MCA	MOCP				POWER	MCA	MOCP	
FCU-B	KIDS CAFE/ KITCHEN	HORIZONTAL SUSPENDED	1,500	500	2.0	1.0	82.0/68.7	55.1/54.7	66.1	44.1	15	480/3/60	26	30	CARRIER OR EQUAL	CU-B	CARRIER OR EQUAL	480/3/60	13	20	ALL
FCU-C	CORRIDOR	VERTICAL FLOOR MOUNTED	1,500	250	1.5	1.0	79.8/68.7	52.1/51.8	62.2	36.3	9	480/3/60	16.4	20	CARRIER OR EQUAL	CU-C	CARRIER OR EQUAL	480/3/60	13	20	ALL

NOTES:
1. PROVIDE CONDENSATE DRAIN, TRAP AND RUN TO THE NEAREST DRAIN OUTLET AS INDICATED ON DRAWINGS.
2. PROVIDE ASHRAE 30% -2" DEEP FILTER WITH THE UNIT.
3. PROVIDE MATCHING CONDENSING UNIT AS INDICATED.
4. MANUFACTURES SHALL RECONFIRM ALL REFRIGERANT LINES, SIZES INDICATED AND SUBMIT A PART OF EQUIPMENT SUBMITTAL.
5. PROVIDE WASHABLE FILTER WITH THE UNIT.
6. UNIT EER MUST COMPLY WITH LATEST IECC REQUIREMENTS.
7. NOTE TO ELECTRICAL CONTRACTOR - POWER THE UNIT FROM EMERGENCY CIRCUIT.

100% OUTSIDE AIR HANDLING UNIT

MARK	AIRFLOW (CFM)	OUTSIDE AIR FLOW (CFM)	CONFIGURATION	FAN		COOLING COIL					HEATING				AMBIENT TEMP (°F)	INDOOR UNIT ELECTRICAL DATA			OUTDOOR UNIT ELECTRICAL DATA			MANUFACTURER	NOTES
				E.S.P. (IN WG)	MOTOR (HP)	MAX FACE VEL. (FPM)	TOT. CAPACITY (MBH)	SEN. CAPACITY (MBH)	EAT DB/WB (°F)	LAT DB/WB (°F)	MAX FACE VEL. (FPM)	EAT DB/WB (°F)	LAT DB/WB (°F)	TOT. CAPACITY (KW)		MCA	MOCP	V/P/Hz	MCA	MOCP	V/P/Hz		
OAHU-1 & OCU-1	3,000	3,000	HORIZONTAL	1.0	2.0	450	268.1	139.3	96.0/79.0	54.4/54.0	450	25.0	51.4	25	105	50	50	460/3/60	60	60	460/3/60	CARRIER OR EQUAL	ALL

NOTES:
1. PROVIDE MERV-8 (2") DEEP FLAT FILTER WITH THE UNIT.
2. PROVIDE IN-DOOR UNIT WITH SINGLE POINT POWER CONNECTION.
3. PROVIDE REFRIGERANT LINES SIZED PER MANUFACTURER'S INSTALLATION INSTRUCTIONS.
4. REFRIGERANT SHALL BE R-410A.
5. PROVIDE STAINLESS STEEL AUXILIARY DRAIN PAN.
6. PROVIDE WATER SENSING DEVICE IN AUXILIARY DRAIN PAN TO SHUT THE UNIT OFF WHEN WATER IS SENSED.
12. PROVIDE UNIT WITH MINIMUM 15 EER.
13. PROVIDE UNIT SUITABLE FOR LOW AMBIENT OPERATION FOR TEMPERATURES DOWN TO 0°F.

ELECTRIC HEATER SCHEDULE

MARK	UH-1
DISCHARGE DIRECTION	HORIZONTAL
SERVES	FIRE RISER ROOM
MANUFACTURER	INDEECO
MOUNTING	SUSPENDED
CAPACITY (KW)	2.0
AIRFLOW (CFM)	510
MOTOR RATING	1/30 HP - 1550 RPM
VOLTAGE	277/1/60
NOTES	ALL

NOTES:
1. PROVIDE MOUNTING BRACKET.
2. PROVIDE UNIT HEATERS WITH WALL MOUNTED THERMOSTAT.
3. PROVIDE 24VAC CONTROL POWER SUPPLY.
4. HEATER SHALL BE FAN FORCED TYPE..
5. PROVIDE WITH LOCAL DISCONNECT IN NEMA 1 ENCLOSURE.

SPLIT DX AIR HANDLING UNIT SCHEDULE

MARK	AIRFLOW (CFM)	OUTSIDE AIR FLOW (CFM)	LOCATION	SERVING	CONFIGURATION	FAN		COOLING COIL					HEATING				AMBIENT TEMP (°F)	OUTDOOR UNIT ELECTRICAL DATA			MANUFACTURER / MODEL	NOTES
						E.S.P. (IN. WG.)	MOTOR (HP)	MAX FACE VEL. (FPM)	TOT. CAPACITY (MBH)	SEN. CAPACITY (MBH)	EAT DB/WB (°F)	LAT DB/WB (°F)	MAX FACE VEL. (FPM)	EAT DB/WB (°F)	LAT DB/WB (°F)	TOT. CAPACITY (KW)		MCA	MOCP	V/P/Hz		
AHU-1A & CU-1A	3,000	1,500 (FROM OAHU-1)	MEZZANINE	GYM	HORIZONTAL	1.5	3.0	433	84.35	61.86	64.5/58.0	51.5/50.7	897.7	61.0	89.1	38.30	105	17.0	25.0	460/3/60	CARRIER OR EQUAL	ALL
AHU-1B & CU-1B	3,000	1,500 (FROM OAHU-1)	MEZZANINE	GYM	HORIZONTAL	1.5	3.0	433	84.35	61.86	64.5/58.0	51.5/50.7	897.7	61.0	89.1	38.30	105	17.0	25.0	460/3/60	CARRIER OR EQUAL	ALL
AHU-2 & CU-2	2,000	450	MEZZANINE	GAME ROOM	HORIZONTAL	1.25	1.5	322	67.39	50.24	79.2/66.0	55.0/54.3	772.4	59.7	90.7	19.0	105	13.0	20.0	460/3/60	CARRIER OR EQUAL	ALL
AHU-3 & CU-3	2,600	605	MECH/ELEC 9	TEEN ROOM	HORIZONTAL	1.25	2.0	441	101.57	71.27	79.1/65.9	54.0/52.8	1056.9	59.9	89.7	25.0	105	18.0	25.0	460/3/60	CARRIER OR EQUAL	ALL
AHU-4 & CU-4	4,300	685	MECH/ELEC 9	LEARNING CENTER	HORIZONTAL	1.25	2.0	433	164.01	116.34	77.5/64.7	52.7/51.6	897.7	63.7	89.7	36.0	105	29.7	40.0	460/3/60	CARRIER OR EQUAL	ALL

NOTES:
1. PROVIDE MERV-8 (2") DEEP FLAT FILTER WITH THE UNIT.
2. PROVIDE IN-DOOR UNIT WITH SINGLE POINT POWER CONNECTION.
3. PROVIDE REFRIGERANT LINES SIZED PER MANUFACTURER'S INSTALLATION INSTRUCTIONS.
4. REFRIGERANT SHALL BE R-410A.
5. PROVIDE STAINLESS STEEL AUXILIARY DRAIN PAN.
6. PROVIDE WATER SENSING DEVICE IN AUXILIARY DRAIN PAN TO SHUT THE UNIT OFF WHEN WATER IS SENSED.
12. PROVIDE UNIT WITH MINIMUM 15 EER.

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SCHEDULES

100% Construction Documents
02.29.2024

STATE OF TEXAS
ANWAR HASSAN
64671
LICENSED
PROFESSIONAL ENGINEER
2024-02-29 #F-4506

M0.10

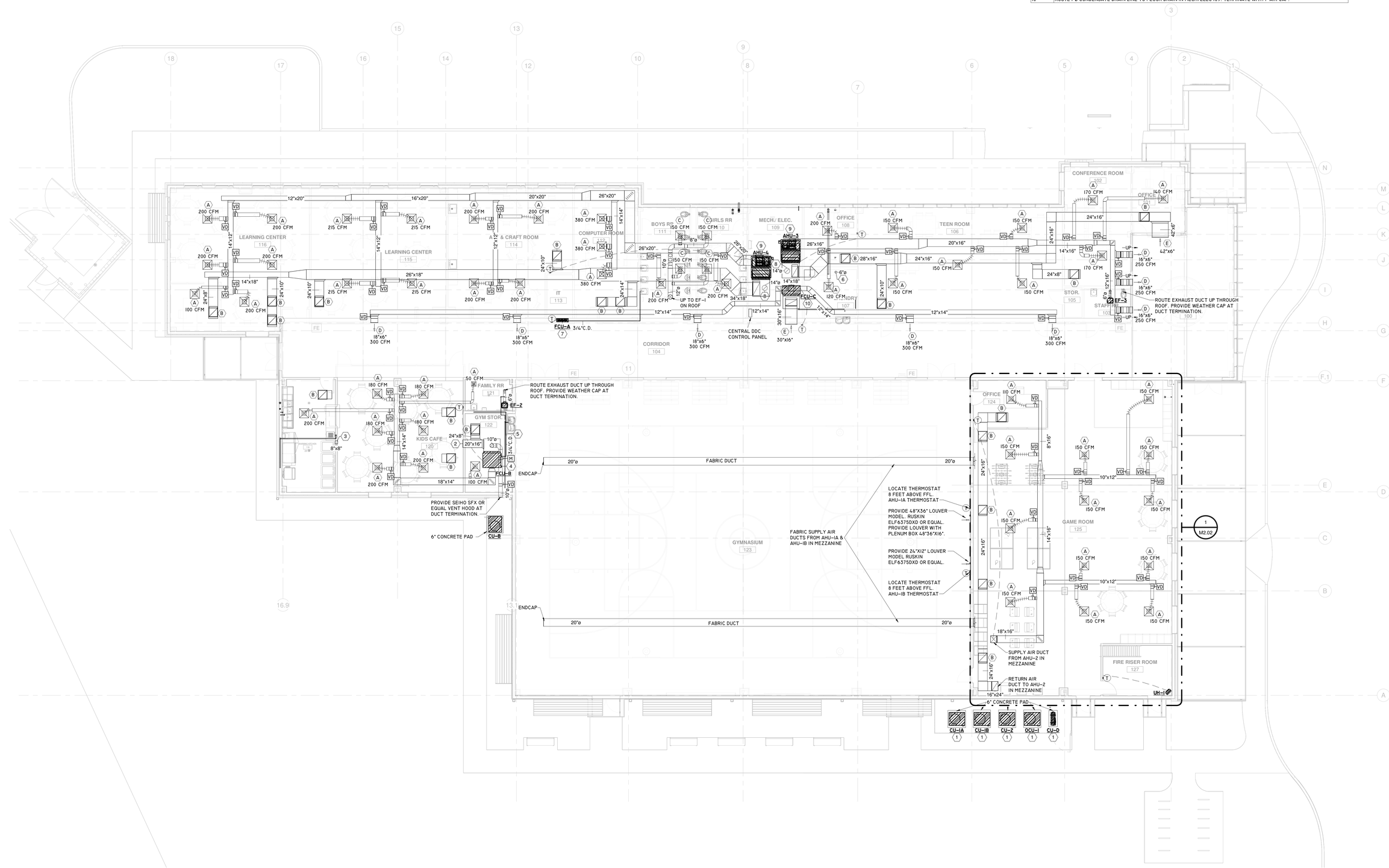
NOTES:

1. PROVIDE CENTRAL DDC CONTROL PANEL TO CONTROL ALL THE UNITS FROM CENTRAL LOCATION.

2. ALL THERMOSTATS INDICATED ON THE DRAWINGS CONTAIN TEMPERATURE SENSOR ONLY WITHOUT SET POINT DISPLAY. ROOM TEMPERATURE AND OPERATION SCHEDULE SHALL BE PROGRAMMED AT THE CENTRAL DDC PANEL.

KEYED NOTE LEGEND

1	PROVIDE REFRIGERANT PIPING FROM CONDENSING UNIT TO RELATED FCU. SIZE REFRIGERANT PIPES PER MANUFACTURER'S INSTRUCTION. INSULATE REFRIGERANT PIPES WITH 2"ARMAFLEX AND PROVIDE ALUMINUM JACKETING FOR EXPOSED PIPES.
2	PROVIDE 20"X16" RETURN AIR OPENING WITH BIRDSCREEN ABOVE CEILING.
3	PROVIDE RETURN AIR OPENING ABOVE THE CEILING SIZE AS SHOWN.
4	PROVIDE OUTSIDE AIR DUCT SIZED AS SHOWN AND CONNECT OUTSIDE AIR DUCT TO FCU PLENUM BOX. PROVIDE MOTORIZED DAMPER AND VOLUME DAMPER. ROUTE OUTSIDE AIR DUCT THROUGH WALL AND PROVIDE SEIHO SFX OR EQUAL VENT HOOD AT DUCT TERMINATION. INTERLOCK MOTORIZED DAMPER WITH FAN COIL OPERATION.
5	ROUTE 3/4"Ø CONDENSATE DRAIN LINE TO SINK P-TRAP IN FAMILY RR 121. REFER 4/M3.01 FOR INSTALLATION DETAIL.
6	6"Ø DRYER EXHAUST VENT UP TO ROOF. REFER TO 13/M3.01 FOR INSTALLATION DETAIL.
7	ROUTE 3/4" CONDENSATE DRAIN LINE TO SINK P-TRAP IN BOYS RR 111. REFER 4/M3.01 FOR INSTALLATION DETAIL.
8	PROVIDE 14"Ø OUTSIDE AIR DUCT AND CONNECT TO AHU PLENUM BOX. PROVIDE MOTORIZED DAMPER AND VOLUME DAMPER ON THE RISE. ROUTE OUTSIDE AIR DUCT THROUGH ROOF AND PROVIDE WEATHER CAP AT DUCT TERMINATION. INTERLOCK MOTORIZED DAMPER WITH FAN COIL OPERATION.
9	ROUTE 1-1/2"Ø CONDENSATE DRAIN LINE TO FLOOR DRAIN IN MECH/ELEC 109. TERMINATE WITH 1" AIR GAP.
10	ROUTE 1"Ø CONDENSATE DRAIN LINE TO FLOOR DRAIN IN MECH/ELEC 109. TERMINATE WITH 1" AIR GAP.



1 HVAC PLAN
Scale: 1/8" = 1'-0"

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STUDIO AVID
6046 FM 2920 RD., #260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE ASSOCIATES
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HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023

DATE ISSUED: 02.29.2024

TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

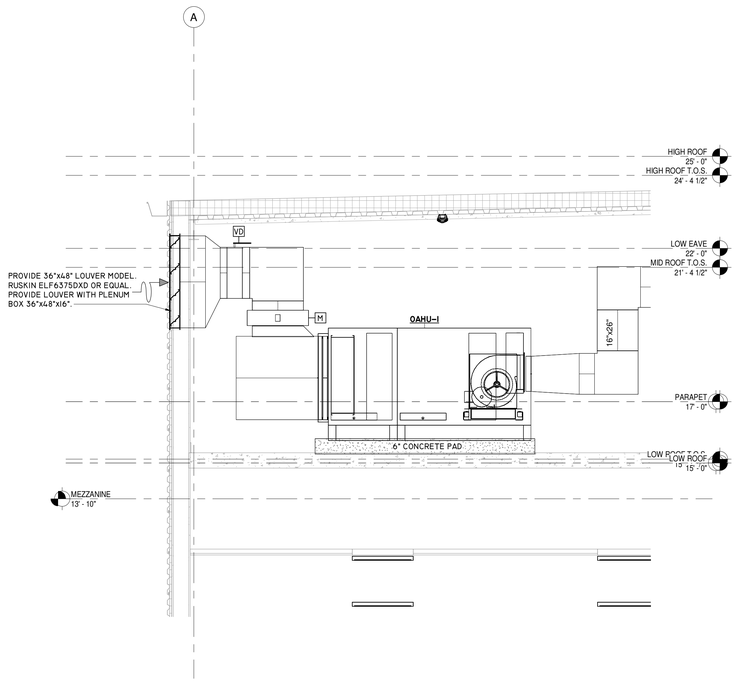
HVAC PLAN

100% Construction Documents
02.29.2024

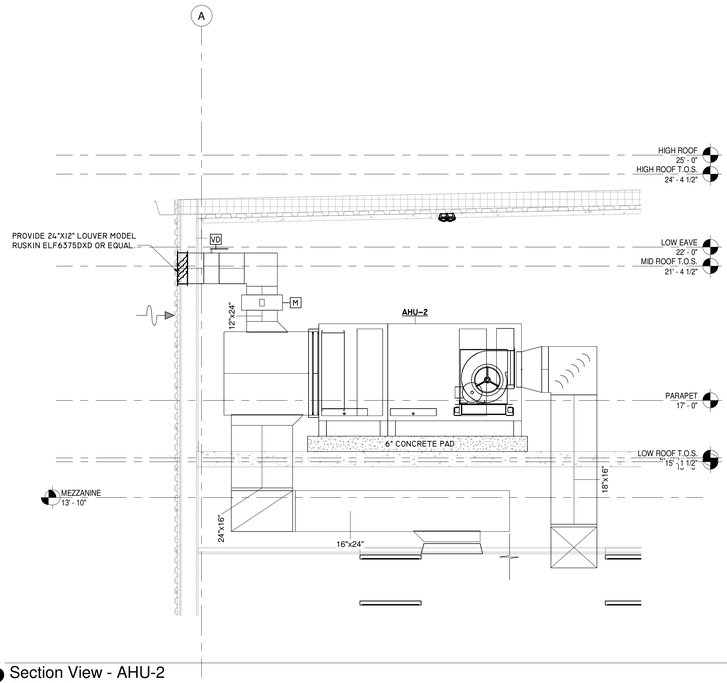
STATE OF TEXAS
ANWAR HASSAN
64671
LICENSED
PROFESSIONAL ENGINEER
2024-02-29 #F-4506

M2.01

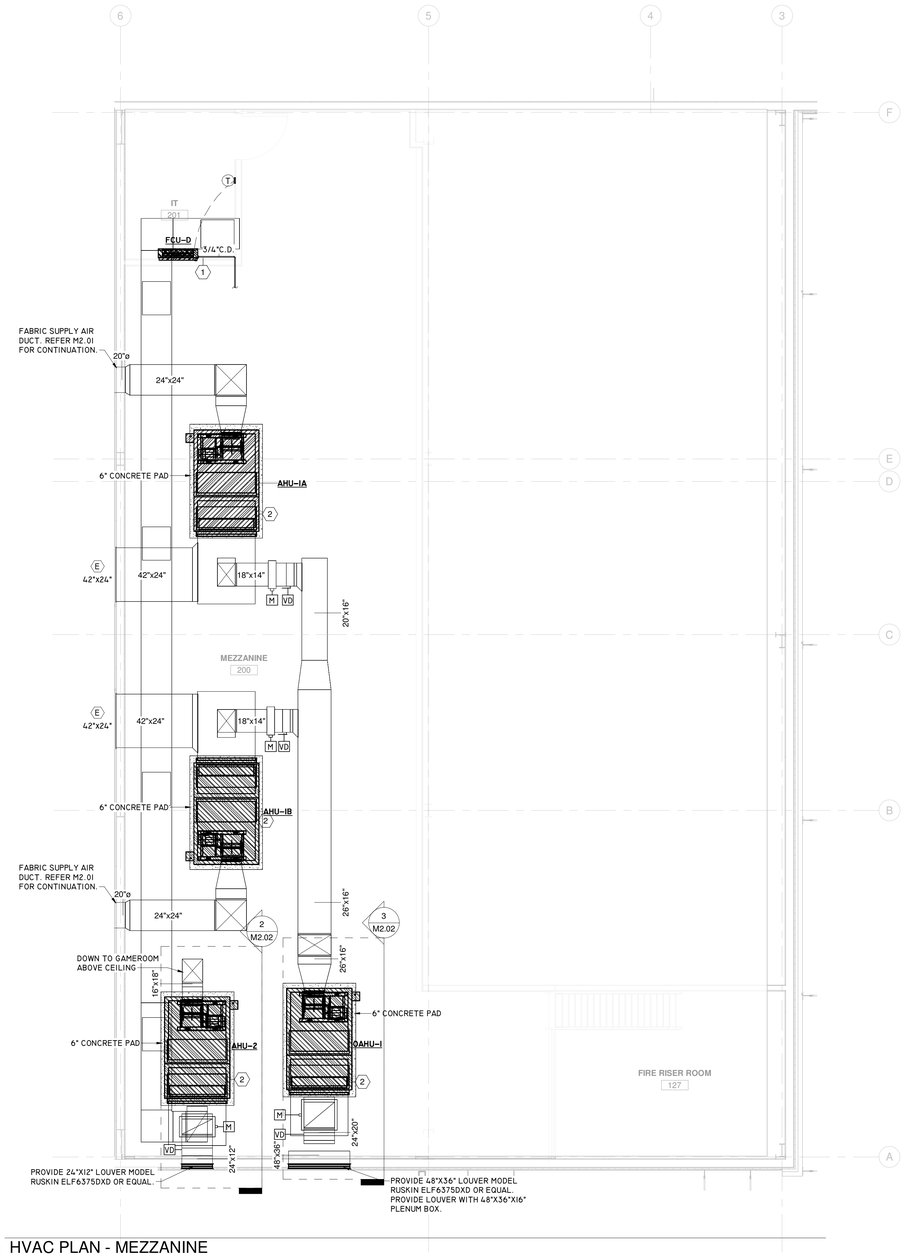
KEYED NOTE LEGEND	
1	ROUTE 3/4" CONDENSATE DRAIN LINE TO FLOOR DRAIN IN MEZZANINE. TERMINATE WITH 1" AIR GAP.
2	ROUTE 1-1/2"Ø CONDENSATE DRAIN LINE TO FLOOR DRAIN IN MEZZANINE. TERMINATE WITH 1" AIR GAP.



3 Section View - OAHU-1
Scale: 1/2" = 1'-0"



2 Section View - AHU-2
Scale: 1/2" = 1'-0"



1 HVAC PLAN - MEZZANINE
Scale: 1/4" = 1'-0"

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MEZZANINE PLAN

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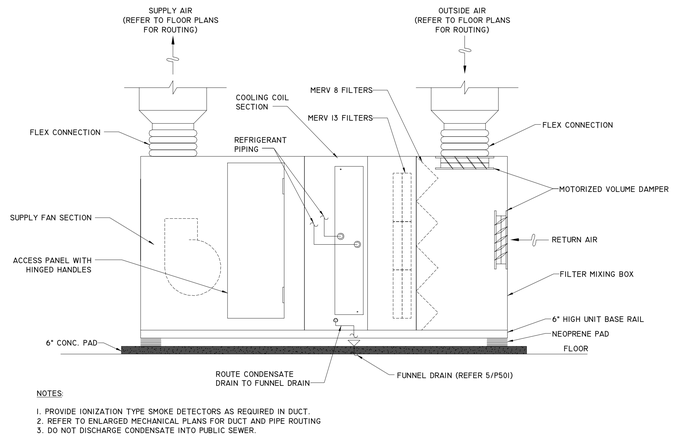
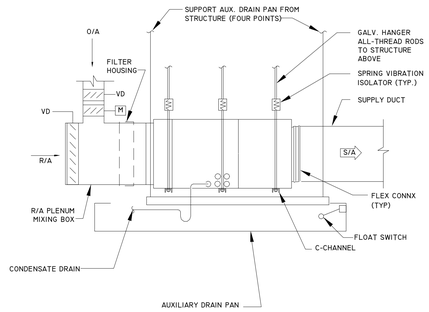


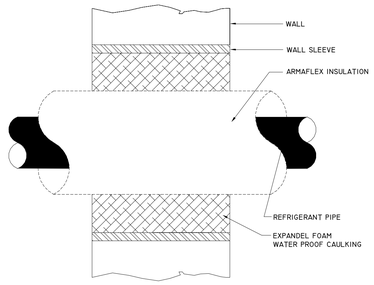
NOTES:

1. PROVIDE IONIZATION TYPE SMOKE DETECTORS AS REQUIRED IN DUCT.
2. REFER TO ENLARGED MECHANICAL PLANS FOR DUCT AND PIPE ROUTING
3. DO NOT DISCHARGE CONDENSATE INTO PUBLIC SEWER.

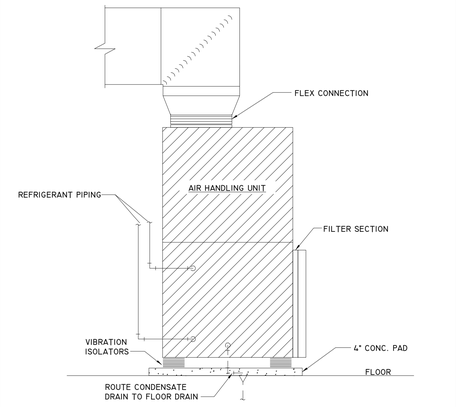
TYPICAL HORIZONTAL FLOOR MOUNTED AHU DETAIL | NOT TO SCALE | 12



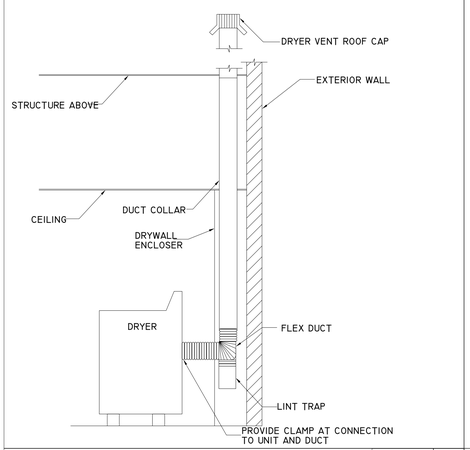
SUSPENDED FAN COIL UNIT DETAIL | NOT TO SCALE | 9



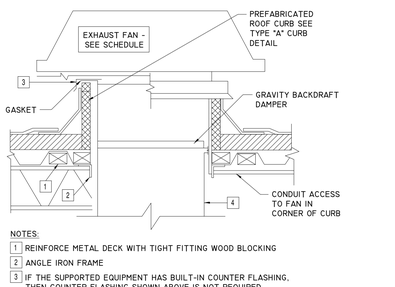
PIPE THRU WALL PENETRATION | NOT TO SCALE | 6



VERTICAL FLOOR MOUNTED AIR HANDLING UNIT | NOT TO SCALE | 3



DRYER EXHAUST THROUGH ROOF | NOT TO SCALE | 13



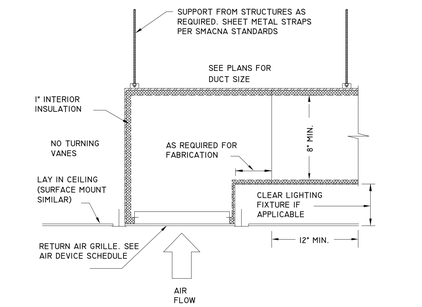
NOTES:

1. REINFORCE METAL DECK WITH TIGHT FITTING WOOD BLOCKING
2. ANGLE IRON FRAME
3. IF THE SUPPORTED EQUIPMENT HAS BUILT-IN COUNTER FLASHING, THEN COUNTER FLASHING SHOWN ABOVE IS NOT REQUIRED
4. DUCTWORK CONNECTIONS SHALL BE FULL SIZE OF CURB. TRANSITION FROM DUCT SIZE SHOWN ON THE PLAN TO CURB SIZE.

NOTE:

SECURE UNIT TO CURB WITH HURRICANE RESTRAINT CLIPS COMPLIANT WITH MIAMI-DADE REQUIREMENTS. CONTRACTOR SHALL PROVIDE SHOP DRAWINGS FOR ENGINEER'S REVIEW.

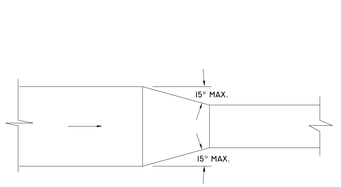
ROOF MOUNTED EXHAUST FAN DETAIL | NOT TO SCALE | 11



NOTE:

1. REFER TO AIR DEVICE SCHEDULE ON DRAWINGS FOR ADDITIONAL REQUIREMENTS.

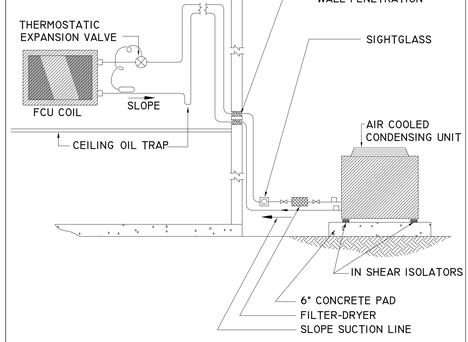
RETURN AIR GRILLE WITH BOOT DETAIL | NOT TO SCALE | 8



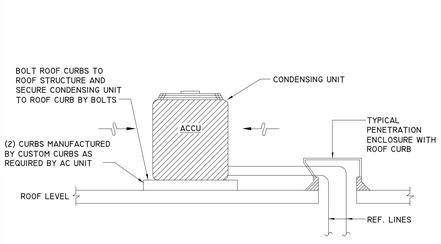
DUCT TRANSITION DETAIL | NOT TO SCALE | 5

NOTE:

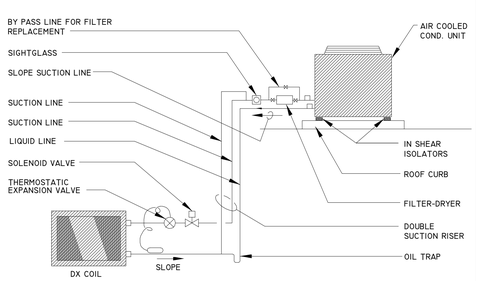
1. SIZE REFRIGERANT PIPING PER MANUFACTURER INSTALLATION INSTRUCTIONS.
2. PROVIDE MIN 3/4" THICK ELASTOMERIC FOAM PIPE INSULATION.
3. PROVIDE ALUMINUM JACKETING OVER EXTERIOR PIPE INSULATION.



SPLIT DX UNIT INSTALLATION DETAIL | NOT TO SCALE | 2

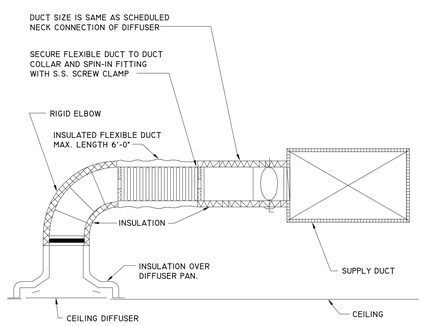


ROOF MOUNTED CONDENSER DETAIL
SCALE: N.T.S.



REFRIGERANT PIPING DETAIL (A)
SCALE: N.T.S.

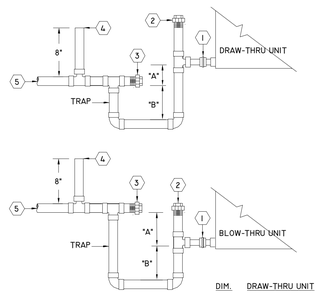
SPLIT SYSTEM INSTALLATION AND PIPING DETAIL | NOT TO SCALE | 10



NOTE:

THE FLANGED BELLMOUTH FITTING MUST BE PROVIDED, WHERE HEIGHT OF DUCT SHOWN ON PLANS CAN ACCOMODATE THE FITTING. ONLY WHERE THE DUCT HEIGHT DOES NOT ALLOW THE INSTALLATION OF BELLMOUTH FITTING, PROVIDE STRAIGHT FITTING. FLEX DUCT MAY BE LOCATED IN RISER OR HORIZONTAL RUN.

CEILING DIFFUSER CONNECTION DETAIL | NOT TO SCALE | 7

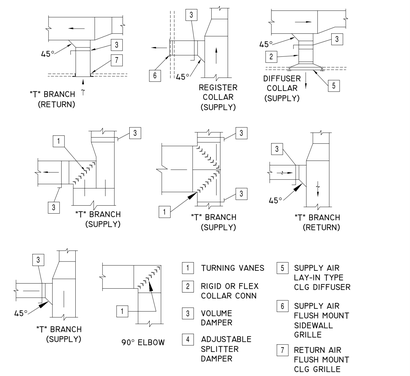


DIM.	DRAW-THRU UNIT	BLOW-THRU UNIT
"A"	FAN T.S.P. + 1"	FAN T.S.P. - 1"
"B"	FAN T.S.P. + 1" / 2	FAN T.S.P. + 1" / 2

KEYED NOTES:

1. SIZE DRAIN PIPING AT LEAST ONE PIPE SIZE LARGER THAN DRAIN PAN CONNECTION. PROVIDE UNION AT UNIT CONNECTION.
2. UPSTREAM CLEANOUT WITH REMOVABLE CAP OR PLUG. EXTEND ABOVE TOP RIM OF DRAIN PAN.
3. DOWNSTREAM PLUGGED CLEANOUT AT HEAD END OF DRAIN.
4. OPEN VENT - DO NOT CAP.
5. ROUTE DISCHARGE TO INDIRECT DRAIN. PITCH DOWN AT 1/8" PER FOOT. PROVIDE CLEANOUTS AT CHANGES OF DIRECTION.

TYPICAL CONDENSATE DRAIN DETAIL | NOT TO SCALE | 4



1	TURNING VANES	5	SUPPLY AIR LAY-IN TYPE CLG DIFFUSER
2	RIGID OR FLEX COLLAR CONN	6	SUPPLY AIR FLUSH MOUNT SIDEWALL GRILLE
3	VOLUME DAMPER	7	RETURN AIR FLUSH MOUNT CLG GRILLE
4	ADJUSTABLE SPLITTER DAMPER		

NOTE: SEE FLOOR PLANS FOR DIMENSIONS

DUCTWORK FITTINGS DETAIL | NOT TO SCALE | 1

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DETAILS

100% Construction Documents
02.29.2024

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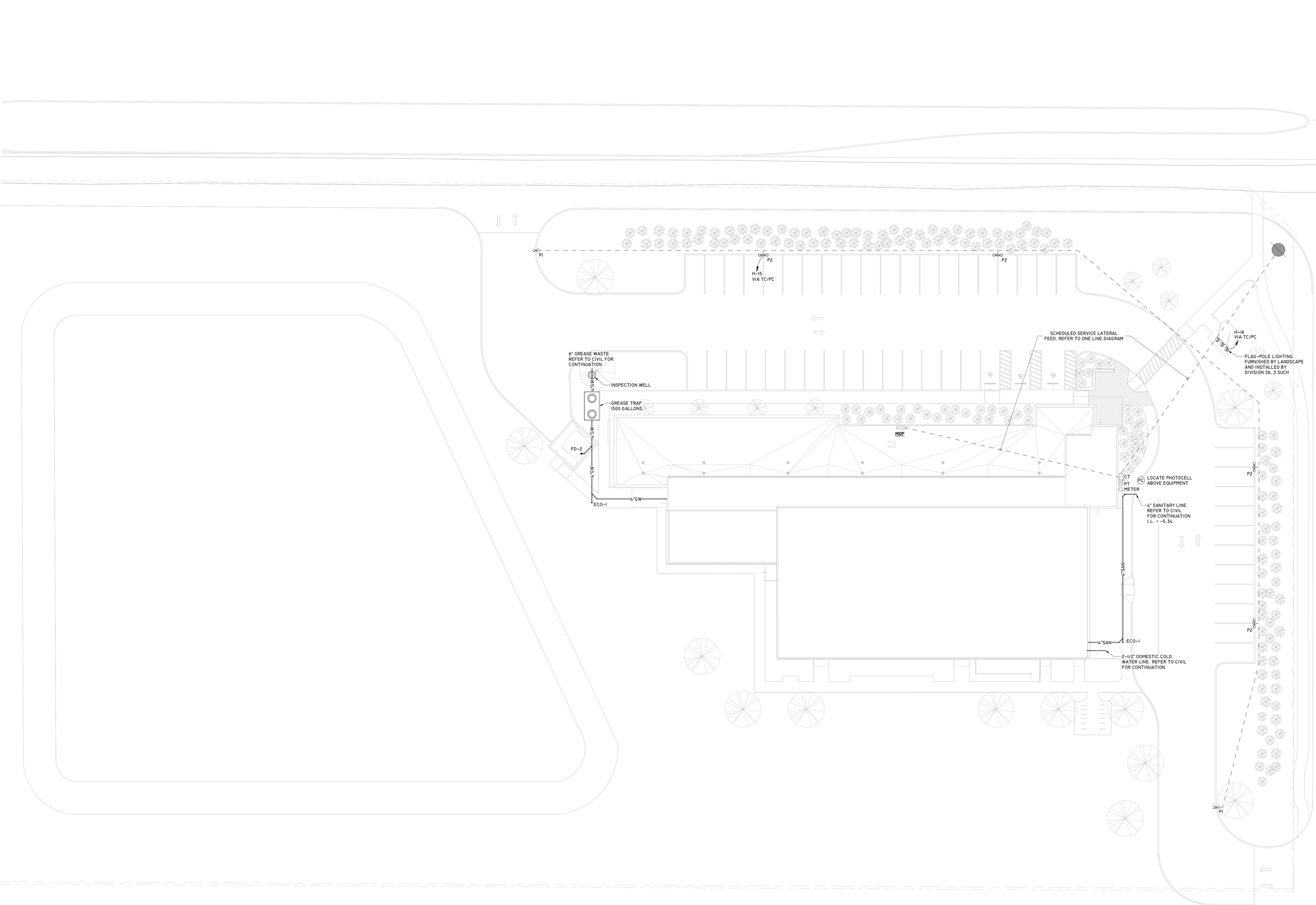

1 SITE PLAN
Scale: 1/16" = 1'-0"

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SITE PLAN

100% Construction Documents
02.29.2024

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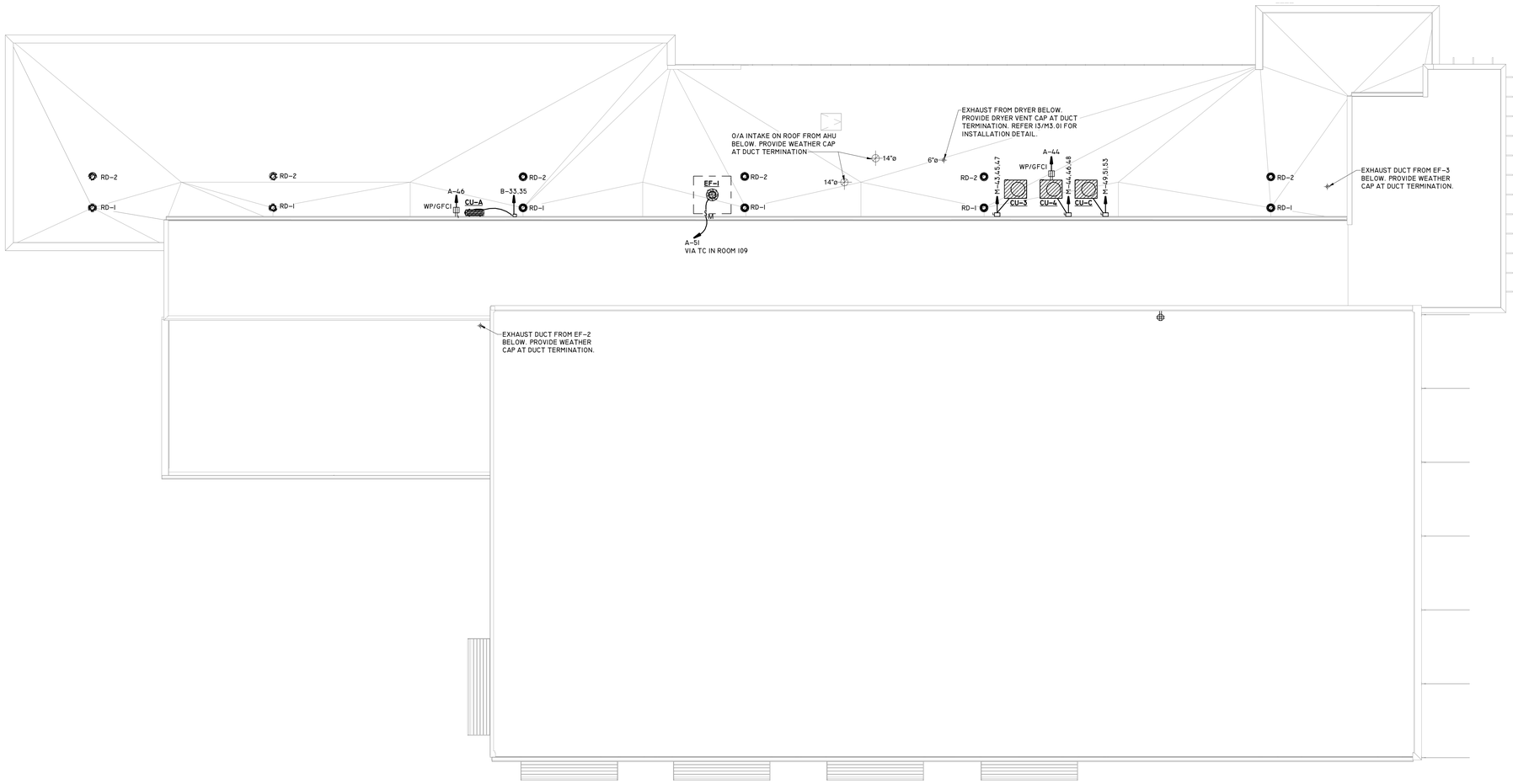

1 ROOF PLAN
Scale: 1/8" = 1'-0"

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ROOF PLAN

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02.29.2024

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2024-02-29 #F-4506

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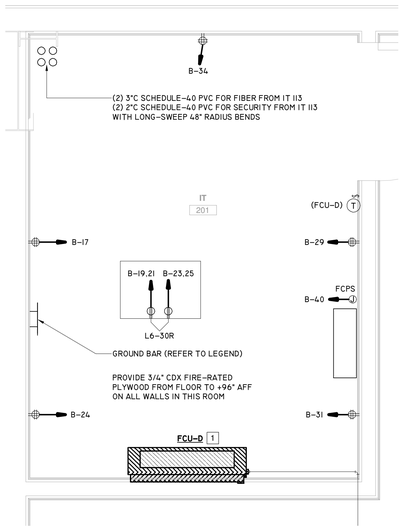
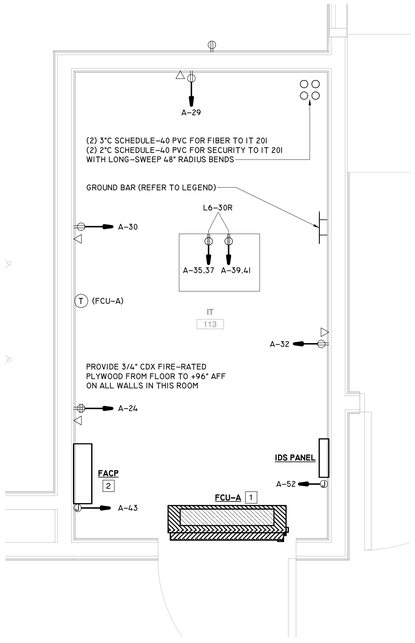
KEYED NOTE LEGEND

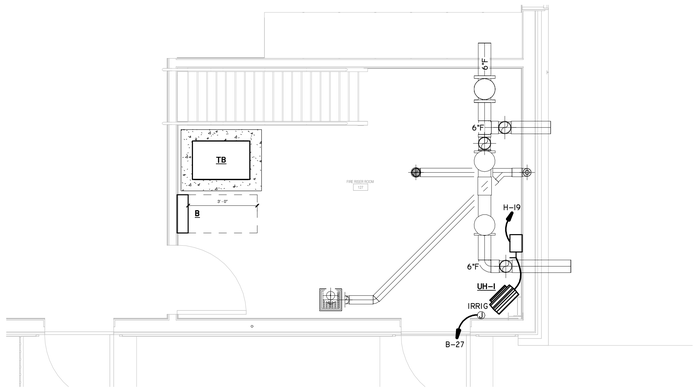
1	FCU IS POWERED THROUGH CONDENSER UNIT. PROVIDE 1"C FROM CONDENSER UNIT TO THIS LOCATION WITH PULL STRING, PULL INTERCONNECT CABLE, AND TERMINATE. COORDINATE EXACT LOCATIONS AND ROUTES WITH MECHANICAL CONTRACTOR.
2	FACP TO BE STARLINK SLE-LTEVI-FIRE. COORDINATE EXACT LOCATION WITH ARCHITECT PRIOR TO ROUGH-IN.



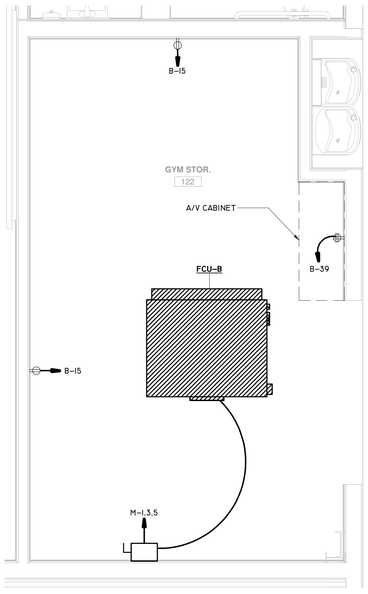
5 ENLARGED PLAN - IT ROOM 201
Scale: 3/4" = 1'-0"



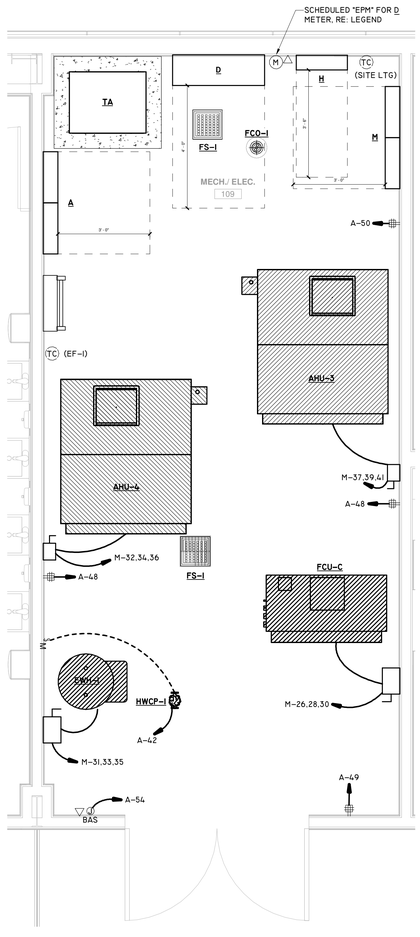
4 ENLARGED PLAN - IT ROOM 113
Scale: 3/4" = 1'-0"



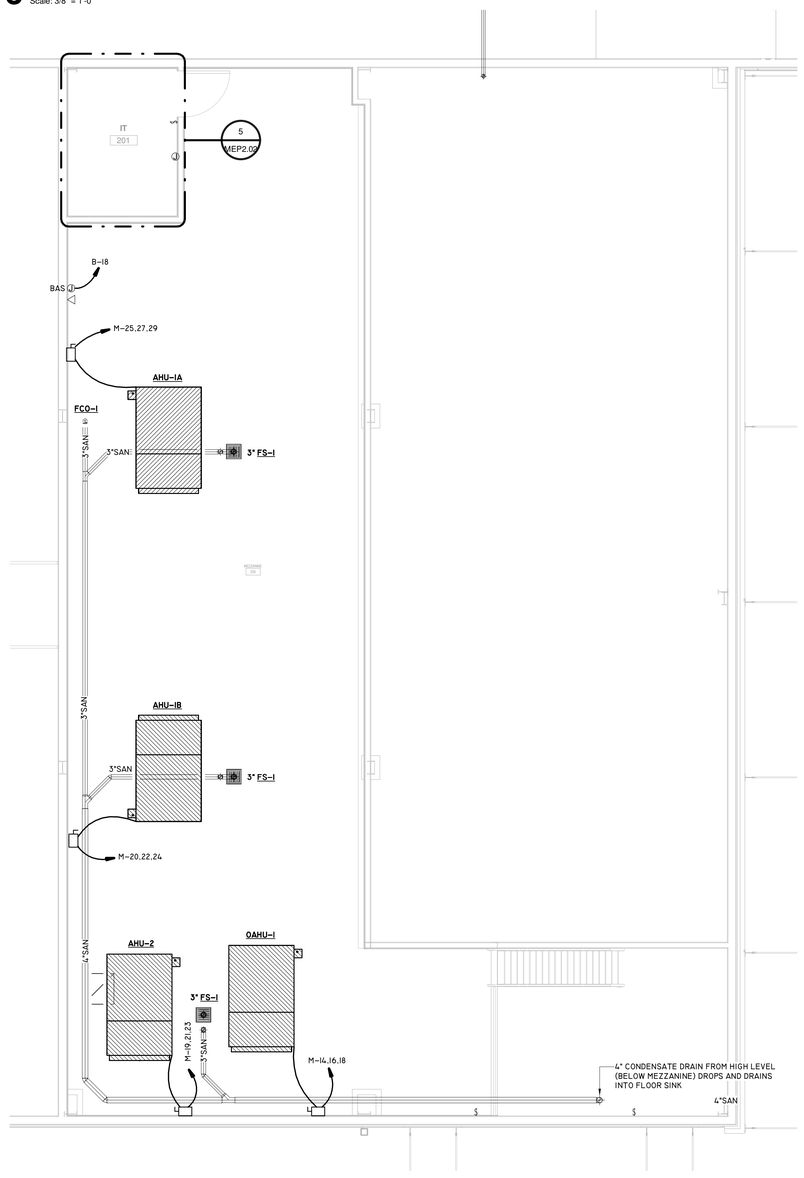
3 ENLARGED PLAN - FIRE RISER ROOM - POWER
Scale: 3/8" = 1'-0"



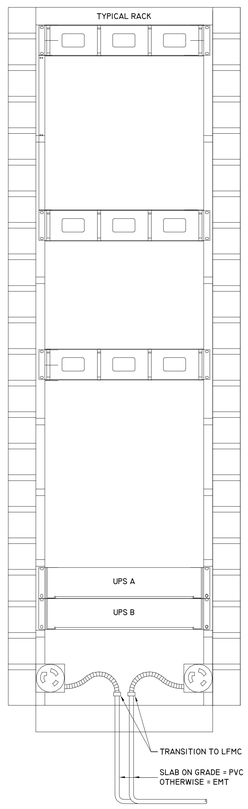
7 ENLARGED PLAN - GYM STORAGE
Scale: 1/2" = 1'-0"



2 MECHANICAL ROOM ENLARGED PLAN
Scale: 1/2" = 1'-0"



1 MEZZANINE PLAN
Scale: 1/4" = 1'-0"



6 RACK OUTLET DETAIL
Scale:NOT TO SCALE

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MEZZANINE AND ENLARGED PLANS

100% Construction Documents
02.29.2024

STATE OF TEXAS
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2024-02-29 #F-4506

MEP2.02

ELECTRICAL SPECIFICATIONS

(BOOKS SPECIFICATIONS SUPERCEDE ANY NOTES BELOW)

1. SCOPE: THIS DIVISION SHALL INCLUDE ALL EQUIPMENT, MATERIALS, AND LABOR REQUIRED FOR COMPLETE INSTALLATION OF THE ELECTRICAL SYSTEM. PROJECT INCLUDES INSTALLATION OF NEW ELECTRICAL DISTRIBUTION SYSTEM, HVAC SYSTEM CONNECTIONS, NEW LIGHTING SYSTEM, NEW RECEPTACLES AND OUTLETS, FIRE ALARM AND NOTIFICATION SYSTEM, AND OTHER ELECTRICAL WORK AS INDICATED ON THE PLANS. CONTRACTOR SHALL PROVIDE CONDUITS, CONDUCTORS FOR POWER, CONTROLS, AND LIGHTING, LIGHTING CONTACTOR AND CONTACT CLOSURES, AND ALL REQUIRED APPARATUS REQUIRED FOR FULL OPERATION OF THE ELECTRICAL SYSTEM.
2. SITE VISIT AND FAMILIARIZATION: CONTRACTORS PROPOSING TO UNDERTAKE WORK UNDER THIS DIVISION SHALL VISIT THE SITE OF THE WORK, AND FULLY INFORM THEMSELVES OF ALL CONDITIONS THAT AFFECT THE WORK, OR COST THEREOF. CONTRACTOR SHALL EXAMINE THE DRAWINGS AND SPECIFICATIONS AS RELATED TO THE SITE CONDITIONS. ANY DISCREPANCY SHALL BE REPORTED TO THE ENGINEER.
3. NOTICE: CONSIDERATION WILL NOT BE GRANTED FOR ANY ALLEGED MISUNDERSTANDING OF THE AMOUNT OF WORK TO BE PERFORMED. TENDER OF A PROPOSAL SHALL CONVEY FULL AGREEMENT TO ALL ITEMS AND CONDITIONS SPECIFIED, INDICATED ON THE DRAWINGS, AND/OR REQUIRED BY NATURE OF THE SITE.
4. DISCREPANCIES: SHOULD CONTRACTOR FIND DISCREPANCIES OR OMISSIONS IN THE CONTRACT DOCUMENTS, OR BE IN DOUBT AS TO THE INTENT THEREOF, HE SHALL IMMEDIATELY OBTAIN CLARIFICATION FROM THE ARCHITECT BEFORE SUBMITTING PROPOSAL FOR WORK IN THIS DIVISION.
5. DEMOLITION: ALL ELECTRICAL COMPONENTS OF THE EXISTING SYSTEM WHICH ARE NOT UTILIZED FOR NEW CONFIGURATION SHALL BE REMOVED AND DISPOSED OF BY CONTRACTOR. REFER TO DEMOLITION NOTES AND DRAWINGS FOR EXTENT OF WORK.
6. TIMELY PLACING OF MATERIALS AND EQUIPMENT: ALL ELECTRICAL APPARATUS SHALL BE INSTALLED AT THE PROPER TIME DURING PROGRESS OF CONSTRUCTION. COORDINATE WORK OPERATIONS WITH OTHER CRAFTS.
7. SPACE REQUIREMENTS: CONTRACTOR FOR WORK UNDER THIS DIVISION SHALL BE FULLY RESPONSIBLE FOR DETERMINING IN ADVANCE OF PURCHASE THAT EQUIPMENT AND MATERIALS PROPOSED FOR INSTALLATION SHALL FIT INTO THE CONFINES INDICATED.
8. MANUFACTURERS' LITERATURE: DELIVER ALL PRINTED TAGS, INSTRUCTIONS, CERTIFIED DRAWINGS, PARTS LISTED, CERTIFICATES, ETC., SUPPLIED WITH EQUIPMENT ITEMS, TO THE OWNER.
9. CODES, PERMITS, AND FEES: WORK UNDER THIS DIVISION SHALL BE CONSTRUCTED IN STRICT CONFORMANCE WITH PERTINENT PROVISIONS OF CITY AND STATE BUILDING CODES.
   - A. ALL WORK SHALL COMPLY WITH THE 2023 EDITION OF NATIONAL ELECTRIC CODE (NEC).
   - B. OBTAIN ALL REQUIRED PERMITS. PAY ALL LEGAL FEES FOR PERMITS AND INSPECTIONS BY AUTHORITIES HAVING JURISDICTION.
   - C. ALL WORK SHALL COMPLY WITH REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.
10. CUTTING AND PATCHING:
    - A. CONTRACTOR FOR THIS DIVISION SHALL LAYOUT TO DIMENSION AND LOCATIONS, CUT AND PATCH ALL OPENINGS ON SURFACES TO BE FORMED, FRAMED, OR CUT.
    - B. SHOULD CONTRACTOR FOR THIS DIVISION FAIL TO ADHERE WITH THIS REQUIREMENT, AS WORK PROGRESSES, ANY OPENINGS SHALL BE CUT AND PATCHED BY GENERAL CONTRACTOR AT THE EXPENSE OF THIS CONTRACTOR FOR THIS DIVISION.
11. PROTECTION OF APPARATUS: TAKE ALL PRECAUTIONS NECESSARY FOR PROPER PROTECTION OF NEW EQUIPMENT, APPARATUS, AND MATERIALS FROM DAMAGE. FAILURE TO DO SO WILL BE CAUSE FOR REJECTION OF ANY ITEM COMING UNDER QUESTION.
12. SHOP DRAWINGS: CONTRACTOR FOR THIS DIVISION SHALL SUBMIT SHOP DRAWINGS AND CATALOGUE DATA ON ALL MAJOR ITEMS OF EQUIPMENT AND SYSTEMS AND OTHER MATERIAL REQUESTED BY ARCHITECT/ENGINEER. SUBMIT PRODUCT DATA FOR SWITCHBOARDS, PANELBOARDS, TRANSFORMERS, WIRES, CABLE, SUPPORTING DEVICES, IDENTIFICATION COMPONENTS, LIGHT FIXTURES, FIRE ALARM SYSTEM AND COMPONENTS, WIRING DEVICES, MULTI-OUTLET RACEWAYS, CABINETS, AND BOXES. SUBMIT SIX COPIES WITHIN THIRTY (30) DAYS AFTER CONTRACT AWARD, AND IN NOT MORE THAN TWO GROUPS OF SUBMITTALS. SUBMITTALS SHALL CONSIST OF LAYOUTS, WORKING DRAWINGS, CUTS, AND OPERATING AND PERFORMANCE DATA. ALLOW FOUR (4) WEEKS FOR REVIEW AND APPROVAL OF THE SHOP DRAWINGS BY ENGINEER.
13. MATERIALS AND WORKMANSHIP: ALL MATERIALS AND EQUIPMENT SHALL BE NEW, OF BEST GRADE OF STANDARD MANUFACTURE. APPROVED BY UL, AND BE SO LABELED. FOR WIRE AND CABLE, MARKED AS REQUIRED BY ART. 310-2, NEC. INSTALLED BY SKILLED ELECTRICIAN, WORKING UNDER THE DIRECT SUPERVISION OF COMPETENT EXPERIENCED FOREMAN AND/OR SUPERINTENDENT. PRODUCTS SHALL BE INSTALLED IN A THOROUGH WORKMANLIKE MANNER, PRESENTING A NEAT, CLEAN-CUT APPEARANCE WHEN COMPLETED. ANY PART OR PARTS NOT MEETING THIS REQUIREMENT SHALL BE REPLACED OR REBUILT WITHOUT EXTRA EXPENSE TO OWNER.
14. PROTECTION OF EXISTING: PLENUM CABLE SHALL BE PROPERLY SECURED ABOVE CEILING PER APPLICABLE CODES.
15. WIRING METHODS: THE DRAWINGS ARE DIAGRAMMATIC AND ARE INTENDED TO SHOW THE LOCATIONS OF EQUIPMENT AND ARRANGEMENT OF CIRCUITS ONLY. EXACT LOCATIONS SHALL BE DETERMINED BY ACTUAL MEASUREMENT AT THE SITE. CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ALL RISES, DROPS, OFFSETS, ETC. NECESSARY TO AVOID CONFLICT WITH STRUCTURAL MEMBERS, AND SIMILAR ITEMS, WHEN INSTALLING ELECTRICAL CONDUITS. INSTALL EXPOSED CONDUIT AS SHOWN OR NOTED, PARALLEL TO HORIZONTAL AND VERTICAL LINES OF STRUCTURES. MAKE BENDS WITH 90 DEGREE TURN ONLY, OR WITH APPROVED FITTINGS.
16. CONDUIT: FURNISH A COMPLETE RACEWAY SYSTEM FOR BUT NOT LIMITED TO FEEDER, BRANCH CIRCUITS, CONTROL WIRING, AND AUXILIARY SYSTEM WIRING.
    - A. USE LIQUID TIGHT FLEXIBLE METAL CONDUIT AND FITTINGS FOR ALL MOTORIZED CONNECTIONS, WHERE EQUIPMENT IS SUBJECT TO MOVEMENT, OR LOCATED OUTDOOR.
    - B. WHERE ENTERING PANELS, PULL BOXES, J-BOXES, OR OUTLET BOXES, SECURED IN PLACE WITH WITH LOCK-NUTS INSIDE AND OUTSIDE, AND INSULATED BUSHING INSIDE.
    - C. BENDS AND OFFSETS MADE WITH APPROVED TOOLS ONLY. BENDS OR OFFSETS IN WHICH THE PIPE IS CRUSHED OR DEFORMED SHALL NOT BE INSTALLED.
    - D. USE EMT FOR INTERIOR DRY LOCATIONS, PVC FOR UNDERGROUND INSTALLATION, AND RIGID GALVANIZED STEEL FOR EXPOSED LOCATIONS SUBJECT TO DAMAGE.
17. OUTLET AND JUNCTION BOXES: FURNISH AND INSTALL ALL JUNCTION BOXES REQUIRED TO FACILITATE INSTALLATION OF THE VARIOUS CONDUIT SYSTEMS. JUNCTION BOXES SHALL BE SUITABLE FOR ENVIRONMENT AND APPLICATION USED FOR.
18. WIRE AND CABLE: ALL WIRE AND CABLE SHALL:
    - A. BE NEW AND OF SOFT DRAWN, ANNEALED, COPPER HAVING A CONDUCTIVITY OF NOT LESS THAN 98% OF THAT OF PURE COPPER; EACH WIRE CONTINUOUS WITHOUT WELD, SPLICE OR JOINT THROUGHOUT ITS LENGTH; UNIFORM IN CROSS SECTION AND FREE FROM FLAWS, SCALES, AND OTHER IMPERFECTIONS.
    - B. UNLESS OTHERWISE SPECIFIED OR NOTED, WIRES SHALL BE #12 AWG (FOR PHASE, NEUTRAL, AND GROUND CONDUCTORS) TYPE THW, THWN, THHN, AS MANUFACTURED BY TRIANGLE, GENERAL ELECTRIC, OKONITE, OR ANACONDA.
    - C. ALL WIRE #8 AND LARGER SHALL BE STRANDED.
    - D. NOT BE DRAWN INTO A CONDUIT UNTIL ALL WORK WHICH MAY CAUSE INJURY TO INSULATION IS COMPLETE. WHERE TWO OR MORE CIRCUITS RUN TO A SINGLE OUTLET BOX, TAG EACH CIRCUIT AS A GUIDE.
    - E. HAVE ALL STRANDED CONDUCTORS FURNISHED WITH COPPER CONNECTING LUGS, DRILLED, OR REAMED THE FULL DIAMETER OF THE BARE CONDUCTORS. MAINS AND FEEDERS SHALL BE RUN THEIR ENTIRE LENGTH IN CONTINUOUS PIECES WITHOUT JOINTS OR SPLICES.
19. IDENTIFICATION OF CONDUCTORS AND PANELBOARD ELEMENTS:
    - A. EACH AND EVERY MAIN AND FEEDER CONDUCTOR SHALL BE IDENTIFIED AT EACH OUTLET POINT WHERE SUCH CONDUCTOR TERMINATES. FEEDER BUNDLES PASSING THROUGH A JUNCTION OR SUPPORT BOX SHALL ALSO BE IDENTIFIED WITHIN SUCH ENCLOSURE, BUT MAY BE IDENTIFIED IN SUCH LOCATIONS AS A GROUP.
    - B. IDENTIFY BY USE OF PERMANENT TYPE BANDS, BRADY, OR T AND B. A DEFINITE NUMBER AND/OR LETTER CODE SHALL BE EMPLOYED AND BE UNIFORM THROUGHOUT EACH CONDUCTOR.
    - C. IDENTIFY EACH SWITCH, INCLUDING MAIN DISCONNECT AND MOTOR STARTER WITH WHITE-ON-BLACK NAMEPLATE, EACH HAVING 1/4" HIGH LETTERS. NEATLY AND SECURELY ADHERE NAMEPLATES TO THE UNIT.
20. SWITCHES: FURNISH AND INSTALL ALL FUSIBLE AND NON-FUSIBLE SWITCHES AS REQUIRED BY CODES, WHETHER OR NOT SHOWN AND/OR NOTED. SWITCHES SHALL BE:
    - A. HEAVY DUTY WITH NEMA-1 OR 3R ENCLOSURE, AS REQUIRED, AND BE PROVIDED WITH PAD-LOCKING FEATURE.
    - B. PROVIDED AT EACH MOTOR THAT IS OUT OF SIGHT OF THE SWITCH OR PANEL FROM WHICH FED; AND BE NON-FUSIBLE DISCONNECT FOR SUCH USE.
    - C. SWITCH MANUFACTURER SHALL BE GE, WESTINGHOUSE, OR SQUARE D.
    - D. DISCONNECT SWITCHES INSTALLED OUTSIDE THE BUILDING SHALL BE IN NEMA-3 ENCLOSURES.
    - E. FUSIBLE SWITCH-STARTER UNITS: EACH UNIT SHALL BE TOTALLY ENCLOSED AND EFFECTIVELY BARRIERED, MANUALLY OPERATED QUICK-MAKE, QUICK BREAK, HORSEPOWER RATED STARTER. PROVIDE CLASS R TYPE REJECTION FUSE CLIPS.
    - F. IDENTIFY EACH DEVICE WITH NAMEPLATE SHOWING THE LOAD SERVED, MATCHING THE EXISTING NAMEPLATES.
21. WIRING DEVICES: FURNISH AND INSTALL ALL WIRING DEVICES AS INDICATED ON THE DRAWINGS. DEVICES SHALL IN ALL CASES BE SUITABLE FOR THE USE INTENDED AND SHALL HAVE VOLTAGE AND CURRENT RATINGS ADEQUATE FOR THE LOADS TO BE SERVED.
    - A. MOUNTING: HEIGHTS OF ALL DEVICES ARE FROM FINISH FLOOR TO CENTERLINE OF DEVICE. DEVICES SHOWN ON THE DRAWINGS IN GROUPS OF TWO OR MORE SHALL BE LOCATED HORIZONTALLY IN SUCH A MANNER AS TO BE CLOSE AS POSSIBLE FROM THE CENTERLINE OF THE FIRST DEVICE TO THE CENTERLINE OF THE NEXT DEVICE UNLESS OTHERWISE NOTES.
    - B. WALL SWITCHES: SHALL BE LEVITON DECORA TYPE, WHITE IN COLOR. USE CORRESPONDING DOUBLE POLE, THREE-WAY, FOUR-WAY, KEYED AND DIMMER SWITCHES WHERE NOTES. MOUNT AT 3'-10" A.F.F. AND WITHIN 6" OF ADJACENT DOOR JAMB, UNLESS OTHERWISE NOTED. USE "KEYED" SWITCHES IN LOCATIONS INDICATED.
    - C. STANDARD RECEPTACLES: SHALL BE GROUNDING TYPE, 20 AMP, 125 VOLT, NEMA 5-20R, WHITE COLOR, DUPLEX. WEATHERPROOF DUPLEX OUTLETS SHALL GFCI EQUAL OF STANDARD WITH IN-USE RATED WEATHERPROOF PLATE. MOUNT AT 18" A.F.F., UNLESS OTHERWISE NOTED. PROVIDE SPECIFICATION (SPEC) GRADE HEAVY DUTY STRAIGHT BLADE DEVICES. PROVIDE TAMPER RESISTANT WHERE REQUIRED BY NEC.
    - D. ACCEPTABLE ALTERNATE MANUFACTURERS: SHALL BE LSI, H.E. WILLIAMS, HUBBELL, P&S AND BRYANT, PROVIDED THEIR DEVICES ARE OF THE SAME TYPE AND QUALITY AND THAT ONLY ONE MANUFACTURER SHALL BE USED THROUGHOUT THE WORK.
    - E. PLATES: SHALL BE MATCHING TYPE FOR FINISHED AREAS AND GALVANIZED STEEL FOR AREAS WITH EXPOSED CONDUIT. PROVIDE STAINLESS STEEL PLATES FOR FLUSH MOUNTED DEVICES. PROVIDE CAST ALUMINUM WET LOCATION TYPE COVER PLATES WITH HINGED COVERS FOR DEVICES LOCATED OUTSIDE. GANG OUTLETS GROUPED TOGETHER UNDER A SINGLE WALL PLATE.
    - F. INCANDESCENT DIMMERS: 120V SLIDE TO OFF, DECORA STYLE SIMILAR TO SWITCHES, WITH WATTAGE AS REQUIRED PER MANUFACTURER'S RECOMMENDATIONS. POWER FAILURE MEMORY. RFI SUPPRESSION. WHERE SWITCHES ARE SHOWN NEXT TO DIMMERS, PROVIDE MULTI-GANG COVER PLATES. PROVIDE DIMMERS WITH IVORY FINISH, SAME AS SWITCHES UNLESS OTHERWISE DIRECTED.
    - G. INSTALL WIRING DEVICES AND ACCESSORIES PLUMB AND LEVEL, IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS, APPLICABLE REQUIREMENTS OF NEC AND IN ACCORDANCE WITH RECOGNIZED INDUSTRY PRACTICES TO FULFILL PROJECT REQUIREMENTS.
    - H. TIGHTEN CONNECTORS AND TERMINALS, INCLUDING SCREWS AND BOLTS, IN ACCORDANCE WITH EQUIPMENT MANUFACTURER'S PUBLISHED TORQUE VALUES FOR WIRING DEVICES.
    - I. COORDINATE WITH OTHER WORK, INCLUDING PAINTING, ELECTRICAL BOXES AND WIRING INSTALLATIONS, AS NECESSARY TO INTERFACE INSTALLATION OF WIRING DEVICES WITH OTHER WORK.
    - J. INSTALL WIRING DEVICES AFTER WIRING WORK IS COMPLETED. INSTALL ONLY IN ELECTRICAL BOXES THAT ARE CLEAN; FREE FROM EXCESS BUILDING MATERIALS, DIRT, AND DEBRIS. INSTALL WALL PLATES AFTER PAINTING WORK IS COMPLETED.
    - K. NO RECEPTACLE OR SWITCH OUTLETS SHALL BE MOUNTED BACK TO BACK. A MINIMUM OF ONE (1) STUD MUST BE BETWEEN OUTLETS.
    - L. INSTALL RECEPTACLES WITH GROUND PIN UP. INSTALL SWITCHES WITH THE "ON" POSITION UP.
    - M. ALL EXTERIOR DEVICES TO BE WEATHER PROOF AND EXTERIOR RECEPTACLES SHALL BE A GFCI TYPE DEVICE.
    - N. ALL 120-VOLT RECEPTACLES OUTLETS LOCATED WITHIN SIX FEET OF SINKS SHALL HAVE GROUND FAULT CIRCUIT INTERRUPTION PROTECTION. GROUND FAULT OUTLETS SHALL BE CONNECTED ON DEDICATED NEUTRAL WIRE SERVING ONLY THE INDIVIDUAL OUTLET WITH THE GROUND FAULT PROTECTION.
    - O. USE JUMBO SIZE WALL PLATES FOR OUTLETS INSTALLED IN MASONRY WALLS.
    - P. DO NOT SHARE NEUTRAL CONDUCTORS ON DIMMERS.
22. PANELBOARD: PANELBOARDS SHALL BE GE TYPE AL, AQ, OR AE OR APPROVED EQUAL. REFER TO CONSTRUCTION DOCUMENTS FOR THE TYPE AND NUMBER OF BRANCH CIRCUIT BREAKERS. ALL PANELBOARD BUSSING SHALL BE COPPER. PANELBOARDS SHALL BE IN OUTDOOR ENCLOSURE WHERE INSTALLED OUTDOOR. MINIMUM INTERRUPTING RATING FOR PANELS SHALL BE AS INDICATED ON DRAWINGS.
23. TRANSFORMERS: DRY TYPE, TWO_WINDING OF THE SIZE AND ELECTRICAL CHARACTERISTICS SHOWN AND SCHEDULED ON DRAWINGS. TRANSFORMERS SHALL BE EQUIPPED WITH 2 2-1/2% TAPS ABOVE AND BELOW RATING. TRANSFORMERS SHALL HAVE A BONDING JUMPER INSTALLED BETWEEN THE SECONDARY NEUTRAL TERMINAL AND METAL CASE, AND SHALL INCLUDE A GROUND TERMINAL OF PROPER SIZE TO RECEIVE GROUND CONDUCTOR. TRANSFORMERS SHALL BE RATED AT FULL LOAD IN A 40°C AMBIENT WITH 30°C ULTIMATE HOT SPOT TEMPERATURE RISE ALLOWANCE, WITH CLASS F INSULATION HAVING A UL 185°C RATING LIMITING SYSTEM TEMPERATURE TO 115°C ON UNITS SMALLER THAN 15 kVA AND CLASS H INSULATION HAVING UL 220°C RATING LIMIT SYSTEM TEMPERATURE TO 150°C ON 15 kVA AND LARGER UNITS. PROVIDE COPPER WINDINGS.
24. FUSES: FUSES IN MAIN, FEEDER, AND BRANCH CIRCUIT SWITCHES, RATED 600 AMPS AND BELOW, FEEDING MOTORS, TRANSFORMERS, AND GENERAL PURPOSE CIRCUITS (UNLESS OTHERWISE SPECIFIED), SHALL BE UL LISTED AND LABELED AS CURRENT LIMITING, TIME-DELAY, 200,000 A.I.C., CLASS RK-5 FUSES SHALL BE BUSSMAN TYPE FRN-R (250V), AND FRS-R (600V).
25. GROUNDING: ALL CONDUIT WORK, MOTOR, STARTERS, AND OTHER ELECTRICAL EQUIPMENT WIRED AND CONNECTED BY THIS CONTRACTOR SHALL BE EFFECTIVELY AND PERMANENTLY GROUNDED IN FULL ACCORDANCE WITH NEC 250.
26. OTHER MATERIALS: FURNISH AND INSTALL ALL OTHER MATERIALS SUCH AS HARDWARE, TAPE, CLAMPS, CONNECTORS, FITTINGS, SUPPORTS, AND ALL OTHER APPURTENANCES REQUIRED TO COMPLETE THE WORK TO THE FULL INTENT OF THE CONTRACT. TERMINAL LUGS SHALL BE FURNISHED BY THE ELECTRICAL CONTRACTOR.
27. ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR ALL TEMPERATURE, CO2, AND HUMIDITY SENSOR STUB-UPS FOR THE MECHANICAL HVAC SYSTEM. REFER TO MECHANICAL PRINTS FOR SENSOR QUANTITY AND LOCATIONS.
28. ELECTRICAL CONTRACTOR WILL CONNECT ALL LOW VOLTAGE PLUMBING CONTRACTOR SUPPLIED TRANSFORMERS (FOR AUTOMATIC FLUSH) TO THE NEAREST 120V CIRCUIT (OR IF INDICATED ON PLANS WITH A CIRCUIT NUMBER). CONTRACTOR TO ASSUME ONE TRANSFORMER PER BATHROOM. THE PLUMBING CONTRACTOR WILL BE RESPONSIBLE FOR LOW VOLTAGE WIRING TO THE FIXTURES.
29. SWITCHGEAR AND DISTRIBUTION PANELS: SHALL BE FIELD MARKED TO WARN QUALIFIED PERSONS OF POTENTIAL ELECTRIC ARC FLASH HAZARDS. THE MARKING SHALL BE LOCATED SO AS TO BE CLEARLY VISIBLE TO QUALIFIED PERSONS BEFORE EXAMINATION, ADJUSTMENT, SERVICING, OR MAINTENANCE OF THE EQUIPMENT, NEC 110.16.
30. ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR COORDINATING THE LOCATIONS OF ALL GTD'S (GENERATOR TRANSFER DEVICES), LIGHTING CONTROL EQUIPMENT, LOW VOLTAGE TRANSFORMERS AND OTHER ELECTRICAL ITEMS WHICH ARE ABOVE CEILINGS. THESE DEVICES SIMILAR TO ELECTRICAL JUNCTION BOXES ARE NOT ALLOWED BY NEC TO BE ABOVE HARD CEILINGS. THE ARCHITECT/OWNER WILL NOT ALLOW THE INSTALLATION OF ACCESS PANELS IN THE CEILINGS. BE AWARE THAT EQUIPMENT IN THOSE AREAS OF HARD CEILINGS WILL HAVE TO BE REMOTELY LOCATED TO THE NEAREST ACOUSTICAL LAY-IN CEILING AREAS.
31. ELECTRICAL MATERIAL AND EQUIPMENT: NO ELECTRICAL MATERIALS, APPARATUS, DEVICES, APPLIANCES, FIXTURES, OR EQUIPMENT SHALL BE SOLD OR INSTALLED IN THE CITY UNLESS THEY ARE IN CONFORMANCE WITH THE PROVISIONS OF THIS CODE, THE LAWS OF THE STATE OF TEXAS AND ANY APPLICABLE RULES AND REGULATIONS ISSUED UNDER THE AUTHORITY OF THE STATE STATUTES. THE MAKER'S NAME, TRADEMARK, OR OTHER IDENTIFICATION SYMBOL SHALL BE PLACED ON ALL ELECTRICAL MATERIALS, APPARATUS, DEVICES, APPLIANCES, FIXTURES, AND EQUIPMENT USED OR INSTALLED UNDER THE PROVISIONS OF THIS CODE. ALL ELECTRICAL MATERIALS AND EQUIPMENT SHALL BE LISTED AND LABELED FOR THE INTENDED USE AND SHALL BE INCLUDED IN A LIST PUBLISHED BY AN APPROVED AGENCY.
32. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR COORDINATING ALL CONDUIT ROUTING TO ANY MECHANICAL ROOF TOP EQUIPMENT AND ROUTE THE CONDUIT THRU THE EQUIPMENT CURB SO THERE IS NOT A SEPARATE ROOF PENETRATION.

ELECTRICAL SYMBOL LEGEND

SYMBOL	DESCRIPTION
PANEL-XX	HOME RUN TO INDICATED PANEL AND CIRCUIT NUMBER REFER TO PANEL SCHEDULE FOR BRANCH CIRCUIT INFORMATION, INCLUDING: BREAKER RATING, WIRE SIZE/QUANTITY, AND CONDUIT SIZE/TYPE
XX	ROUND LUMINAIRE RECESSED OR SUSPENDED FROM ABOVE OPEN = DOWN-LIGHT, HALF-SHADED = WALL-WASHER XX = TYPE ON LUMINAIRE SCHEDULE
XX	ROUND WALL-MOUNTED LUMINAIRE SUSPENDED FROM SIDE ARM XX = TYPE ON LUMINAIRE SCHEDULE
XX	24"X48" TROFFER LUMINAIRE RECESSED OR SUSPENDED FROM ABOVE XX = TYPE ON LUMINAIRE SCHEDULE
XX	EXTERIOR POLE-MOUNTED AREA LIGHT, NUMBER OF HEADS AND SEPARATION ANGLE AS INDICATED ON PLANS AND LUMINAIRE SCHEDULE XX = TYPE ON LUMINAIRE SCHEDULE
X1 X2	EXIT SIGN WITH DIRECTIONAL ARROWS AS INDICATED, 1 OR 2 FACE, UNIVERSAL MOUNT X1 OR X2 = TYPE ON LUMINAIRE SCHEDULE, ALL WITH NICKEL/CADMIUM 90 MINUTE BATTERY BACKUP WITH INTEGRAL TEST SWITCH AND CHARGE INDICATOR LED
XX	EMERGENCY EGRESS ONLY LUMINAIRE SURFACE MOUNTED FROM BACK XX = TYPE ON LUMINAIRE SCHEDULE
	NEMA 5-20R DUPLEX RECEPTACLE, MOUNTED 18" AFF (UON) WP = WEATHER PROOF, GFI = GFCI PROTECTED, IG = ISOLATED GROUND PROVIDE WITH SS-302 COVERPLATE AND ENGRAVED CIRCUIT NUMBER
	NEMA 5-20R QUADRAPLEX RECEPTACLE, MOUNTED 18" AFF (UON) WP = WEATHER PROOF, GFI = GFCI PROTECTED, IG = ISOLATED GROUND PROVIDE WITH SS-302 COVERPLATE AND ENGRAVED CIRCUIT NUMBER
	NEMA 5-20R GFCI PROTECTED RECEPTACLE WITH INTEGRAL TEST AND RESET SWITCH DUPLEX AND QUADRUPLEX AS INDICATED PROVIDE WITH SS-302 COVERPLATE AND ENGRAVED CIRCUIT NUMBER
L6-30R	SIMPLEX RECEPTACLE, MOUNTED 18" AFF (UON) WITH INDICATED CONFIGURATION (E.G. L6-30R = NEMA TWISTLOCK, 250 VAC, 30 A) PROVIDE WITH SS-302 COVERPLATE AND ENGRAVED CIRCUIT NUMBER
	FLUSH FLOOR BOX WITH WIRING DEVICES AS INDICATED ON PLANS HUBBELL SYSTEM ONE ONLY
J	JUNCTION BOX
$XX	LIGHT SWITCH RATED 120/277 VAC, MOUNTED 42" AFF (UON), SINGLE-POLE (UON) 2 = 2-POLE, 3 = 3-WAY, 4 = 4-WAY, D = DIMMER, M = MOTOR-RATED W/ OL, WP = WEATHER PROOF, R = RED COLOR, K = KEYED, VS = INTEGRAL VACANCY SENSOR, OS = INTEGRAL OCCUPANCY SENSOR PROVIDE WITH SS-302 COVERPLATE AND ENGRAVED CIRCUIT NUMBER
OS DR	CEILING OR WALL MOUNTED SENSOR LIGHTING CONTROL, DR = DAYLIGHT RESPONSIVE, OS = OCCUPANCY WITH PASSIVE INFRARED AND ULTRASOUND DUAL TECHNOLOGY, 20 A
TV	TV OUTLET 1-GANG BACKBOX, +42" AFF (UON), SS-302 COVER 1" C WITH PULL STRING ROUTED IN CONDUITS BACK TO SERVER ROOM MEASURED DEVICES AND LOW-VOLTAGE CABLING BY TELECOM CONTRACTOR
CR	INTRUSION CARD READER OUTLET 1-GANG BACKBOX, +42" AFF (UON), SS-302 COVER 1" C WITH PULL STRING ROUTED IN CONDUITS BACK TO IT ROOM. DEVICE PROVIDED BY TECHNOLOGY CONTRACTOR, LOW-VOLTAGE CABLING BY TELECOM CONTRACTOR.
XX	DEVICES AND LOW-VOLTAGE CABLING BY TELECOM CONTRACTOR. XX - DENOTES NUMBER OF CAT6E CABLES
KP	INTRUSION KEYPAD OUTLET 1-GANG BACKBOX, +42" AFF (UON), SS-302 COVER 1" C WITH PULL STRING ROUTED IN CONDUITS BACK TO IT ROOM. DEVICE PROVIDED BY TECHNOLOGY CONTRACTOR, LOW-VOLTAGE CABLING BY TELECOM CONTRACTOR.
EPO	EMERGENCY POWER OFF, MUSHROOM HEAD, MAINTAINED CONTACT PUSH BUTTON
PC	PHOTOELECTRIC SENSOR AIMED NORTH
TC	TIME CLOCK, ASTRONOMIC/MULTI-POLE CONTACTOR INTERMATIC #ET1125C FOR EF AND #ET2115C FOR SITE LIGHTING
M	POWER COMPANY POWER METER
HA	LIGHTING CLASS PANEL HA = PANEL NAME CHARACTERISTICS AS INDICATED ON ONE LINE DIAGRAM AND PANEL SCHEDULE
DA	DISTRIBUTION CLASS PANEL DA = PANEL NAME CHARACTERISTICS AS INDICATED ON ONE LINE DIAGRAM
	CONDUIT TURNING UP CONDUIT TURNING DOWN
OH	WEATHER HEAD FOR CONNECTING OVER HEAD CONDUCTORS
	20" Cu CHATWORTH GROUNDING BUSBAR 40153-020 TMGB PATTERN, 4" W x 1/4" H, 20"L, INSULATED STANDOFFS, PRE-DRILLED & TAP AS REQUIRED FOR CONDUCTORS, #2/0 Cu/RHW-2 GREEN INSULATED WIRE IN 1"C IMC BACK TO MAIN BUILDING GROUND SYSTEM
EPM	SHARK 250V4 POWER AND QUALITY METER, PROVIDE INTERFACE TO BAS SYSTEM AND ETHERNET CARD FOR MONITORING, PROVIDE ENCLOSURE WITH FUSES AND SHORTING BLOCKS
LC CHA 24 COIL 277 VAC 30 AS 12 P NEMA-1	LIGHTING CONTACTOR CHA = CONTACTOR NAME, COIL = COIL CONTROL VOLTAGE, VAC = VOLTAGE RATING, AS = CURRENT RATINGS, P = POLE COUNT, NEMA-# = ENCLOSURE TYPE
240 VAC 60 AF 60 AT CB 3 P NEMA-1	CIRCUIT BREAKER, MOLDED-CASE, THERMO-MAGNETIC (UON) VAC = VOLTAGE RATING, AF = FRAME SIZE, AT = TRIP SETTING, P = POLE COUNT, NEMA- = ENCLOSURE TYPE (WHEN APPLICABLE)
240 VAC 60 AF 60 AF 3 P NEMA-1	DISCONNECT SWITCH VAC = VOLTAGE RATING, AS = SWITCH CURRENT RATING AF = FUSE SIZE/TYPE (E.G. DETD), NF = NON-FUSIBLE P = POLE COUNT, NEMA- = ENCLOSURE TYPE (WHEN APPLICABLE)
240 VAC 60 AF 40 AT #1 3 P NEMA-1 HOA	COMBINATION CIRCUIT BREAKER, MOTOR CONTROLLER, AND THERMAL OVERLOAD VAC = VOLTAGE RATING, AF = FRAME SIZE, AT = TRIP SETTING, NEMA-# = MOTOR STARTER SIZE/TYPE (E.G. FVNR), HOA = SELECTOR SWITCH TYPE, P = POLE COUNT, NEMA- = ENCLOSURE TYPE (WHEN APPLICABLE)

SYMBOL	DESCRIPTION
TLA DRY-TYPE 480Δ : 208Y/120 VAC 45 kVA NEMA-2	TRANSFORMER = TLA TRANSFORMER NAME TYPE = TRANSFORMER TYPE (E.G. DRY-TYPE, HARMONIC-MITIGATING...), VAC = WINDING VOLTAGES (PRIMARY : SECONDARY), kVA = CONTINUOUS CAPACITY, TAPS = QUANTITY/DEVIATION OF TAPS, RISE = TEMP RISE, INSUL = INSULATION CLASS, WOUND = WINDING MATERIAL/CONFIGURATION, NEMA- = ENCLOSURE TYPE
VFD	VARIABLE FREQUENCY DRIVE WITH INTEGRAL DISCONNECTING MEANS, VFCI
HP	MOTOR, SINGLE OR THREE PHASE HP = HORSE POWER
	EQUIPMENT CONNECTION

ABBREVIATION DEFINITIONS

2SIW	TWO-SPEED, ONE-WINDING MOTOR
2S2W	TWO-SPEED, TWO-WINDING MOTOR
(A)	ABANDONED TO REMOVE
A	PHASE "A" IN THREE-PHASE SYSTEM
A	AMPERES
AF	AMPERE FUSE OR FRAME RATING
AFCI	ARC FAULT CIRCUIT INTERRUPTER
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
Ag	SILVER
AL	ALUMINUM
AT	AMPERE TRIP SETTING
Au	GOLD
B	PHASE "B" IN THREE-PHASE SYSTEM
BF	BALLAST FACTOR
BFC	BELOW FINISHED CEILING
BFF	BELOW FINISHED FLOOR
BFG	BELOW FINISHED GRADE
C	PHASE "C" IN THREE-PHASE SYSTEM
C	CONDUIT
CB	CIRCUIT BREAKER
CH	CONSTANT HORSE POWER (2SIW MOTOR)
CKT	CIRCUIT
CS	COMBINATION STARTER (MOTOR STARTER / DISCONNECT)
CT	CONSTANT TORQUE (2SIW MOTOR)
CT	CURRENT TRANSFORMER
Cu	COPPER
(D)	EXISTING TO BE DEMOLISHED AND REMOVED
DETD	DUAL ELEMENT, TIME DELAY
DS	DISCONNECT SWITCH
(E)	EXISTING TO REMAIN
EGC	EQUIPMENT GROUNDING CONDUCTOR
EMT	ELECTRICAL METALLIC TUBING
EPM	ELECTRONIC POWER METER
EPR	ETHYLENE PROPYLENE RUBBER
FAAP	FIRE ALARM ANNUNCIATOR PANEL
FACP	FIRE ALARM CONTROL PANEL
Fe	IRON
FRP	FIBERGLASS REINFORCED POLYESTER
FVNR	FULL VOLTAGE NON-REVERSING
G	GROUND
GEC	GROUNDING ELECTRODE CONDUCTOR
GFI/GFCI	GROUND FAULT CIRCUIT INTERRUPTER
HMT	HARMONIC-MITIGATING TRANSFORMER
HOA	HAND / OFF / AUTO SWITCH (FOR FVNR CONTACTOR)
HLOA	HIGH / LOW / OFF / AUTO (FOR 2SIW OR 2S2W CONTACTOR)
IG	ISOLATED GROUND
IMC	INTERMEDIATE METAL CONDUIT
J/R	JAMMING RATIO
kAIC	KILO AMPERE INTERRUPTING CAPACITY
KCMIL	KILO CIRCULAR MILS
kVA	KILO VOLT AMPERES COMPLEX OR APPARENT POWER
kVAR	KILO VOLT AMPERES REACTIVE POWER
kW	KILO WATT REAL POWER
L1, L2	HOT LEG 1, 2 IN SINGLE-PHASE SYSTEM < 250 VAC
LSI+G	LONG TERM, SHORT TERM, INSTANTANEOUS, AND GROUND-FAULT
MCB / MF	MAIN CIRCUIT BREAKER / MAIN FUSE
MCC	MOTOR CONTROL CENTER
MLO	MAIN LUGS ONLY
(N)	NEW
N	NEUTRAL
NEC	NATIONAL ELECTRICAL CODE (NFPA 70)
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NF	NON-FUSIBLE
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NSL	NON-SWITCHED HOT LEG
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
OS	OCCUPANCY SENSOR
P	POLES
PC	POLYCARBONATE
PF	POWER FACTOR
PFCC	POWER FACTOR CORRECTION CAPACITOR
PVC	POLY VINYL CHLORIDE (RNC CONDUIT)
PVDF	POLYVINYLIDENE FLUORIDE
PT	POTENTIAL TRANSFORMER
RAL	RIGID ALUMINUM
RGS	RIGID GALVANIZED STEEL
RMC	RIGID METAL CONDUIT
SEC	SECTION OF LIGHTING-CLASS PANEL
SF6	SULFUR HEXAFLOURIDE INSULATING GAS
Sn	TIN
SPD	SURGE PROTECTION DEVICE
SS-xxx	STAINLESS STEEL, "xxx" = ALLOY TYPE (E.G. 304, 316)
ST	SHUNT-TRIP FOR CIRCUIT BREAKER
THD	TOTAL HARMONIC DISTORTION
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
XLPE	CROSS-LINKED POLYETHYLENE
XLPO	CROSS-LINKED POLYOLEFIN
V	VOLTS
VAC	VOLTS, ALTERNATING CURRENT
VDC	VOLTS, DIRECT CURRENT
VFCI	VENDOR FURNISHED, CONTRACTOR INSTALLED
VFD	VARIABLE FREQUENCY DRIVE
VS	VACANCY SENSOR
VT	VARIABLE TORQUE (2SIW MOTOR)
W	WIRES, NOT INCLUDING EGC
WP	WEATHER PROOF
#	AMERICAN WIRE GAGE
Ø	PHASE
μF	MICRO FARAD
Ω	OHMS

GENERAL NOTES:

1. SYMBOL LEGEND MAY CONTAIN SYMBOLS THAT ARE NOT USED ON ALL DRAWINGS.
2. ABBREVIATION DEFINITIONS ARE NOT COMPREHENSIVE, AND NOT ALL ABBREVIATIONS MAY APPLY TO ALL DRAWINGS. SUBMIT FORMAL REQUEST FOR INFORMATION WHEN ENCOUNTERING CONFLICTS OR AMBIGUOUS SYMBOLS OR ABBREVIATIONS, AS THESE WILL NOT CONSTITUTE DISMISSAL OF CONTRACTOR RESPONSIBILITY.
3. ALL COVER PLATES FOR RECEPTACLES, SWITCHES, AND DATA SHALL BE SS-302 (UON).
4. PROVIDE DECORA TYPE DEVICES FOR LIGHT SWITCHES AND RECEPTACLES.

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TBPE FIRM REG:#F-4506

TECHNOLOGY CONSULTANT
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3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

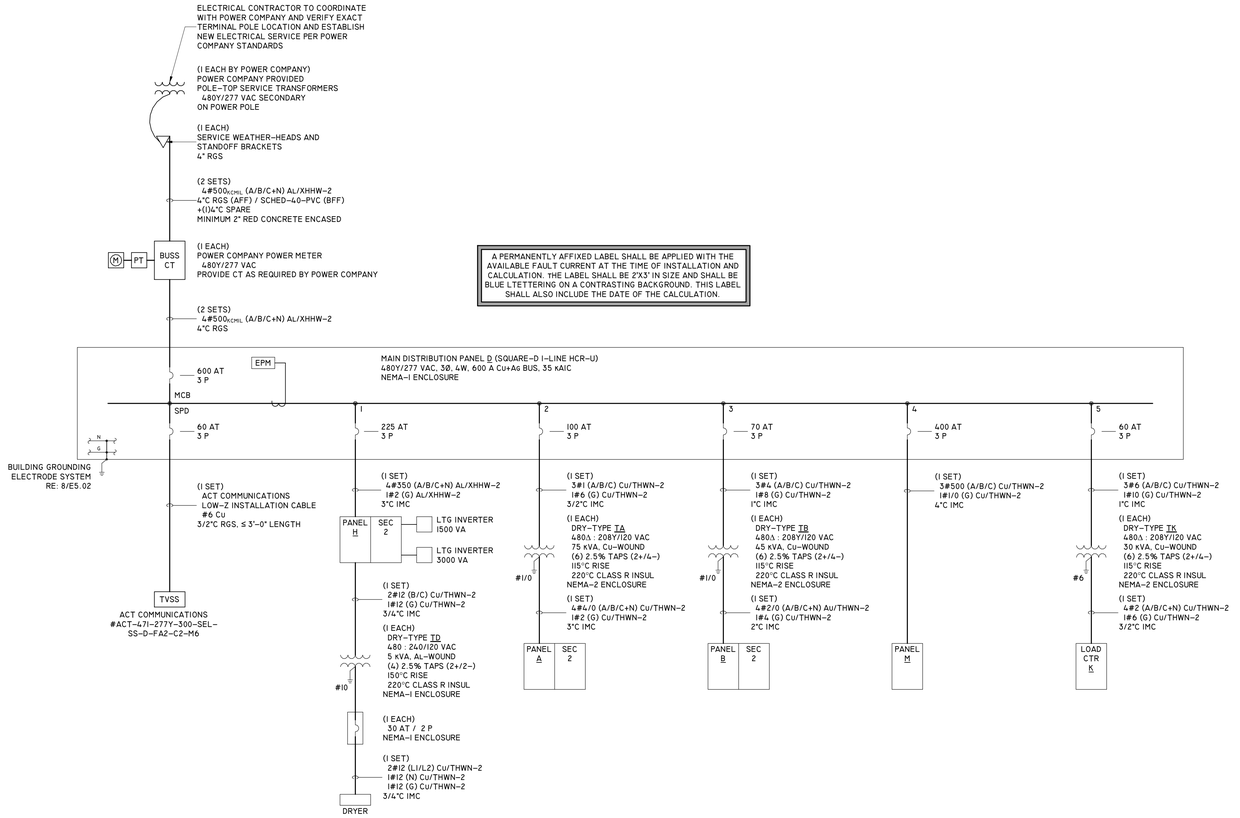
FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

NOTES AND LEGEND

100% Construction Documents
02.29.2024

STATE OF TEXAS
SEVAK KALANTARIANS
97498
LICENSED
PROFESSIONAL ENGINEER
2024-02-29 #F-4506

E0.00



GENERAL SWITCHBOARD NOTES:

1. CONCRETE PAD, 6" ABOVE FINISH GRADE WITH 5/16" RE-BAR PIERS IN FOUR SIDES. MAINTAIN A MINIMUM OF 8" OF POURED CONCRETE PAD ALL AROUND THE SWITCHBOARD.
2. BUS (COPPER) SHALL BE CONTINUOUS RATED. CONSTRUCT THROUGH-BUS OF COPPER WITH SILVER-PLATED CONNECTIONS, WITH AMPACITY RATING, AND WITH SHORT-CIRCUIT CURRENT RATING.
3. NAMEPLATE: PROVIDE SWITCHBOARD WITH ENGRAVED NAMEPLATE INDICATING DESIGNATION, VOLTAGE, AND NUMBER OF PHASES. PROVIDE ENGRAVED ID TAGS (BAKELITE) FOR EACH OVER CURRENT DEVICE INDICATING LOAD SERVED.
4. PROVIDE FULLY RATED COPPER MAIN BUS, FULL CAPACITY NEUTRAL BUS, GROUND BUS FULL LENGTH OF SWITCHBOARD, FIRMLY CONNECTED TO EACH VERTICAL SECTION OF THE SWITCHBOARD.
5. PROVIDE ELECTRIC HEATER IN EACH COMPARTMENT. ELECTRIC HEATER MUST BE PROTECTED BY A DEDICATED FUSE AND CIRCUIT CONDUCTORS.
6. BUS BARS AT LEAST 12" AWAY FROM THE BACK HINGED COVER WITH INSULATED FIRE CARDBOARD. THE BUS BAR ENDS MUST BE INSULATED AND ON THE SIDES WITH INSULATED FIRE CARDBOARD.
7. SURGE PROTECTION: FURNISH AND INSTALL INTERNAL SURGE PROTECTION UNIT CONNECTED TO THE SWITCHBOARD. THE SURGE PROTECTION MUST HAVE AN ISOLATION ENCLOSURE FROM THE REST OF THE EQUIPMENT.
8. SWITCHBOARDS SHALL BE PROVIDED WITH A FULL HINGED FRONT AND BACK COVERS, FULL HEIGHT HINGED REAR COVERS, AND HINGED GUTTER COVERS.

ELECTRICAL ONE-LINE DIAGRAM NOTES:

1. ALL CIRCUIT BREAKERS INDICATED ON ONE LINE DIAGRAM ARE THERMAL-MAGNETIC UNLESS NOTED OTHERWISE AS "ELECTRONIC" EXCLUDING THE MAIN WHICH WILL BE ELECTRONIC AND INSULATED CASE.
2. CIRCUIT BREAKER FRAME SIZES 250 AF AND LARGER SHALL BE ADJUSTABLE TRIP-UNIT TYPE, AND FRAME SIZES LESS THAN 250 AF MAY BE MOLDED-CASE TYPE.
3. PROVIDE CONDUCTORS WITH INSULATION TYPES INDICATED ON ONE LINE DIAGRAM. SUBSTITUTION OF THWN OR THHN IN LIEU OF INDICATED XHHW-2 IS NOT ACCEPTABLE.
4. LOAD SIDE FEEDERS OF INDIVIDUALLY-MOUNTED DISCONNECT SWITCHES AND ENCLOSED CIRCUIT BREAKERS SHALL MATCH LINE SIDE FEEDERS UNLESS LOAD SIDE FEEDER IS SPECIFICALLY INDICATED OTHERWISE.
5. UNDERGROUND FEEDERS SHALL HAVE SCHEDULE-80 PVC CONDUIT BELOW GRADE WITH LONG-SWEEP, TRANSITIONAL ELBOWS TO RGS CONDUIT AT WHEN STUBBING-UP ABOVE GRADE.
6. A PERMANENTLY AFFIXED LABEL SHALL BE APPLIED WITH THE AVAILABLE FAULT CURRENT AT THE TIME OF INSTALLATION AND CALCULATION. THE LABEL SHALL BE 2"X3" IN SIZE AND SHALL BE BLUE LETTERING ON A CONTRASTING BACKGROUND. THIS LABEL SHALL ALSO INCLUDE THE DATE OF THE CALCULATION.

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6. WHERE FEEDER DESCRIPTION IS NOT SHOWN ON LOAD-SIDE OF ELECTRICAL EQUIPMENT, USE SAME FEEDER AS LARGEST LINE-SIDE FEEDERS: EXCEPT, FOR TRANSFORMER SECONDARY USE SIMILAR FEEDER WITH TWO TIMES AMPACITY OF PRIMARY.
7. WHERE PANEL SCHEDULE DOES NOT INDICATE FULLY-RATED SHORT-CIRCUIT WITHSTAND, SERIES-RATED EQUIPMENT WITH MINIMUM 22 KAIC BRANCH BREAKERS MAY BE USED FOR THAT PANEL.

SHORT CIRCUIT CALCULATIONS

Connection		Feeder					Motors [hp]	Impedance							Fault Current	
Source Panel	Target Panel	Conductor		Sets	Length (ft)	Conduit Material		Feeder [μΩ/ft]			Cumulative [mΩ]				Available [A]	Rating [kA]
		AWG	Material					R	jX	X/R	Z	R	jX	X/R		
-	(UTILITY)			N/A			N/A		N/A		39.17	4.86	38.87	8.00	21226	-
(UTILITY)	D	#350	CU	2	300	PVC	-	19.00	20.00	1.05	46.09	10.56	44.87	4.25	18038	22
D	H	#4/0	CU	1	5	IMC	-	63.00	51.00	0.81	46.41	10.87	45.12	4.15	17913	22
D	M	#4/0	CU	1	10	IMC	-	63.00	51.00	0.81	46.73	11.19	45.38	4.06	17790	22

ELECTRICAL LOAD ANALYSIS

Description	Qty		Rate		Total	
Lighting - Office (220.12)	20000	ft²	1.3	VA/ft²	26	kVA
Lighting - Exterior	5	kW	1.25	kVA/kW	6	kVA
Receptacle (220.14-K)	20000	ft²	2	VA/ft²	40	kVA
HVAC Cooling	80	Ton	1.4	kVA/Ton	112	kVA
HVAC Heating	215	kW	1	kVA/kW	215	kVA
HVAC Motors	14	hp	1.3	kVA/hp	18	kVA
Largest Motor	3	hp	0.325	kVA/hp	1	kVA
Miscellanous Equipment	20	kVA	1	Each	20	kVA
Water Heating	45	kW	1	kVA/kW	45	kVA
Total Power					**371**	**kVA**
Total Current at 480Y/277 VAC					**447**	**A**

Utility Transformer Secondary

Parameter	Symbol	Value	Units
System Voltage	VLL	480	VAC
Phases	np	3	ϕ
Rated Power	S	300	KVA
Base Impedance	%Z	1.70%	%Z
Impedance Ratio	X/R	8	Ω/Ω

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FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

ONE LINE DIAGRAM

100% Construction Documents
02.29.2024

STATE OF TEXAS
SEVAK KALANTARIANS
97498
LICENSED
PROFESSIONAL ENGINEER
2024-02-29 #F-4506

E0.10

PANEL: M

LOCATION: ELEC ROOM
FED FROM: D

MTG:		BUS:		OPT:		ENCL:	MAIN:		
X	SURFACE	0%	NEUTRAL	X	INT SPD	NEMA	400 A	BUS	3 ø 3 WIRE
	FLUSH	X	SYS GND		FTL	TYPE 1	CU/SN		35 KAIC
	STRUT		ISO GND		FUSIBLE	STEEL	400 A	MLO	480Δ VOLT

WIRE SIZE	LOAD DESCRIPTION	LOAD TYPE	TRIP RATE / P	CKT NO	A (kVA)		B (kVA)		C (kVA)		CKT NO	P / TRIP RATE	LOAD TYPE	LOAD DESCRIPTION	WIRE SIZE
3-#10, 1-#10, 3/4"C	FCU-B VIA 30AS / NF / 3P / NEMA-1 DS	H	30 / 3	1	5.8	2.9					2	3 / 20	C	CU-2 VIA 30AS / NF / 3P / NEMA-3R DS	3-#12, 1-#12, 3/4"C
				3			5.8	2.9			4				
				5					5.8	2.9	6				
3-#10, 1-#10, 3/4"C	CU-1B VIA 30AS / NF / 3P / NEMA-3R DS	C	25 / 3	7	3.8	2.9					8	3 / 25	C	CU-1A VIA 30AS / NF / 3P / NEMA-3R DS	3-#10, 1-#10, 3/4"C
				9			3.8	2.9			10				
				11					3.8	2.9	12				
3-#6, 1-#10, 1"C	OCU-1 VIA 60AS / NF / 3P / NEMA-3R DS	C	60 / 3	13	13.3	11.1					14	3 / 50	H	OAHU-1 VIA 60AS / NF / 3P / NEMA-1 DS	3-#8, 1-#10, 1"C
				15			13.3	11.1			16				
				17					13.3	11.1	18				
3-#10, 1-#10, 3/4"C	AHU-2 VIA 30AS / NF / 3P / NEMA-1 DS	H	30 / 3	19	6.3	12.8					20	3 / 60	H	AHU-1B VIA 60AS / NF / 3P / NEMA-1 DS	3-#6, 1-#10, 1"C
				21			6.3	12.8			22				
				23					6.3	12.8	24				
3-#6, 1-#10, 1"C	AHU-1A VIA 60AS / NF / 3P / NEMA-1 DS	H	60 / 3	25	12.8	3.6					26	3 / 20	H	FCU-C VIA 30 AS / NF / 3P / NEMA-1 DS	3-#12, 1-#12, 3/4"C
				27			12.8	3.6			28				
				29					12.8	3.6	30				
3-#6, 1-#10, 1"C	EWH-1 VIA 60AS / NF / 3P / NEMA-1 DS	Q	60 / 3	31	15.0	12.0					32	3 / 50	H	AHU-4 VIA 60AS / NF / 3P / NEMA-1 DS	3-#8, 1-#10, 1"C
				33			15.0	12.0			34				
				35					15.0	12.0	36				
3-#8, 1-#10, 1"C	AHU-3 VIA 60AS / NF / 3P / NEMA-1 DS	H	40 / 3	37	8.3	2.9					38	3 / 20	C	CU-B VIA 30AS / NF / 3P / NEMA-3R DS	3-#12, 1-#12, 3/4"C
				39			8.3	2.9			40				
				41					8.3	2.9	42				
3-#10, 1-#10, 3/4"C	CU-3 VIA 30AS / NF / 3P / NEMA-3R DS	C	25 / 3	43	4.0	6.6					44	3 / 40	C	CU-4 VIA 60AS / NF / 3P / NEMA-3R DS	3-#8, 1-#10, 3/4"C
				45			4.0	6.6			46				
				47					4.0	6.6	48				
3-#12, 1-#12, 3/4"C	CU-C VIA 30AS / NF / 3P / NEMA-3R DS	C	20 / 3	49	2.9	--					50	1 / --	--	SPACE	--
				51			2.9	--			52	1 / --	--	SPACE	--
				53					2.9	--	54	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	55	--	--					56	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	57			--	--			58	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	59					--	--	60	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	61	--	--					62	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	63			--	--			64	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	65					--	--	66	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	67	--	--					68	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	69			--	--			70	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	71					--	--	72	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	73	--	--					74	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	75			--	--			76	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	77					--	--	78	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	79	--	--					80	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	81			--	--			82	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	83					--	--	84	1 / --	--	SPACE	--
				Total Load:	121 kVA		121 kVA		121 kVA						
				Total Amps:	436 A		436 A		436 A						

LOAD ANALYSIS

LOAD TYPE		CONNECTED	FACTOR	DEMAND	TOTALS	
LIGHTING	L	0 VA	0.00%	0 VA		
RECEPTACLE	R	0 VA	0.00%	0 VA	CONNECTED LOAD (kVA)	362 kVA
EQUIPMENT	Q	45000 VA	100.00%	45000 VA	DEMAND LOAD (kVA)	258 kVA
COOLING	C	117469 VA	0.01%	12 VA	CONNECTED CURRENT (A)	436 A
HEATING	H	213062 VA	100.00%	213062 VA	DEMAND CURRENT (A)	310 A
MOTOR	M	0 VA	0.00%	0 VA		
LARGEST MOTOR	G	0 VA	0.00%	0 VA		
KITCHEN	K	0 VA	0.00%	0 VA		
EXISTING	X	0 VA	0.00%	0 VA		

NOTES:
ALL WIRING FOR 20A/1P CKT. SHALL CONSIST OF 2#12, 1#12G IN 3/4"C UNLESS OTHERWISE NOTED.
* PROVIDE A BREAKER WITH GFCI ** ROUTE CIRCUIT THROUGH LIGHTING CONTACTOR

PANEL: B

LOCATION: ELEC ROOM
FED FROM: TB

MTG:		BUS:		OPT:		ENCL:	MAIN:		
X	SURFACE	100%	NEUTRAL	X	INT SPD	NEMA	150 A	BUS	3 ø 4 WIRE
	FLUSH	X	SYS GND		FTL	TYPE 1	CU/SN		22 KAIC
	STRUT		ISO GND		FUSIBLE	STEEL	150 A	MCB	208Y/120 VOLT

WIRE SIZE	LOAD DESCRIPTION	LOAD TYPE	TRIP RATE / P	CKT NO	A (kVA)		B (kVA)		C (kVA)		CKT NO	P / TRIP RATE	LOAD TYPE	LOAD DESCRIPTION	WIRE SIZE
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 125	R	20 / 1	1	0.9	0.7					2	1 / 20	R	RECEPTACLES - RM 125	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 125	R	20 / 1	3			1.4	0.7			4	1 / 20	R	RECEPTACLES - RM 125	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 125	R	20 / 1	5					1.4	0.4	6	1 / 20	R	RECEPTACLES - RM 124,125	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLE - RM 126	R	20 / 1	7	0.2	0.4					8	1 / 20	R	RECEPTACLES - RM 124	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 123	R	20 / 1	9			0.5	0.7			10	1 / 20	R	RECEPTACLES - RM 123	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	BASKETBALL GOALS - RM 123	M	20 / 1	11					1.8	0.7	12	1 / 20	R	RECEPTACLES - RM 120	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 123	R	20 / 1	13	0.7	0.2					14	1 / 20	R	* EDH - RM 123	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 122	R	20 / 1	15			0.4	0.4			16	1 / 20	Q	SCOREBOARD - RM 123	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 201	R	20 / 1	17					0.4	0.5	18	1 / 20	Q	BAS CONTROL PANEL - RM 200	1-#12, 1-#12, 1-#12, 3/4"C
2-#12, 1-#12, 1-#12, 3/4"C	UPS RACK - RM 201	R	20 / 2	19	1.3	0.2					20	1 / 20	R	FLUSH SENSORS - RM 121	1-#12, 1-#12, 1-#12, 3/4"C
				21			1.3	0.0			22	1 / 20	L	LIGHTING AND EF - RM 121	1-#12, 1-#12, 1-#12, 3/4"C
2-#12, 1-#12, 1-#12, 3/4"C	UPS RACK - RM 201	R	20 / 2	23					1.3	0.4	24	1 / 20	R	RECEPTACLES - RM 201	1-#12, 1-#12, 1-#12, 3/4"C
				25	1.3	1.5					26	1 / 20	M	MOTORIZED SCREEN - RM 123	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	IRRIGATION CONTROLLER - RM 127	Q	20 / 1	27			0.5	0.2			28	1 / 20	R	OUDOOR WP GFCI RECEPT	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 201	R	20 / 1	29					0.4	0.3	30	2 / 20	Q	CU-D VIA 30AS / NF / 3P / NEMA-3R DS	2-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 201	R	20 / 1	31	0.4	0.3					32				
2-#12, 1-#12, 1-#12, 3/4"C	CU-A VIA 30AS / NF / 2P / NEMA-3R DS	Q	20 / 2	33			0.3	0.4			34	1 / 20	R	SECURITY SWITCH 1 - 201	1-#12, 1-#12, 1-#12, 3/4"C
				35					0.3	0.2	36	1 / 20	R	SECURITY SWITCH 2 - RM 124	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 201	R	20 / 1	37	0.2	0.1					38	1 / 20	M	EF-2 - RM 121	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	A/V CABINET - RM 122	R	20 / 1	39			0.4	1.0			40	1 / 20	Q	FCPS - RM 201	1-#12, 1-#12, 1-#12, 3/4"C
--	SPARE	--	20 / 1	41					0.0	0.0	42	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	43	0.0	0.0					44	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	45			0.0	0.0			46	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	47					0.0	0.0	48	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	49	0.0	0.0					50	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	51			0.0	0.0			52	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	53					0.0	0.0	54	1 / 20	--	SPARE	--
--	SPACE	--	-- / 1	55	--	--					56	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	57			--	--			58	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	59					--	--	60	1 / --	--	SPACE	--
				Total Load:	8 kVA		8 kVA		8 kVA						
				Total Amps:	69 A		69 A		67 A						

LOAD ANALYSIS

LOAD TYPE		CONNECTED	FACTOR	DEMAND	TOTALS	
LIGHTING	L	23 VA	125.00%	29 VA		
RECEPTACLE	R	17240 VA	79.00%	13620 VA	CONNECTED LOAD (kVA)	24 kVA
EQUIPMENT	Q	3806 VA	100.00%	3806 VA	DEMAND LOAD (kVA)	21 kVA
COOLING	C	0 VA	0.00%	0 VA	CONNECTED CURRENT (A)	68 A
HEATING	H	0 VA	0.00%	0 VA	DEMAND CURRENT (A)	58 A
MOTOR	M	3400 VA	100.00%	3400 VA		
LARGEST MOTOR	G	0 VA	0.00%	0 VA		
KITCHEN	K	0 VA	0.00%	0 VA		
EXISTING	X	0 VA	0.00%	0 VA		

NOTES:
ALL WIRING FOR 20A/1P CKT. SHALL CONSIST OF 2#12, 1#12G IN 3/4"C UNLESS OTHERWISE NOTED.
* PROVIDE A BREAKER WITH GFCI ** ROUTE CIRCUIT THROUGH LIGHTING CONTACTOR

PANEL: H

LOCATION: ELEC ROOM
FED FROM: D

MTG:		BUS:		OPT:		ENCL:	MAIN:		
X	SURFACE	100%	NEUTRAL	X	INT SPD	NEMA	225 A	BUS	3 ø 4 WIRE
	FLUSH	X	SYS GND		FTL	TYPE 1	CU/SN		35 KAIC
	STRUT		ISO GND		FUSIBLE	STEEL	225 A	MLO	480Y/277 VOLT

WIRE SIZE	LOAD DESCRIPTION	LOAD TYPE	TRIP RATE / P	CKT NO	A (kVA)		B (kVA)		C (kVA)		CKT NO	P / TRIP RATE	LOAD TYPE	LOAD DESCRIPTION	WIRE SIZE
1-#12, 1-#12, 1-#12, 3/4"C	LIGHTING - RM 113	L	20 / 1	1	0.0	0.6					2	1 / 20	L	LIGHTING - CANOPIES	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	LIGHTING - RM 118,119,120,121,122	L	20 / 1	3			0.6	0.4			4	1 / 20	L	LIGHTING - RM 115	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	LIGHTING - RM 24,25,27	L	20 / 1	5					1.3	2.2	6	1 / 20	L	LIGHTING - RM 123	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	EXTERIOR SIGN	L	20 / 1	7	0.1	0.6					8	1 / 20	L	LIGHTING - RM 105,106,107,108	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	LIGHTING - RM 109	L	20 / 1	9			0.1	1.0			10	1 / 20	L	LIGHTING - RM 100,104	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	LIGHTING - RM 112,114	L	20 / 1	11					0.5	0.1	12	1 / 20	L	LIGHTING - EXTERIOR DOWNLIGHTS	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	LIGHTING - RM 101,102,103	L	20 / 1	13	0.2	0.1					14	1 / 20	L	LIGHTING - RM 111	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	LIGHTING - PARKING LOT	L	20 / 1	15			1.8	0.5			16	1 / 20	L	LIGHTING - RM 116,117	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	LIGHTING - RM 110	L	20 / 1	17					0.1	0.8	18	1 / 20	L	LIGHTING - FLAG POLE	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	UH-1 - RM 127	H	20 / 1	19	2.0	0.0					20	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	21			0.0	0.0			22	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	23					0.0	0.0	24	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	25	0.0	0.0					26	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	27			0.0	0.0			28	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	29					0.0	0.0	30	1 / 20	--	SPARE	--
--	SPACE	--	-- / 1	31	--	--					32	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	33			--	--			34	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	35					--	--	36	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	37	--	--					38	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	39			--	--			40	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	41					--	--	42	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	43	--	--					44	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	45			--	--			46	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	47					--	--	48	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	49	--	--					50	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	51			--	--			52	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	53					--	--	54	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	55	--	--					56	1 / --	--	SPACE	--
2-#12, 1-#12, 1-#12, 3/4"C	LAUNDRY DRYER VIA TD	Q	20 / 2	57			2.5	--			58	1 / --	--	SPACE	--
				59					2.5	--	60	1 / --	--	SPACE	--
				Total Load:	3 kVA		7 kVA		7 kVA						
				Total Amps:	13 A		27 A		28 A						

LOAD ANALYSIS

LOAD TYPE		CONNECTED	FACTOR	DEMAND	TOTALS	
LIGHTING	L	10802 VA	125.00%	13503 VA		
RECEPTACLE	R	0 VA	0.00%	0 VA	CONNECTED LOAD (kVA)	17 kVA
EQUIPMENT	Q	5000 VA	100.00%	5000 VA	DEMAND LOAD (kVA)	20 kVA
COOLING	C	0 VA	0.00%	0 VA	CONNECTED CURRENT (A)	21 A
HEATING	H	2000 VA	100.00%	2000 VA	DEMAND CURRENT (A)	24 A
MOTOR	M	0 VA	0.00%	0 VA		
LARGEST MOTOR	G	0 VA	0.00%	0 VA		
KITCHEN	K	0 VA	0.00%	0 VA		
EXISTING	X	0 VA	0.00%	0 VA		

NOTES:
ALL WIRING FOR 20A/1P CKT. SHALL CONSIST OF 2#12, 1#12G IN 3/4"C UNLESS OTHERWISE NOTED.
* PROVIDE A BREAKER WITH GFCI ** ROUTE CIRCUIT THROUGH LIGHTING CONTACTOR

PANEL: A

LOCATION: ELEC ROOM
FED FROM: TA

MTG:		BUS:		OPT:		ENCL:	MAIN:		
X	SURFACE	100%	NEUTRAL	X	INT SPD	NEMA	225 A	BUS	3 ø 4 WIRE
	FLUSH	X	SYS GND		FTL	TYPE 1	CU/SN		22 KAIC
	STRUT		ISO GND		FUSIBLE	STEEL	225 A	MCB	208Y/120 VOLT

WIRE SIZE	LOAD DESCRIPTION	LOAD TYPE	TRIP RATE / P	CKT NO	A (kVA)		B (kVA)		C (kVA)		CKT NO	P / TRIP RATE	LOAD TYPE	LOAD DESCRIPTION	WIRE SIZE
1-#12, 1-#12, 1-#12, 3/4"C	LAUNDRY WASHER - RM 8	Q	15 / 1	1	1.5	0.6					2	1 / 20	Q	* EDF-1 - RM 104	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 107	R	20 / 1	3			0.2	0.4			4	1 / 20	R	FLUSH SENSORS - RM 111	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 112	R	20 / 1	5					0.5	0.7	6	1 / 20	R	RECEPTACLES - RM 112	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 112	R	20 / 1	7	0.7	0.7					8	1 / 20	R	RECEPTACLES - RM 112	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 112	R	20 / 1	9			0.7	0.5			10	1 / 20	R	RECEPTACLES - RM 114	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 114	R	20 / 1	11					0.4	0.4	12	1 / 20	R	RECEPTACLES - RM 115	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 116	R	20 / 1	13	0.5	0.5					14	1 / 20	R	RECEPTACLES - RM 117	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 100	R	20 / 1	15			0.5	0.5			16	1 / 20	R	RECEPTACLES - RM 101	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 102	R	20 / 1	17					0.4	0.2	18	1 / 20	R	RECEPTACLES - RM 103	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 102	R	20 / 1	19	0.4	0.7					20	1 / 20	R	RECEPTACLES - RM 106	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 106	R	20 / 1	21			0.5	0.5			22	1 / 20	R	RECEPTACLES - RM 104	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 108	R	20 / 1	23					0.5	0.4	24	1 / 20	R	RECEPTACLES - RM 113	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 104	R	20 / 1	25	0.4	0.2					26	1 / 20	R	RECEPTACLES - RM 105	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 100	R	20 / 1	27			0.4	0.4			28	1 / 20	R	RECEPTACLES - RM 102	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	SECURITY NVR	R	20 / 1	29					0.2	0.2	30	1 / 20	R	RECEPTACLES - RM 113	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 100	R	20 / 1	31	0.4	0.2					32	1 / 20	R	RECEPTACLES - RM 113	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 115	R	20 / 1	33			0.7	0.7			34	1 / 20	R	RECEPTACLES - RM 116	1-#12, 1-#12, 1-#12, 3/4"C
2-#12, 1-#12, 1-#12, 3/4"C	UPS RACK - RM 113	R	20 / 2	35					1.3	0.5	36	1 / 20	R	FLOOR BOX - RM 106	1-#12, 1-#12, 1-#12, 3/4"C
				37	1.3	1.0					38	1 / 20	R	FLOOR BOX - RM 102	1-#12, 1-#12, 1-#12, 3/4"C
2-#12, 1-#12, 1-#12, 3/4"C	UPS RACK - RM 113	R	20 / 2	39			1.3	1.5			40	1 / 20	Q	POWERED SPEAKERS - RM 123	1-#12, 1-#12, 1-#12, 3/4"C
				41					1.3	0.9	42	1 / 20	M	HWCP-1	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	FACP - RM 113	Q	20 / 1	43	1.0	0.2					44	1 / 20	R	RECEPTACLE - ROOFTOP	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 114	R	20 / 1	45			0.5	0.2			46	1 / 20	R	RECEPTACLE - ROOFTOP	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	LIGHTING AND EF - RM 103	L	20 / 1	47					0.0	0.7	48	1 / 20	R	RECEPTACLES - RM 109	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	RECEPTACLES - RM 109	R	20 / 1	49	0.4	0.4					50	1 / 20	R	RECEPTACLES - RM 109	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	EF-1	M	20 / 1	51			2.2	1.0			52	1 / 20	Q	IDS PANEL - RM 113	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	LANDSCAPE LIGHTING	L	20 / 1	53					0.1	0.5	54	1 / 20	Q	BAS CONTROL PANEL - RM 109	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	EF-3 - RM 103	M	20 / 1	55	0.1	0.0					56	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	57			0.0	0.0			58	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	59					0.0	0.0	60	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	61	0.0	0.0					62	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	63			0.0	0.0			64	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	65					0.0	0.0	66	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	67	0.0	0.0					68	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	69			0.0	0.0			70	1 / 20	--	SPARE	--
--	SPARE	--	20 / 1	71					0.0	0.0	72	1 / 20	--	SPARE	--
--	SPACE	--	-- / 1	73	--	--					74	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	75			--	--			76	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	77					--	--	78	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	79	--	--					80	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	81			--	--			82	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	83					--	--	84	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	85	--	--					86	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	87			--	--			88	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	89					--	--	90	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	91	--	--					92	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	93			--	--			94	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	95					--	--	96	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	97	--	--					98	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	99			--	--			100	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	101					--	--	102	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	103	--	--					104	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	105			--	--			106	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	107					--	--	108	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	109	--	--					110	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	111			--	--			112	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	113					--	--	114	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	115	--	--					116	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	117			--	--			118	1 / --	--	SPACE	--
--	SPACE	--	-- / 1	119					--	--	120	1 / --	--	SPACE	--
				Total Load:	11 kVA		13 kVA		9 kVA						
				Total Amps:	95 A		109 A		75 A						

LOAD ANALYSIS

LOAD TYPE		CONNECTED	FACTOR	DEMAND	TOTALS	
LIGHTING	L	82 VA	125.00%	103 VA		
RECEPTACLE	R	23380 VA	71.39%	16690 VA	CONNECTED LOAD (kVA)	33 kVA
EQUIPMENT	Q	6100 VA	100.00%	6100 VA	DEMAND LOAD (kVA)	26 kVA
COOLING	C	0 VA	0.00%	0 VA	CONNECTED CURRENT (A)	91 A
HEATING	H	0 VA	0.00%	0 VA	DEMAND CURRENT (A)	73 A
MOTOR	M	2300 VA	100.00%	2300 VA		
LARGEST MOTOR	G	0 VA	0.00%	0 VA		
KITCHEN	K	0 VA	0.00%	0 VA		
EXISTING	X	0 VA	0.00%	0 VA		

NOTES:
ALL WIRING FOR 20A/1P CKT. SHALL CONSIST OF 2#12, 1#12G IN 3/4"C UNLESS OTHERWISE NOTED.
* PROVIDE A BREAKER WITH GFCI ** ROUTE CIRCUIT THROUGH LIGHTING CONTACTOR

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
HOUSTON, TX 77024

STRUCTURAL ENGINEER
STANLEY SPURLING & HAMILTON INC.
3301 EDLOE ST.
HOUSTON, TX 77027

CIVIL ENGINEER
LJA ENGINEERING
1904 W GRAND PARKWAY N, SUITE 100
KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., #260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE ASSOCIATES
6117 RICHMOND AVE., SUITE 200
HOUSTON, TX 77057
TBPE FIRM REG:#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:
NO. DATE DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

PANEL SCHEDULES

100% Construction Documents
02.29.2024

STATE OF TEXAS
SEVAK KALANTARIANS
97498
LICENSED
PROFESSIONAL ENGINEER
2024-02-29 #F-4506

E0.20

PANEL: K

LOCATION: KITCHEN 118
FED FROM: TK

MTG: [X] SURFACE [ ] FLUSH [ ] STRUT
BUS: 100% NEUTRAL, X SYS GND, ISO GND
OPT: [ ] INT SPD [ ] FTL [ ] FUSIBLE
ENCL: NEMA TYPE 1 STEEL
MAIN: 100 A CU/SN 100 A MCB BUS
3 ø 4 WIRE
22 KAIC
208Y/120 VOLT

WIRE SIZE	LOAD DESCRIPTION	LOAD TYPE	TRIP	RATE	/ P	CKT NO	A (kVA)		B (kVA)		C (kVA)		CKT NO	P /	TRIP RATE	LOAD TYPE	LOAD DESCRIPTION	WIRE SIZE
						1	1.0	1.0					2					
2-#12, 1-#12, 1-#12, 3/4"C	WARMING CABINET - RM 118	K	20	/	2	3			1.0	1.0			4	2 /	20	K	WARMING CABINET - RM 118	2-#12, 1-#12, 1-#12, 3/4"C
						5					1.0	1.0	6					
2-#12, 1-#12, 1-#12, 3/4"C	WARMING CABINET - RM 118	K	20	/	2	7	1.0	1.0					8	2 /	20	K	WARMING CABINET - RM 118	2-#12, 1-#12, 1-#12, 3/4"C
						9			0.8	1.0			10	1 /	20	Q	REFRIGERATOR - RM 118	1-#12, 1-#12, 1-#12, 3/4"C
2-#12, 1-#12, 1-#12, 3/4"C	ICE MAKER - RM 118	K	20	/	2	11					0.8	0.5	12	1 /	20	Q	GREASE TRAP ALARM	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	SMALL APPLIANCE - RM 118	K	20	/	1	13	1.5	0.9					14	1 /	20	M	OVERHEAD DOOR - RM 118	1-#12, 1-#12, 1-#12, 3/4"C
1-#12, 1-#12, 1-#12, 3/4"C	SMALL APPLIANCE - RM 118	K	20	/	1	15			1.5	0.0			16	1 /	20	--	SPARE	--
1-#12, 1-#12, 1-#12, 3/4"C	SMALL APPLIANCE - RM 118	K	20	/	1	17					1.5	0.0	18	1 /	20	--	SPARE	--
--	SPACE	--	--	/	1	19	--	--					20	1 /	--	--	SPACE	--
--	SPACE	--	--	/	1	21			--	--			22	1 /	--	--	SPACE	--
--	SPACE	--	--	/	1	23					--	--	24	1 /	--	--	SPACE	--
--	SPACE	--	--	/	1	25	--	--					26	1 /	--	--	SPACE	--
--	SPACE	--	--	/	1	27			--	--			28	1 /	--	--	SPACE	--
--	SPACE	--	--	/	1	29					--	--	30	1 /	--	--	SPACE	--
					Total Load:		6 kVA		5 kVA		5 kVA							
					Total Amps:		54 A		44 A		40 A							

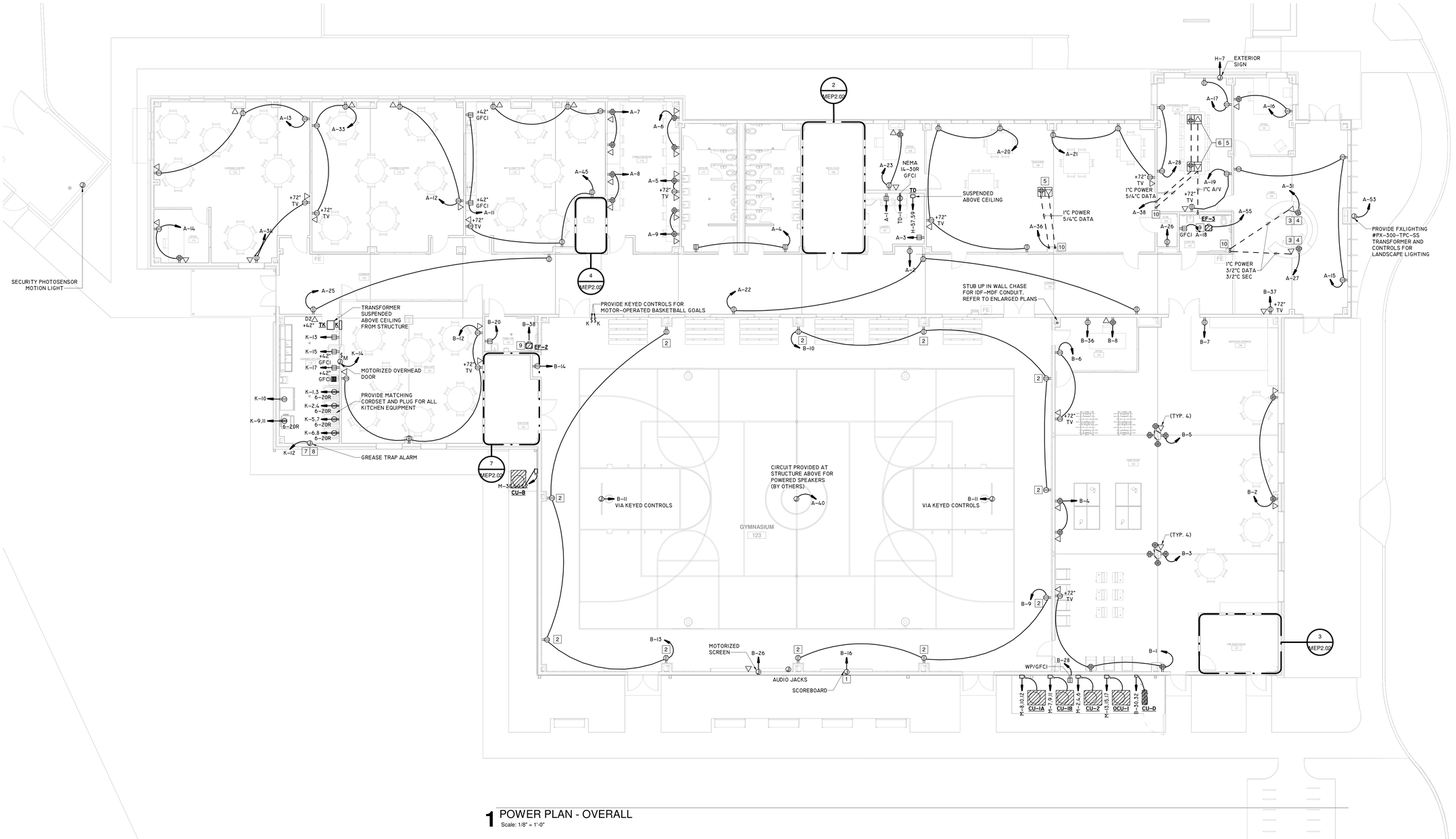
LOAD ANALYSIS

LOAD TYPE		CONNECTED	FACTOR	DEMAND	TOTALS	
LIGHTING	L	0 VA	0.00%	0 VA		
RECEPTACLE	R	0 VA	0.00%	0 VA	**CONNECTED LOAD (kVA)**	16 kVA
EQUIPMENT	Q	1500 VA	100.00%	1500 VA	**DEMAND LOAD (kVA)**	14 kVA
COOLING	C	0 VA	0.00%	0 VA	**CONNECTED CURRENT (A)**	46 A
HEATING	H	0 VA	0.00%	0 VA	**DEMAND CURRENT (A)**	38 A
MOTOR	M	900 VA	100.00%	900 VA		
LARGEST MOTOR	G	0 VA	0.00%	0 VA		
KITCHEN	K	14000 VA	81.25%	11375 VA		
EXISTING	X	0 VA	0.00%	0 VA		

NOTES:
ALL WIRING FOR 20A/1P CKT. SHALL CONSIST OF 2#12, 1#12G IN 3/4"C UNLESS OTHERWISE NOTED.
* PROVIDE A BREAKER WITH GFCI ** ROUTE CIRCUIT THROUGH LIGHTING CONTACTOR

KEYED NOTE LEGEND

1	PROVIDE JUNCTION BOX FOR SCOREBOARD. COORDINATE WITH ARCHITECT FOR EXACT HEIGHT AND LOCATION PRIOR TO ROUGH-IN.
2	COORDINATE FINAL RECEPTACLE LOCATION WITH PADDING MANUFACTURER PRIOR TO ROUGH-IN.
3	PROVIDE TWO-GANG OUTLET BOXES SURFACE MOUNTED AT FLOOR FACING UP INSIDE MILLWORK CAVITY ACCESSIBLE AND OPERABLE WHEN ACCESS DOOR IS OPEN. POWER OUTLET IS QUADRUPLEX 5-20R AND DATA IS TWO 1-1/4"C FROM MDF LOCATION WITH INSULATED THROAT BUSHINGS AND PULL STRINGS FOR USE BY DIVISIONS 27 AND 28. REFER TO DETAILS.
4	PROVIDE TWO ADDITIONAL 1-1/2"C STUBBED UP WITH PULL STRINGS FROM THIS LOCATION TO MDF ROOM FOR USE BY DIVISION 28.
5	PROVIDE HUBBELL SYSTEMONE RECESSED 4 GANG CONCRETE FLOOR BOX #CFB4G50RCR WITH 2" HUBS #CFBHUB2, (2) PWFBMPDR20GRYTR DUPLEX RECEPTACLES, (2) FBMP6KS 6-PORT KEYSTONE PLATES, AND CFBSIR8CVR COVER. FINISH TO BE SELECTED BY ARCHITECT. PROVIDE (1) 1"C FOR POWER, (1) 2"C FOR DATA TO NEAREST ACCESSIBLE CEILING, AND (1) 2"C FOR A/V TO STUB UP IN TV WALL CAVITY 24" AFF.
6	FIELD COORDINATE EXACT LOCATION OF BOXES WITH TABLE LEGS SUCH THAT BOXES DO NOT RESIDE WITHIN 18" OF ANY LEG TO ANY EDGE OF BOX COVER.
7	PROVIDE CIRCUIT FOR GREASE TRAP ALARM POWER. COORDINATE WITH DIVISION 22 FOR TERMINATION.
8	PROVIDE ADDITIONAL 1"C FROM THIS LOCATION TO GREASE TRAP WITH PULL STRING FOR SENSOR CABLING (DIVISION 21 FURNISHED, DIVISION 26 INSTALLED). COORDINATE WITH GREASE TRAP VENDOR FOR TERMINATION REQUIREMENTS.
9	EXHAUST FAN TO BE CONTROLLED BY SWITCH SERVING SAME RESTROOM.
10	STUB CONDUIT UP FROM UNDERGROUND TO ACCESSIBLE CEILING ABOVE, SCHEDULE-40 PVC BELOW GRADE AND COMPRESSION EMT ABOVE FINISHED FLOOR.



1 POWER PLAN - OVERALL
Scale: 1/8" = 1'-0"

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PROJECT #: N032023
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FRESNO BOYS & GIRLS CLUB
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POWER PLAN

100% Construction Documents
02.29.2024

STATE OF TEXAS
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2024-02-29 #F-4506

E2.01

LIGHT FIXTURE SCHEDULE

Type	Manufacturer	Model Number	Description	Mounting	Lamp	Wattage	Voltage	Dimmable	Controls	Notes
A	SPECTRUM	PR3007LEDLXI40L35KEX/CD3X	LED HIGH BAY/GYM LIGHTS	PENDANT	LED	109 W	UNV	0–10V DIMMING		
B	LITHONIA	STA2X4–400LM–80CRI–35K–COLT–MVOLT	2X2 LED TROFFER	RECESSED	LED	34 W	UNV	0–10V DIMMING		
BE	LITHONIA	STA2X4–400LM–80CRI–35K–COLT–MVOLT	SAME AS TYPE B WITH BATTERY BACKUP	RECESSED	LED	34 W	UNV	0–10V DIMMING		
C	LF ILLUMINATION	RINGER_GSSR47L9030	DECORATIVE HALLWAY RING/HOOP	PENDANT	LED	45 W	UNV	0–10V DIMMING		
FE	LITHONIA	FEM–L46–6000LM–IMACD–MD–80CRI–35K	INDUSTRIAL LINEAR	SURFACE	LED	38 W	UNV	0–10V DIMMING		
G	LITHONIA	LDN4–35/20–L04–WR	6 INCH LED DOWNLIGHT	RECESSED	LED	23 W	UNV	0–10V DIMMING		
GE	LITHONIA	LDN4–35/20–L04–WR	<VARIES>	RECESSED	LED	23 W	UNV	0–10V DIMMING		
H	PRUDENTIAL	BPR03–PER–REGI–LED35–LO–4–WWF	LINEAR COVE	RECESSED	LED	15 W	UNV	0–10V DIMMING		
I	PAL	ML3WL–D–HO–ASY–K35–4–X–VR–X	EXTERIOR LINEAR	SURFACE	LED	30 W	UNV	0–10V DIMMING		
IE	PAL	ML3WL–D–HO–ASY–K35–4–X–VR–X	SAME AS TYPE I WITH BATTERY BACKUP	SURFACE	LED	30 W	UNV	0–10V DIMMING		
J	FINELITE	HP–2–ID–8FT––V–V–835	DIRECT/INDIRECT LINEAR PENDANT	PENDANT	LED	148 W	UNV	0–10V DIMMING		
KE	SIGNIFY	P6R–DL–15–940–W–CC–Z10–U–6RNEM6	6 INCH LED DOWNLIGHT W/BATTERY BACKUP	RECESSED	LED	15 W	UNV	0–10V DIMMING		
P1	GARDCO	ECF–S–64L–900–NW–G2–AR–3	SINGLE HEAD POLE MOUNTED LED	POLE	LED	178 W	UNV			
P2	GARDCO	ECF–S–64L–900–NW–G2–AR–3	DUAL HEADED POLE MOUNTED LED	POLE	LED	356 W	UNV			
X	BEGHELLI	BRUNO EXIT	EDGE–LIT EXIT SIGN	WALL/CEILING	LED	5 W	UNV			PROVIDE WITH NUMBER OF FACES AND DIRECTIONAL ARROWS AS SHOWN ON PLANS

LIGHTING NOTES:

1. ALL LIGHT FIXTURES APPENDED WITH NL (NIGHT LIGHT) SHALL BE NON–SWITCHED AND CONNECTED TO EMERGENCY LIGHTING PANEL CIRCUIT IN AREA.
2. ALL LIGHT FIXTURES APPENDED WITH E (EMERGENCY) TO HAVE GENERATOR TRANSFER DEVICE FOR AUTOMATIC FULL INTENSITY LIGHTING WHEN NORMAL POWER IS LOST, PROVIDE CONNECTION FROM EMERGENCY LIGHTING PANEL CIRCUIT IN AREA AND UNSWITCHED NORMAL POWER FOR LOSS DETECTION.
3. PROVIDE ADDITIONAL, NON–SWITCHED HOT CIRCUIT LEG TO FIXTURE FOR BATTERY CHARGING AND POWER–LOSS DETECTION FOR ALL EMERGENCY EGRESS OR EXIT SIGN FIXTURES AS PART OF BASE BID.
4. ALL OUTDOOR LIGHTING FIXTURES REQUIRE CORROSION–RESISTANT OPTION.
5. COORDINATE MOUNTING HEIGHT OF ALL FIXTURES WITH ARCHITECTURAL PLANS.
6. COORDINATE FINISH OF ALL FIXTURE WITH ARCHITECT PRIOR TO ORDERING.
7. REFER TO ARCHITECTURAL PLANS FOR GRID/FLANGE AREAS, PRIOR TO BIDDING OF LIGHT FIXTURES. ORDER CORRECT QUANTITY OF EACH VARIATION.
8. IN SPACES INDICATED WITH DAYLIGHT–RESPONSIVE CONTROLS, CONNECT THE DAYLIGHT ZONE FIXTURES SUCH THAT THE CONTROLS WILL DIM THESE FIXTURES TO REQUIRED LEVELS PER IECC.
9. FIXTURES DESIGNATED AS "DZ" ARE IN THE DAYLIGHT ZONE AND ARE TO BE DIMMED BY THE DAYLIGHT–RESPONSIVE CONTROLS, EXCEPT WHEN IN EMERGENCY OPERATION.
10. ALL LIGHTING CONTROLS TO BE INTERFACED WITH BUILDING AUTOMATION SYSTEM BY DIVISIONS 23 AND 25 FOR BOTH MONITORING AND CONTROL.

TECH BRIEF

IIS Central Inverters for 2-Hour Operation

The purpose of this Tech Brief is to help...

- *Identify IIS Central Inverter models for 120 minute runtime applications.*
- *Discuss size/weight considerations that come with extending IIS Central Inverter runtime.*

Select IIS single-phase and IIS3P three-phase central inverter systems may be configured to provide 120 minutes of emergency egress power. These models may be indicated by selecting the "120M" option when ordering.

To accommodate the additional battery capacity requirements, 120 minute runtime IIS Central Inverters will have different weight and size specifications than their 90 minute counterparts. See the tables below for weights and dimensions for IIS 120M and IIS3P 120M models:

IIS Single Phase Models for 120 Minute Runtime

Inverter Model	Output Rating for 120 Minute Runtime	Dimensions L x H x W	Electronics Cabinet Weight	# of Batteries	Battery Weight	Total Weight
IIS 1500 * 120M	1500 VA	30" x 47" x 25"	230 lbs	6	444 lbs	674 lbs
IIS 2250 * 120M	2250 VA	30" x 47" x 25"	235 lbs	8	592 lbs	827 lbs
IIS 3000 * 120M	3000 VA	30" x 47" x 25"	240 lbs	10	740 lbs	980 lbs
IIS 3750 * 120M	3750 VA	30" x 47" x 25"	280 lbs	12	888 lbs	1168 lbs
IIS 5000 * 120M	5000 VA	48" x 76" x 25"	605 lbs	15	1110 lbs	1715 lbs
IIS 6000 * 120M	6000 VA	48" x 76" x 25"	640 lbs	20	1480 lbs	2120 lbs
IIS 8000 * 120M	8000 VA	48" x 76" x 25"	785 lbs	24	1776 lbs	2561 lbs
IIS 10000 * 120M	10000 VA	48" x 76" x 25"	805 lbs	30	2220 lbs	3025 lbs
IIS 12500 * 120M	12500 VA	48" x 76" x 25"	885 lbs	40	2960 lbs	3845 lbs

*Input Voltage, Output Voltage, and Transfer Sime, must be specified when ordering. See product specification sheet.

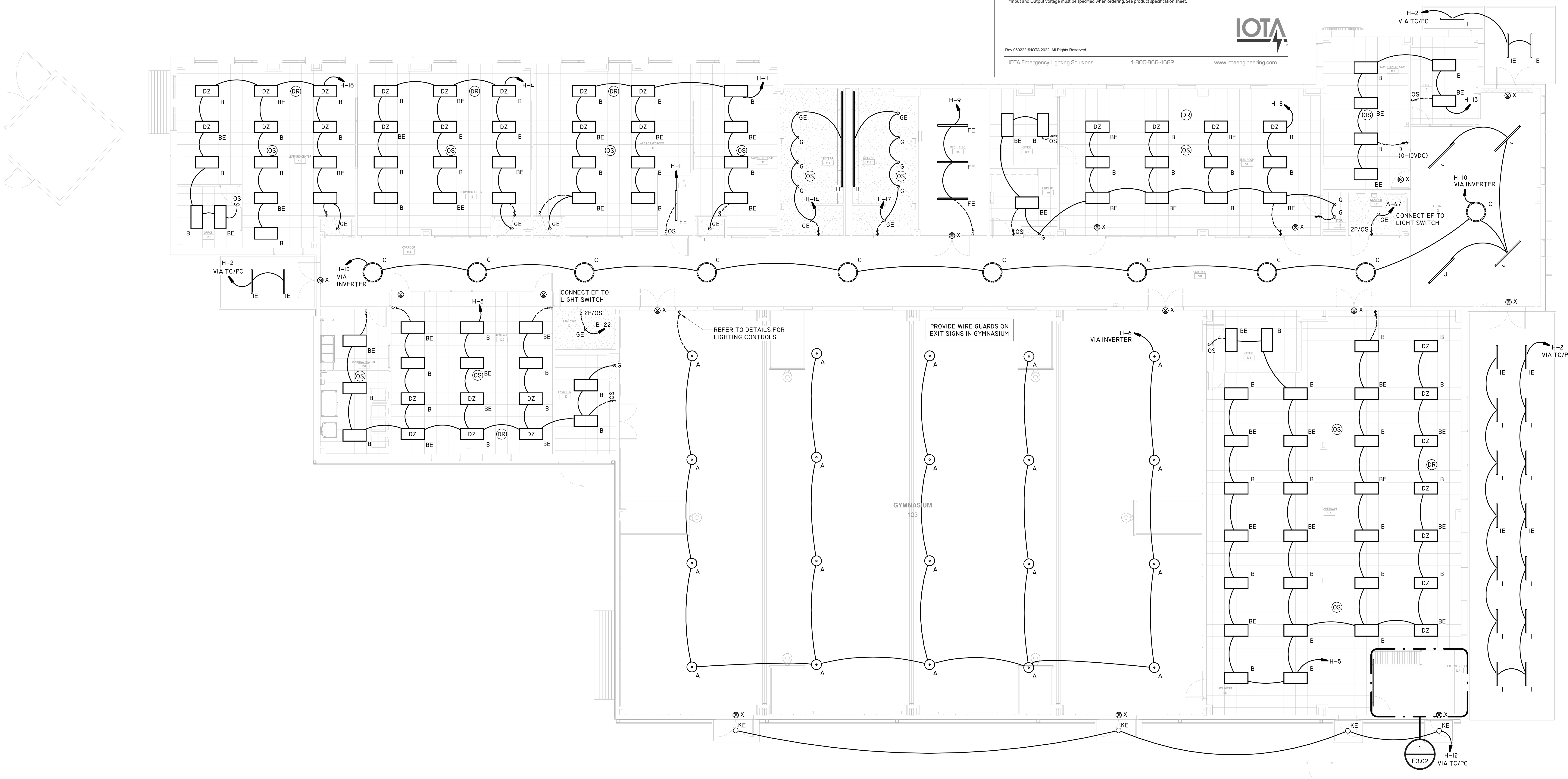
IIS Three Phase Models for 120 Minute Runtime

		Electronics Enclosure		Battery Cabinet				
Inverter Model	Output Rating for 120 Minute Runtime	Dimensions L x H x W	Weight	Dimensions L x H x W	# of Bat. Cabinets	# of Batteries	Battery & Cabinet Weight	Total Weight
IIS3P 4800 * 120M	4800 VA	30" x 47" x 25"	535 lbs	30" x 47" x 25"	1	15	1320 lbs	1855 lbs
IIS3P 6000 * 120M	6000 VA	30" x 47" x 25"	535 lbs	30" x 47" x 25"	1	20	1712 lbs	2247 lbs
IIS3P 8000 * 120M	8000 VA	30" x 47" x 25"	639 lbs	30" x 47" x 25"	1	24	2196 lbs	2835 lbs
IIS3P 10000 * 120M	10000 VA	30" x 47" x 25"	639 lbs	30" x 47" x 25"	2	30	2640 lbs	3279 lbs
IIS3P 12500 * 120M	12500 VA	30" x 47" x 25"	639 lbs	30" x 47" x 25"	2	40	3424 lbs	4063 lbs
IIS3P 16700 * 120M	16700 VA	44" x 72" x 31"	1250 lbs	48" x 72" x 31"	1	60	5140 lbs	6390 lbs
IIS3P 24000 * 120M	24000 VA	44" x 72" x 31"	1250 lbs	48" x 72" x 31"	2	80	7380 lbs	8630 lbs
IIS3P 33000 * 120M	33000 VA	44" x 72" x 31"	1450 lbs	48" x 72" x 31"	2	100	8700 lbs	10,150 lbs
IIS3P 40000 * 120M	40000 VA	44" x 72" x 31"	1460 lbs	48" x 72" x 31"	2	60	10,520 lbs	11,980 lbs

*Input and Output Voltage must be specified when ordering. See product specification sheet.

IOTA Emergency Lighting Solutions 1-800-866-4682 www.iotaengineering.com

PROVIDE IN MEZZANINE 200 (2) IOTA #:
- IIS–1500–277V–120M FOR CORRIDOR LIGHTING
- IIS–3000–277V–120M FOR GYM LIGHTING



1 LIGHTING PLAN - OVERALL
Scale: 1/8" = 1'-0"

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LIGHTING PLAN

100% Construction Documents
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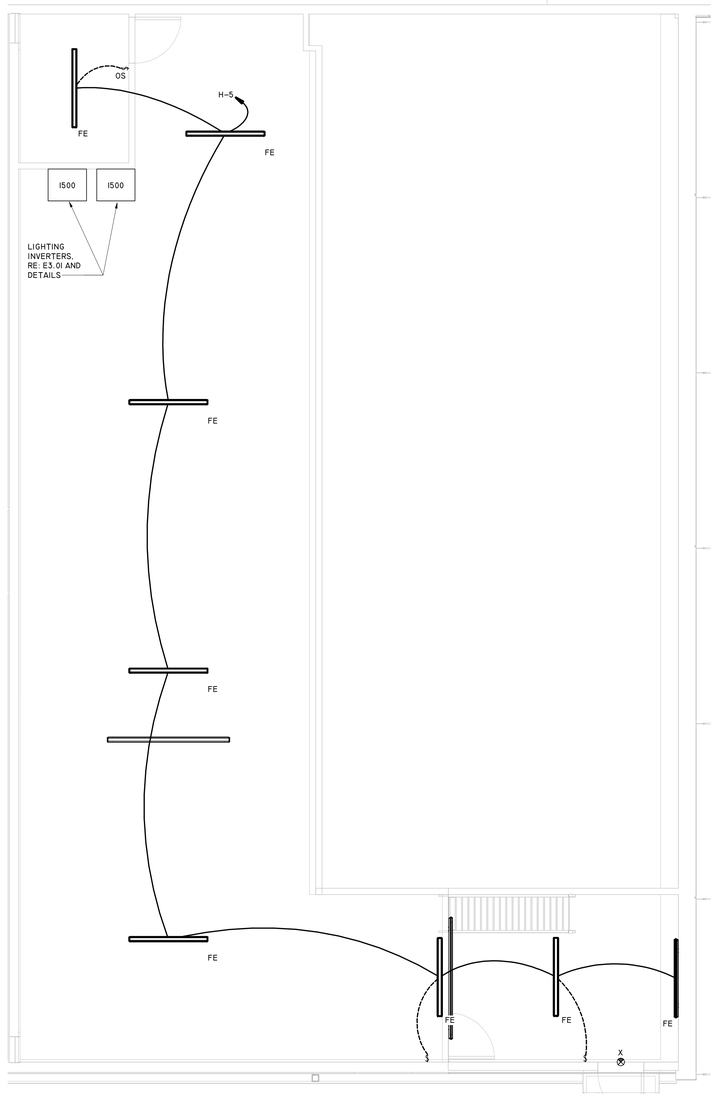

1 LIGHTING PLAN - MEZZANINE
Scale: 1/4" = 1'-0"

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LIGHTING PLAN – MEZZANINE

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E3.02

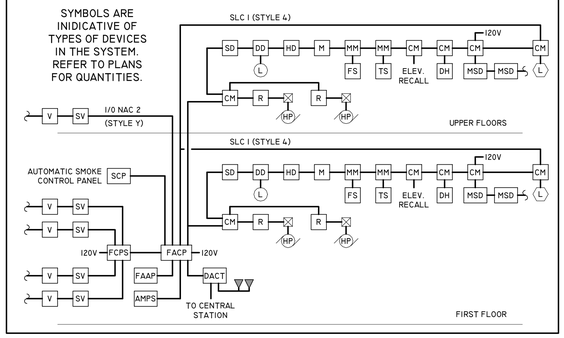
FIRST RESPONDER COVERAGE NOTES

1. TYPICAL SYSTEM OPERATION IS CONTINUOUS OR AUTOMATIC.
2. PER IFC SIGNAL STRENGTH INTO AND OUT OF THE BUILDING TO HAVE A DELIVERED AUDIO QUALITY OF 95/95 @ 3.4 DAQ.
3. THE EQUIPMENT MUST BE APPROVED. THE SYSTEM DESIGN AND OPERATION MUST BE SPECIFICALLY DESIGNATED FOR USE AS AN IN-BUILDING EMERGENCY RADIO COMMUNICATION ENHANCEMENT SYSTEM BY THE MANUFACTURER.
4. THE SYSTEM MUST MEET SPECIFIC SURVIVABILITY REQUIREMENTS TO ENSURE IT WILL CONTINUE TO OPERATE DURING A FIRE.
5. THE SYSTEM MUST HAVE REDUNDANT PRIMARY POWER SOURCES AND STAND-BY OR BACKUP POWER TO OPERATE AT 100% CAPACITY FOR AT LEAST 12 HOURS.
6. THE SYSTEM MUST BE MONITORED THROUGH THE BUILDING FIRE ALARM SYSTEM FOR LOSS OF POWER; FAILURE OF THE BATTERY CHARGER; LOW-BATTERY CAPACITY INDICATION WHEN 70% OF THE 12-HOUR OPERATING CAPACITY HAS BEEN DEPLETED; MALFUNCTION OF THE DONOR ANTENNA AND ACTIVE RF-EMITTING DEVICE(S); AND FAILURE OF ANY CRITICAL SYSTEM COMPONENTS AND PROVIDE EITHER AN AUDIBLE WARNING OR TROUBLE SIGNAL..
7. THE SYSTEM PERFORMANCE AND RELIABILITY MUST BE TESTED ON INSTALLATION AND MAINTAINED OPERATIONAL AT ALL TIMES. AN ANNUAL INSPECTION IS ALSO REQUIRED.

FIRE ALARM SYMBOLS LEGEND

XX V P/C	FIRE ALARM VISUAL STROBE, TYP. +80" AFF TO TOP. XX = CANDELA LEVEL. P = PROTECTIVE COVER, C = CEILING MOUNT	FACP	FIRE ALARM CONTROL PANEL
XX AV P/C	FIRE ALARM AUDIO/VISUAL STROBE, TYP. +80" AFF TO TOP. XX = CANDELA LEVEL. P = PROTECTIVE COVER, C = CEILING MOUNT	FAAP	FIRE ALARM ANNUNCIATOR PANEL
XX SV P/C	FIRE ALARM SPEAKER/VISUAL STROBE, TYP. +80" AFF TO TOP. XX = CANDELA LEVEL. P = PROTECTIVE COVER, C = CEILING MOUNT	FCPS	REMOTE FIRE ALARM SYSTEM POWER SUPPLY
M P/PD	FIRE ALARM MANUAL PULLSTATION. TYP. +48" AFF PD = PEDESTAL MOUNT, P = PROTECTIVE COVER	DACT	DIGITAL ALARM COMMUNICATOR TRANSMITTER
SD	FIRE ALARM SMOKE DETECTOR. PHOTOELECTRIC	MSD	FIRE ALARM SMOKE FIRE DAMPER BY DIV. 15 PROVIDE 120VAC CIRCUIT BY DIV. 16
SD S	FIRE ALARM SINGLE STATION SMOKE DETECTOR 120V WITH BATTERY	CM	FIRE ALARM CONTROL MODULE
HD	FIRE ALARM HEAT DETECTOR	MM	FIRE ALARM MONITOR MODULE
BD	FIRE ALARM BEAM DETECTOR	DH	FIRE ALARM DOOR HOLDER
CO	FIRE ALARM CARBON MONOXIDE DETECTOR	FS	FIRE ALARM SPRINKLER FLOW SWITCH
DD	FIRE ALARM DUCT SMOKE DECECTOR WITH REMOTE LED	TS	FIRE ALARM SPRINKLER VALVE TAMPER SWITCH
R	FIRE ALARM SHUTDOWN RELAY FOR HVAC EQUIPMENT	A	FIRE ALARM SPEAKER

FIRE ALARM TYPICAL SYSTEM DIAGRAM



FIRE ALARM DELEGATED DESIGN NOTE

THE BIDDING CONTRACTOR IS RESPONSIBLE FOR A COMPLETE FIRE ALARM SYSTEM DELEGATED-DESIGN. THE CONTRACTOR IS REQUIRED TO PROVIDE ALL DEVICES REQUIRED TO MEET ALL APPLICABLE CODES, PROJECT SPECIFICATIONS REQUIREMENTS, AND THE AHJ REQUIREMENTS. THE CONTRACTOR IS REQUIRED TO COMPLY WITH PERFORMANCE REQUIREMENTS AND DESIGN CRITERIA, INCLUDING SIGNED AND SEALED CALCULATIONS BY A QUALIFIED PROFESSIONAL ENGINEER RESPONSIBLE FOR SHOP DRAWING PREPARATION. THE CONTRACTOR SHALL PRODUCE SHOP DRAWINGS, REQUIRED BATTERY POWER CALCULATIONS, INTERCONNECTION WIRING DIAGRAMS, POWER SUPPLY DESIGN AND REQUIREMENTS, ETC. THESE DOCUMENTS SHALL BE SUBMITTED BY THE CONTRACTOR FOR REVIEW AND/OR APPROVAL BY THE AHJ AND A/E TEAM AS REQUIRED. ALLOW FOR 10% ADDITIONAL DEVICES WITH ASSOCIATED CABLING RESULTING FROM DELEGATED DESIGN.

FIRE ALARM SEQUENCE OF OPERATION

A. DETECTION & ALARM

WHEN A FIRE ALARM CONDITION IS DETECTED BY ANY ALARM INITIATING DEVICE (SMOKE DETECTOR, DUCT DETECTOR, PULL STATION, OR SPRINKLER FLOW SWITCH), THE FOLLOWING FUNCTIONS WILL OCCUR:

1. THE FIRE ALARM CONTROL PANEL COMMON ALARM INDICATOR WILL FLASH AND THE AUDIBLE DEVICE WILL SOUND. ACKNOWLEDGING THE ALARM CONDITION WILL SILENCE THE AUDIBLE DEVICE AND CAUSE THE COMMON ALARM INDICATOR TO ILLUMINATE STEADILY.
2. THE DISPLAY WILL INDICATE ALL APPLICABLE INFORMATION ASSOCIATED WITH THE ALARM CONDITION INCLUDING ZONE, DEVICE TYPE, DEVICE LOCATION, AND TIME OF ALARM. LOCATION AND ZONING MESSAGES WILL BE CUSTOM FIELD-PROGRAMMED TO MATCH THE RESPECTIVE PREMISES. LOCAL ANNUNCIATOR LED'S ASSOCIATED WITH THE ALARM POINT WILL FLASH UNTIL PANEL IS SILENCED.
3. DISPLAY SYSTEM STATUS CHANGES ON ANY REMOTE ANNUNCIATOR(S) VIA AN ALPHANUMERIC MESSAGE ON THE DISPLAY.
4. ACTIVATE AN ALARM CONTACT CLOSURE TO ACTIVATE A DIGITAL ALARM COMMUNICATOR TRANSMITTER (DACT) FOR SIGNALING TO A UL-APPROVED CENTRAL MONITORING STATION VIA TELEPHONE LINES FURNISHED BY OWNER.
5. ACTIVATE ALL AUDIO/VISUAL SIGNALS THROUGHOUT THE ENTIRE FACILITY.
6. ACTIVATE ALL VISUAL SIGNALS. VISUAL SIGNALS WILL BE HIGH INTENSITY STROBES (75 cd MINIMUM) TO MEET THE REQUIREMENTS OF THE AMERICANS WITH DISABILITIES ACT (ADA) & TEXAS ACCESSIBILITY STANDARDS (TAS). ACTIVATE THROUGHOUT THE ENTIRE FACILITY.STROBES SHALL SHALL BE XENON TYPE AND WHITE OR CLEAR IN COLOR. THE MAX PULSE DURATION WILL BE 0.2 SECONDS WITH A MAXIMUM DUTY CYCLE OF 40%. THE FLASH RATE WILL BETWEEN 1-HZ AND 3-HZ.
7. DEACTIVATE ALL FANS RATED OVER 2,000 CFM.
8. ALARM VERIFICATION WILL BE FIELD-PROGRAMMABLE FOR EACH SMOKE DETECTOR. THE VERIFICATION SEQUENCE IS ACTIVATED AFTER A "CHECK" PROCEDURE AND THE PANEL WILL WAIT FOR A TIME THEN RESAMPLE THE DETECTOR FOR CONTINUED PRESENCE OF SMOKE. IF THE ALARM CONDITION CONTINUES OR A NON-VERIFIED DEVICE IS ACTUATED DURING THIS VERIFICATION PERIOD, THE PANEL WILL INITIATE ALL ALARM SEQUENCES. THIS ENTIRE SEQUENCE WILL OCCUR WITHIN 60 SEC. THE SYSTEM WILL LOG INTO MEMORY THE NUMBER OF VERIFICATION EVENTS.
9. CLOSE ALL SMOKE FIRE DAMPERS ASSOCIATED WITH THE HVAC UNIT(S).
10. ALL NON-SILENCEABLE AUXILIARY CONTROL FUNCTIONS (FANS, CENTRAL STATION INTERFACE, ELEVATOR RECALL INTERFACE, ETC) WILL REMAIN IN OPERATION, EVEN WHEN A/V DEVICES ARE SILENCED, UNTIL THE PANEL IS CLEARED AND RESET.
11. IF GAS WATER HEATERS OR BOILERS (DOMESTIC OR HYDRONIC) ARE PROVIDED FOR THE PROJECT PROVIDE A MANUAL RESET CARBON MONOXIDE (CO) DETECTOR ADJACENT TO THE WATER HEATER(S). INTERLOCK THE CO DETECTOR TO DISABLE THE WATER HEATER BURNERS UPON DETECTION OF 100 PPM OR HIGHER CO CONCENTRATION AND UPON LOSS OF POWER TO THE CO DETECTOR. SUBMIT PRODUCT DATA FOR CO DETECTOR AND CERTIFICATE OF CALIBRATION.

B. SYSTEM TROUBLE DETECTION

WHEN A TROUBLE CONDITION IS DETECTED BY THE FIRE ALARM CONTROL PANEL, THE FOLLOWING FUNCTIONS SHALL OCCUR:

1. THE FIRE ALARM CONTROL PANEL TROUBLE INDICATOR WILL FLASH AND THE INTERNAL AUDIBLE DEVICE WILL SOUND. ACKNOWLEDGMENT OF THE AUDIBLE DEVICE WILL SILENCE THE AUDIBLE DEVICE AND CAUSE ALL TROUBLE INDICATORS TO ILLUMINATE STEADY.
2. THE DISPLAY WILL DISPLAY ALL APPLICABLE INFORMATION ASSOCIATED WITH THE RESPECTIVE TROUBLE CONDITIONS. LOCAL ANNUNCIATOR LEDs ASSOCIATED WITH THE ALARM POINT WILL ILLUMINATE.
3. ACTIVATE A TROUBLE CONTACT CLOSURE TO ACTIVATE A DACT FOR SIGNALING TO A UL-APPROVED CENTRAL MONITORING STATION VIA PHONE LINES FURNISHED BY OWNER.
4. DISPLAY THE SYSTEM STATUS CHANGES ON THE REMOTE ANNUNCIATOR(S) VIA AN ALPHANUMERIC MESSAGE ON THAT DISPLAY.

C. SYSTEM SUPERVISORY ALARM DETECTION

WHEN A SUPERVISORY ALARM CONDITION IS DETECTED DUE TO A FIRE SPRINKLER VALVE BEING PLACED IN AN "OFF-NORMAL" POSITION, THE FOLLOWING FUNCTIONS WILL OCCUR:

1. THE FIRE ALARM CONTROL PANEL SUPERVISORY INDICATOR WILL FLASH AND THE INTERNAL AUDIBLE DEVICE WILL SOUND. ACKNOWLEDGMENT OF THE SUPERVISORY CONDITION WILL SILENCE THE AUDIBLE DEVICE.
2. THE DISPLAY WILL DISPLAY ALL APPLICABLE INFORMATION ASSOCIATED WITH THE RESPECTIVE SUPERVISORY CONDITION. LOCAL ANNUNCIATOR LED'S WILL ILLUMINATE FOR THE ALARM POINT.
3. DISPLAY THE SYSTEM STATUS CHANGE ON THE REMOTE ANNUNCIATOR(S) VIA AN ALPHANUMERIC MESSAGE ON THAT DISPLAY.
4. ACTIVATE A SUPERVISORY ALARM CONTACT CLOSURE TO ACTIVATE THE DACT FOR SIGNALING TO A UL-APPROVED CENTRAL MONITORING STATION VIA PHONE LINES FURNISHED BY OWNER.

D. FIRE ALARM PANEL

FIRE ALARM PANEL SHALL BE INTELLIGENT DIGITAL PROTOCOL ANALOG ADDRESSABLE FIRE ALARM SYSTEM. THIS SYSTEM SHALL INCLUDE, BUT NOT BE LIMITED TO SYSTEM CABINET, POWER SUPPLY, BUILT SIGNALING LINE CIRCUIT (SLC), 80 CHARACTER LCD ANNUNCIATOR, SIX PROGRAMMABLE "FLEXPUT" CIRCUITS, BUILT IN DUAL LINE DIGITAL COMMUNICATOR ASSOCIATED PERIPHERAL DEVICES, BATTERIES, WIRING, CONDUIT AND OTHER RELEVANT COMPONENTS AND ACCESSORIES REQUIRED TO FURNISH A COMPLETE AND OPERATIONAL LIFE SAFETY SYSTEM. THE SYSTEM SHALL BE TESTED AFTER COMPLETION OF INSTALLATION IN ACCORDANCE WITH MANUFACTURE RECOMMENCED TESTING PROCEDURE AND GOVERNING LIFE SAFETY CODES. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION AND REQUIREMENTS.

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CIVIL ENGINEER
LJA ENGINEERING
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KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., #260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE ASSOCIATES
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HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023

DATE ISSUED: 02.29.2024

TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

FIRE ALARM NOTES AND LEGEND

100% Construction Documents
02.29.2024

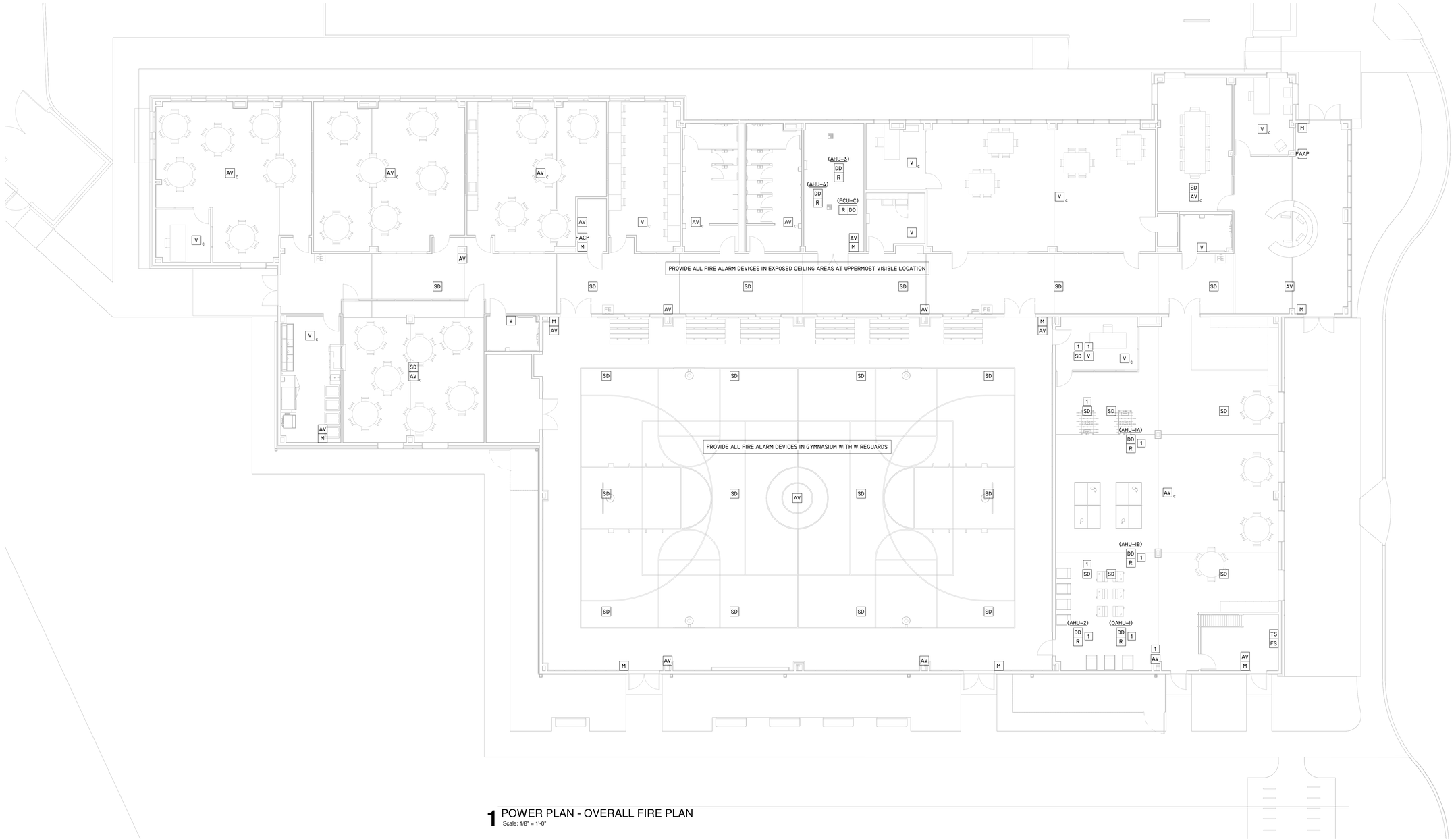
STATE OF TEXAS
SEVAK KALANTARIANS
97498
LICENSED
PROFESSIONAL ENGINEER

2024-02-29 #F-4506

E4.00

KEYED NOTE LEGEND

1	PROVIDE ADDITIONAL 1"C FROM THIS LOCATION TO GREASE TRAP WITH PULL STRING FOR SENSOR CABLING (DIVISION 21 FURNISHED, DIVISION 26 INSTALLED). COORDINATE WITH GREASE TRAP VENDOR FOR TERMINATION REQUIREMENTS.



1 POWER PLAN - OVERALL FIRE PLAN
Scale: 1/8" = 1'-0"

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FIRE ALARM PLAN

100% Construction Documents
02.29.2024

STATE OF TEXAS
SEVAK KALANTARIANS
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2024-02-29 #F-4506

E4.01

1 RACEWAY PROVISION PLAN
Scale: 1/8" = 1'-0"

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SMITH & COMPANY ARCHITECTS
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RACEWAY PROVISION PLAN

100% Construction Documents
02.29.2024

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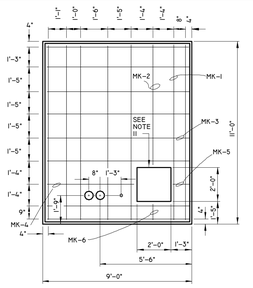
2024-02-29 #F-4506

E4.02

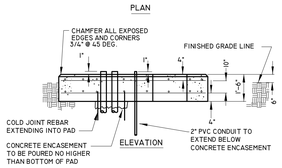
VERIFY WITH POWER CURRENT REQUIREMENTS WITH POWER COMPANY PRIOR TO CONSTRUCTION



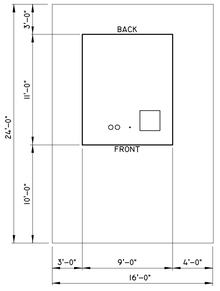
PLAN

REINFORCING SCHEDULE PER FOUNDATION				
MARK	QTY.	SIZE	LENGTH	REMARKS
MK-1	14	#7	10'-6"	STRAIGHT
MK-2	2	#7	7'-0"	STRAIGHT
MK-3	16	#7	8'-6"	STRAIGHT
MK-4	2	#7	5'-3"	STRAIGHT
MK-5	2	#7	0'-9"	STRAIGHT
MK-6	2	#7	1'-0"	STRAIGHT

MATERIAL ESTIMATE PER FOUNDATION	
DESCRIPTION	QUANTITY
REINFORCING STEEL #7	636 LBS
CONCRETE (5 SACK)	5 CU. YDS.
TYPE EB OR BETTER PVC CONDUIT, 90 DEG. 60" R	2
2" PVC CONDUIT	5 FT



ELEVATION



MINIMUM EASEMENT REQUIREMENTS

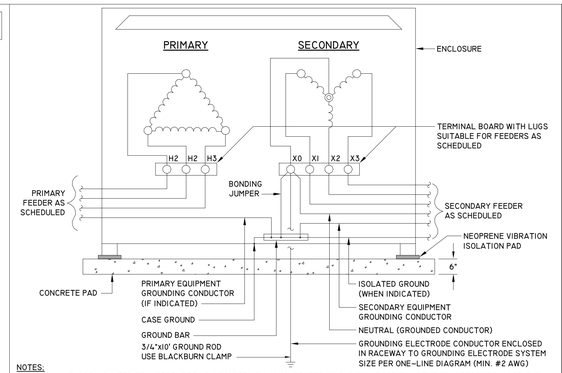
EQUIPMENT WEIGHT 43,000 LBS MAXIMUM

500–5000 KVA PMT
FOUNDATION, 12KV & 35KV

BASED ON DISTRIBUTION STANDARD 80-400

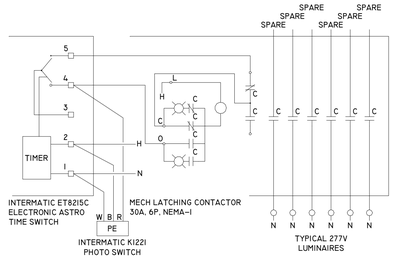
NOTES:
1. CONCRETE SHALL BE IN ACCORDANCE WITH CNP SPECIFICATION 007-221-01, LATEST REVISION (MINIMUM COMPRESSION IN 28 DAYS, 3000 PSI).
2. REINFORCING STEEL SHALL BE INTERMEDIATE GRADE DEFORMED BARS IN ACCORDANCE WITH A.S.T.M. SPECIFICATION A-615, GRADE 60, OR BETTER.
3. ALL SPLICES IN REINFORCING SHALL LAP A LENGTH EQUAL TO 24 BAR DIAMETERS.
4. ALL DIMENSIONS ON REINFORCING ARE TO THE CENTER OF BARS.
5. CONCRETE SHALL BE THOROUGHLY WORKED AROUND REINFORCING, ANY EMBEDDED FIXTURES AND INTO ALL CORNERS OF FORMS.
6. IF REQUIRED, GROUT SHALL BE A MIXTURE OF 1 PART CEMENT TO 2 PARTS SAND WITH ENOUGH WATER TO PRODUCE A WORKABLE MIXTURE.
7. CONCRETE IS TO BE POURED ONLY WHEN THE ATMOSPHERIC TEMPERATURE IS A MINIMUM 40\ F. (5\ C.) AND RISING.
8. STRIP BACK ALL VEGETATION AND APPROXIMATELY 12" OF TOP SOIL. REMOVE ALL LOOSE CLODS AND STONES. BACKFILL AND THOROUGHLY COMPACT ALL CONDUIT TRENCHES AND HOLES BEFORE CONCRETE IS PLACED.
9. REINFORCING SHALL HAVE A MINIMUM OF 2" CONCRETE COVER.
10. SLOPE PAD 1" FRONT TO BACK.
11. THE SQUARE OPENING IS FOR THE CUSTOMER'S SECONDARY CONDUITS.
12. CNP WILL NOT ALLOW OTHER FACILITIES TO PASS BENEATH ITS EQUIPMENT PADS. A ONE FOOT MINIMUM HORIZONTAL CLEARANCE SHALL BE MAINTAINED BETWEEN CNP PADS AND ALL OTHER FACILITIES.
13. THE SECONDARY OPENING IS TO BACKFILLED WITH SAND TO WITHIN 4" OF THE TOP OF THE PAD.

DETAIL – PRIMARY TRANSFORMER PAD | NOT TO SCALE | 15

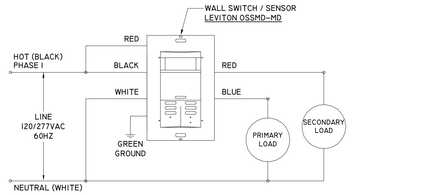


NOTES:
INSTALL ALL FLOOR MOUNTED TRANSFORMERS AS INDICATED ON 6" HOUSEKEEPING PAD 3" LARGER THAN THE TRANSFORMER (6" AT THE REAR), COMPLYING WITH MANUFACTURER'S WRITTEN INSTRUCTIONS, APPLICABLE REQUIREMENTS OF NEC, NESC, NEMA, ANSI, AND IEEE STANDARDS, AND IN ACCORDANCE WITH RECOGNIZED INDUSTRY PRACTICES TO ENSURE THAT PRODUCTS FULFILL REQUIREMENTS. PROVIDE NEC WORKING CLEARANCE IN FRONT OF TRANSFORMERS ASSUMING THEY WILL REQUIRE EXAMINATION WHILE ENERGIZED.

DETAIL – TRANSFORMER GROUNDING | NOT TO SCALE | 12

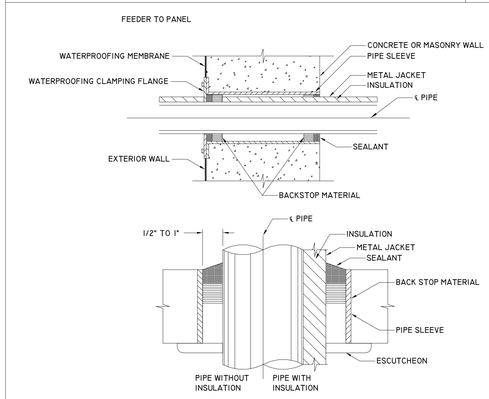


DETAIL – LIGHTING CONTACTOR | NOT TO SCALE | 8

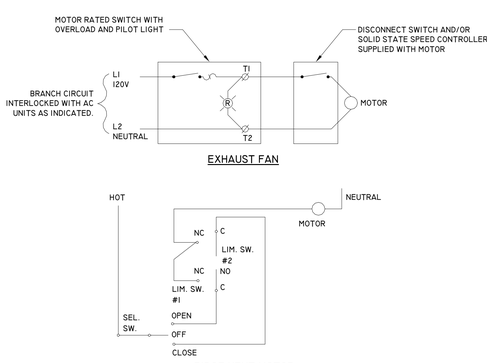


OCCUPANCY SENSOR SHALL BE PROGRAMMED AUTOMATIC OFF / AUTOMATIC ON
VACANCY SENSOR SHALL BE PROGRAMMED AUTOMATIC OFF / MANUAL ON

DETAIL – WALL OCCUPANCY / VACANCY SENSOR SWITCH | NOT TO SCALE | 4

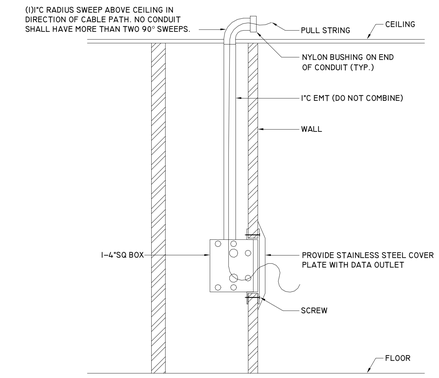


DETAIL – SLAB PENETRATION | NOT TO SCALE | 11

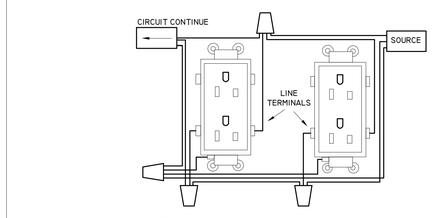


RIDGE VENT MOTOR

DETAIL – SINGLE PHASE MOTOR CONTROL | NOT TO SCALE | 7

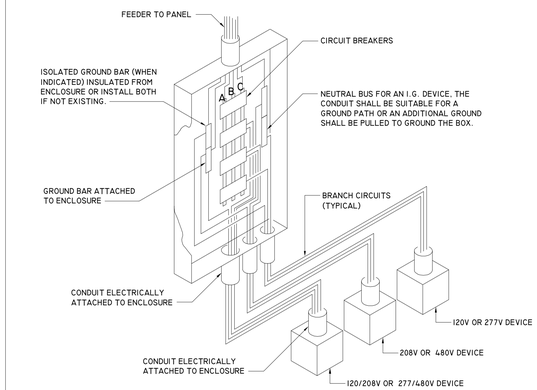


DETAIL – DATA OUTLETS | NOT TO SCALE | 3

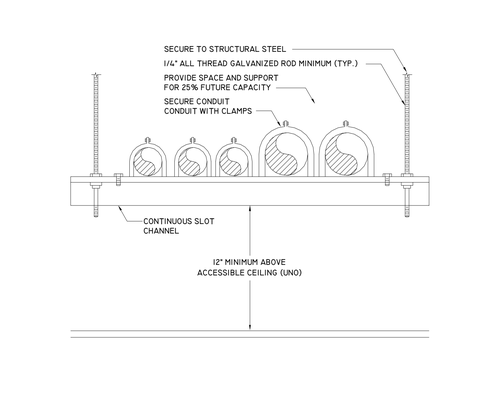


NOTES:
1. CIRCUITING TO ALL NON DEDICATED ELECTRICAL RECEPTACLES AND SWITCHES ARE REQUIRED TO UTILIZE PARALLEL CIRCUITING BY THE USE OF "PIG TAILS" TO EACH DEVICE SO THAT IF AN OUTLET IS REMOVED OR FAILS ELECTRICAL CONTINUITY OF THE CIRCUIT WILL NOT BE COMPROMISED.
2. ALL ELECTRICAL WIRING MUST BE PROPERLY SPLICED BY TWISTING THE WIRES TOGETHER AND USE OF APPROVED AND LISTED COMPRESSION WIRE NUTS FOR ANY WIRING.
3. DO NOT USE END TO END BUTT-SPLICING CONNECTORS FOR ANY WIRING.
4. WRAP AROUND THE TERMINALS WITH ELECTRICAL TAPE.

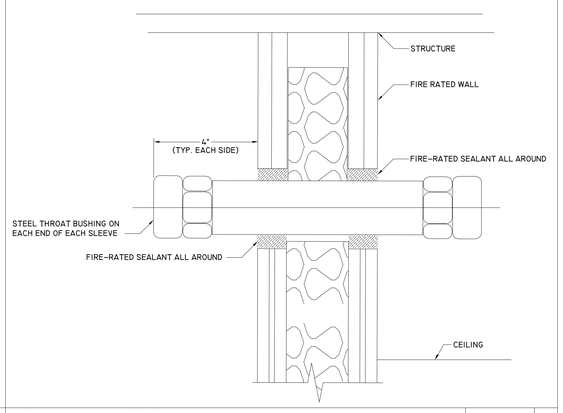
DETAIL – PIGTAIL RECEPTACLE WIRING | NOT TO SCALE | 14



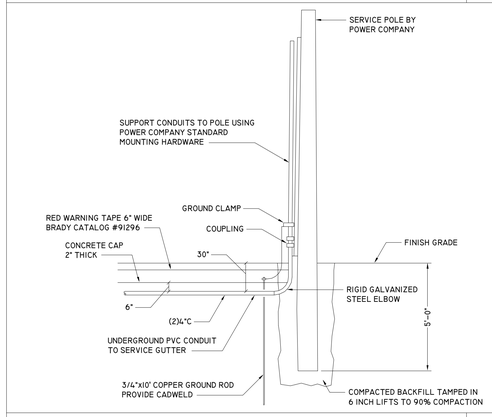
DETAIL – PANEL GROUNDING | NOT TO SCALE | 10



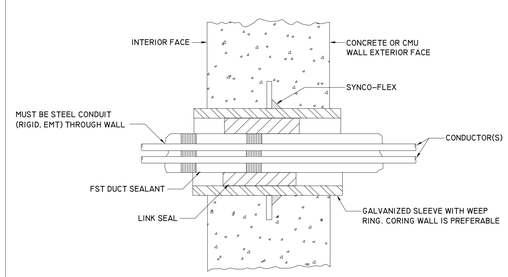
DETAIL – CONDUIT RACK | NOT TO SCALE | 6



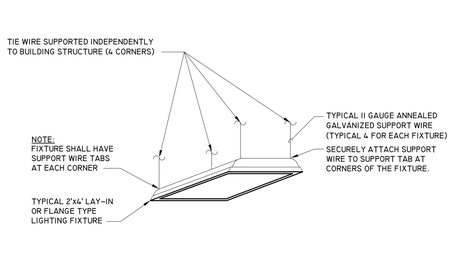
DETAIL – WALL SLEEVE | NOT TO SCALE | 2



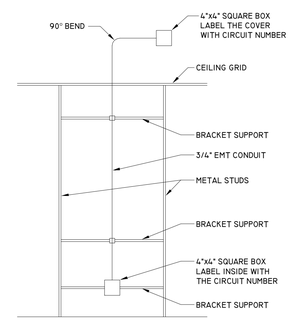
DETAIL – ELECTRICAL SERVICE INSTALLATION | NOT TO SCALE | 13



DETAIL – CONDUIT WALL PENETRATION | NOT TO SCALE | 9



DETAIL – FIXTURE SUPPORT | NOT TO SCALE | 5



DETAIL – CONDUIT ROUGH-IN | NOT TO SCALE | 1

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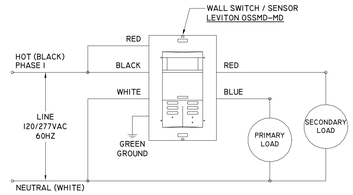
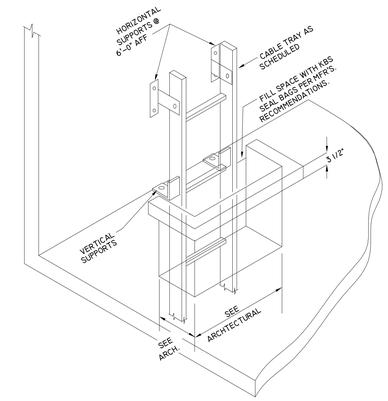
DETAIL – | NOT TO SCALE | 7

DETAIL – WALL OCCUPANCY / VACANCY SENSOR SWITCH | NOT TO SCALE | 7



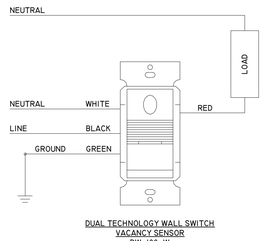
OCCUPANCY SENSOR SHALL BE PROGRAMMED AUTOMATIC OFF / AUTOMATIC ON
VACANCY SENSOR SHALL BE PROGRAMMED AUTOMATIC OFF / MANUAL ON

DETAIL – CABLE TRAY RISER | NOT TO SCALE | 3



DETAIL – | NOT TO SCALE | 6

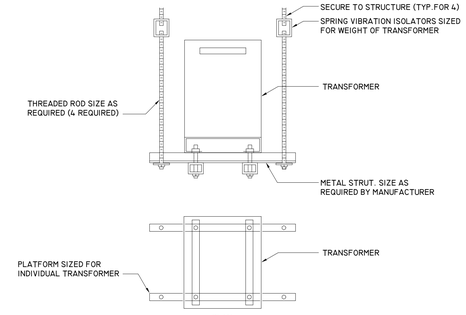
DETAIL – TYP. WALL VACANCY SENSOR SWITCH | NOT TO SCALE | 6



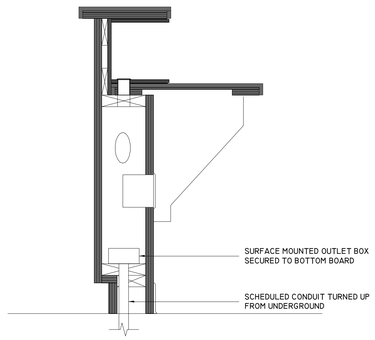
DUAL TECHNOLOGY WALL SWITCH
VACANCY SENSOR
DW-100-W

ADJUST AND PROGRAM SYSTEM FOR SEQUENCE OF OPERATION:
1. UPON ENTERING THE ROOM, OCCUPANT WILL NEED TO USE THE WALL SWITCH TO TURN LIGHTS ON.
2. THE VACANCY SENSOR WILL TURN LOAD OFF AFTER 20 MINUTES OF NO OCCUPANCY DETECTION. THE SENSOR SHALL BE PROGRAMMED FOR AUTOMATIC OFF/MANUAL ON FUNCTION.

DETAIL – TRANSFORMER INSTALLATION ABOVE CEILING | NOT TO SCALE | 2

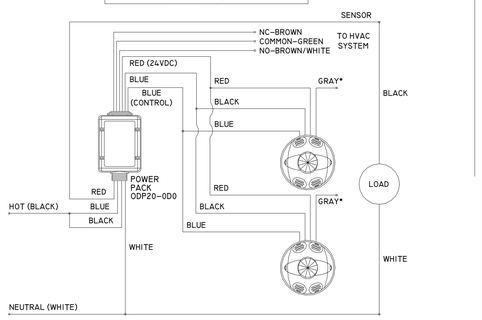


SECTION – FRONT DESK MILLWORK CAVITY OUTLET MOUNT | 3/2" = 1'-0" | 9



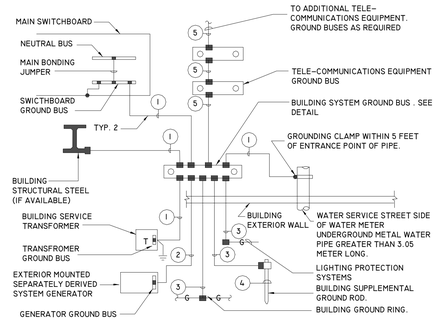
DETAIL – CEILING OCCUPANCY / VACANCY SENSOR | NOT TO SCALE | 5

OCCUPANCY SENSORS: LEVITON OSC20-M0W
POWER PACK: LEVITON OSP20-0D0
ADD-A-RELAY: LEVITON OSP20-RD0/BAS



OCCUPANCY SENSOR SHALL BE PROGRAMMED AUTOMATIC OFF / AUTOMATIC ON
VACANCY SENSOR SHALL BE PROGRAMMED AUTOMATIC OFF / MANUAL ON

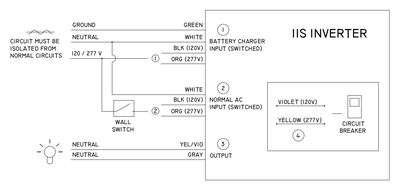
NOTE:
THIS INFORMATION MAY NOT CONTAIN ALL DETAILS REQUIRED FOR CONSTRUCTION. APPROPRIATE MODIFICATION MAY BE REQUIRED TO ENSURE SUITABILITY OF THESE DRAWINGS FOR THE SPECIFIC APPLICATION. IT IS THE USER'S RESPONSIBILITY TO ENSURE INSTALATION OF EQUIPMENT/SYSTEM IS IN ACCORDANCE WITH BUILDING/PROJECT SPECIFICATIONS, APPLICABLE CODES AND STANDARDS.



LEGEND:

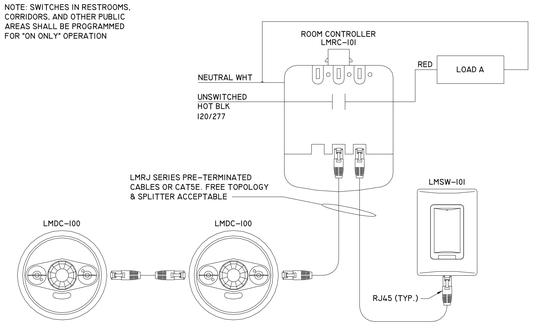
- ○ INDICATES BOLTED CONNECTION.
- ▭ INDICATES EXOTHERMIC WELD CONNECTION, COMPATIBLE WITH MATERIALS BEING JOINED.
- (1) #4/0 AWG INSULATED COPPER GROUND CONDUCTOR IN 1-1/4" CONDUCTOR.
- (2) #4/0 AWG COPPER GROUND CONDUCTOR ENCASED IN CONCRETE.
- (3) #4/0 AWG BARE COPPER GROUND CONDUCTOR.
- (4) 3/4" x 10'0" LONG COPPER-CLAD GROUND ROD DRIVEN WITH TOP 12" BELOW GRADE.
- (5) #2/0 AWG INSULATED COPPER GROUND CONDUCTOR IN 1-1/4" CONDUIT.

WIRING DIAGRAM – EMERGENCY LIGHTING INVERTER | NOT TO SCALE | 8



DETAIL – TYP. MULTISTALL RESTROOM | NOT TO SCALE | 4

NOTE: SWITCHES IN RESTROOMS, CORRIDORS, AND OTHER PUBLIC AREAS SHALL BE PROGRAMMED FOR "ON ONLY" OPERATION



ADJUST AND PROGRAM SYSTEM FOR SEQUENCE OF OPERATION:
1. THE SWITCH SHALL BE USED TO TURN LIGHTS ON AND ADJUST THE LIGHTING LEVEL.
2. THE OCCUPANCY SENSOR SHALL TURN LIGHTS OFF AFTER NO OCCUPANCY IS DETECTED FOR 20 MINUTES. THE SENSOR SHALL BE PROGRAMMED FOR AUTOMATIC OFF/AUTOMATIC ON FUNCTION.

DETAIL – BUILDING GROUNDING ELECTRODE SYSTEM | NOT TO SCALE | 1

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PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

DETAILS

100% Construction Documents
02.29.2024

STATE OF TEXAS
SEVAK KALANTARIANS
97498
LICENSED
PROFESSIONAL ENGINEER

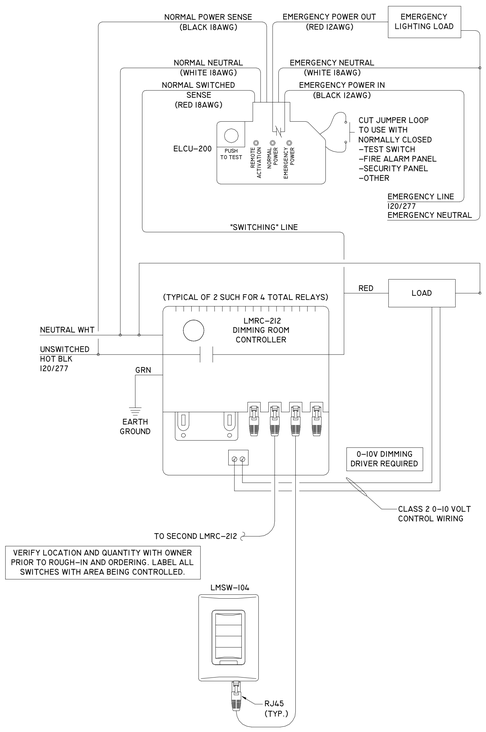
2024-02-29 #F-4506

E5.02

NOT TO SCALE 7

NOT TO SCALE 6

DETAIL – TYP. GYMNASIUM LIGHTING CONTROL

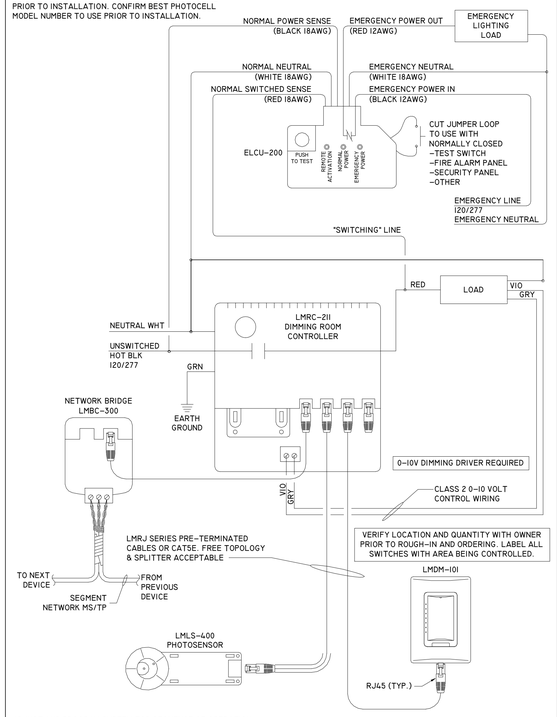


ADJUST AND PROGRAM SYSTEM FOR SEQUENCE OF OPERATION:
1. THE DIMMER SWITCH SHALL BE USED TO TURN LIGHTS ON AND OFF AND ADJUST THE LIGHTING LEVEL.
2. THE OCCUPANCY SENSOR SHALL TURN LIGHTS OFF AFTER NO OCCUPANCY IS DETECTED FOR 20 MINUTES. THE SENSOR SHALL BE PROGRAMMED FOR AUTOMATIC OFF/AUTOMATIC ON FUNCTION.

NOT TO SCALE 3

DETAIL – TYP. CORRIDOR LIGHTING CONTROL

NOTE: LOCATION ON PHOTOCELL ON THE PLANS IS APPROXIMATE. REFER TO WATTSTOPPER PHOTOCELL INSTALLATION INSTRUCTIONS FOR BEST PLACEMENT AND CONFIRM LOCATION WITH FACTORY REPRESENTATIVE PRIOR TO INSTALLATION. CONFIRM BEST PHOTOCELL MODEL NUMBER TO USE PRIOR TO INSTALLATION.



ADJUST AND PROGRAM SYSTEM FOR SEQUENCE OF OPERATION:
1. THE SPACE SHALL BE CENTRALLY SCHEDULED WITH "NORMAL HOURS" AND "AFTER HOURS" TIMES.
2. THE DIMMER SWITCH MAY BE USED TO ADJUST THE LIGHT LEVELS.
3. THE PHOTOSENSOR, IF PRESENT, SHALL MONITOR THE LIGHT LEVELS IN THE AREA AND AUTOMATICALLY ADJUST THE LIGHT LEVEL OF THE DAYLIGHT ZONE TO COMPENSATE FOR CONTRIBUTED DAYLIGHT. THE SWITCH MAY BE USED TO OVERRIDE THE AUTOMATICALLY SET LIGHT LEVEL.
4. ELCU SHALL ALLOW EMERGENCY LIGHTTING TO BE SWITCHED WITH NORMAL LIGHTING. UPON LOSS OF NORMAL POWER SENSE FEED, ELCU WILL WILL FORCE LIGHTS TO FULL REGARDLESS OF POSITION OF SWITCH.

NOT TO SCALE 2

DETAIL –

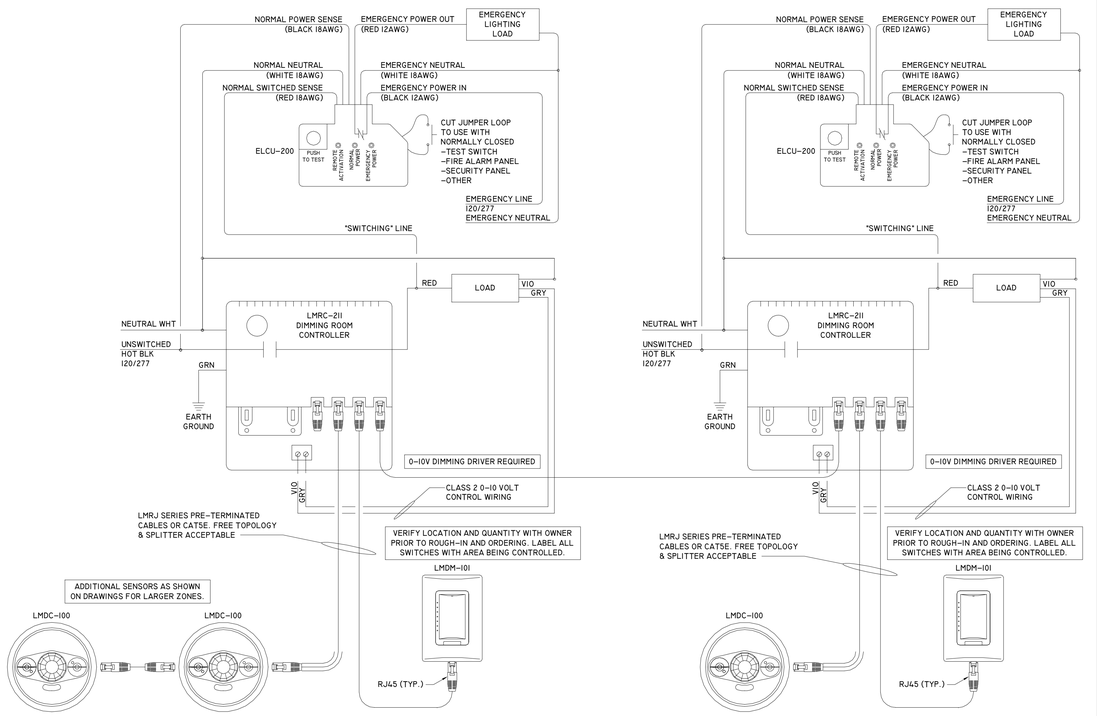
NOT TO SCALE 5

DETAIL –

NOT TO SCALE 4

DETAIL – TYP. CORRIDOR / LOBBY AREA LIGHTING CONTROL WITH OCCUPANCY SENSORS

NOT TO SCALE 1



ADJUST AND PROGRAM SYSTEM FOR SEQUENCE OF OPERATION:
1. THE OCCUPANCY SENSOR SHALL TURN LIGHTS ON TO THE PRESET LEVEL UPON OCCUPANCY DETECTION AND OFF AFTER NO OCCUPANCY IS DETECTED FOR 20 MINUTES.
2. THE DIMMER SWITCH MAY BE USED TO ADJUST THE LIGHT LEVELS.
3. ELCU SHALL ALLOW EMERGENCY LIGHTTING TO BE SWITCHED WITH NORMAL LIGHTING. UPON LOSS OF NORMAL POWER SENSE FEED, ELCU WILL WILL FORCE LIGHTS TO FULL REGARDLESS OF POSITION OF SWITCH.

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PLUMBING LEGEND & ABBREVIATIONS

DISREGARD LEGEND ITEMS NOT INDICATED ON DRAWINGS	
	NEW PLUMBING FIXTURE
SAN / S	SANITARY WASTE
STORM / ST	STORM DRAINAGE LINE
C.D.	CONDENSATE DRAIN LINE
GW	GREASE WASTE
AW	ACID WASTE
CHEM-W	CHEMICAL WASTE
V	VENT
FIRE	FIRE LINE
DIS	DEIONIZED WATER SUPPLY
DIR	DEIONIZED WATER RETURN
SW	SOFT WATER
CW	DOMESTIC COLD WATER PIPING
HW	DOMESTIC HOT WATER PIPING
HWR	DOMESTIC HOT WATER RETURN PIPING
TW	TEMPERED WATER PIPING
TWR	TEMPERED WATER RETURN PIPING
NPW(C)	NON POTABLE WATER (COLD)
HPW(H)	NON POTABLE WATER (HOT)
DI	DEIONIZED WATER
NG / G	NATURAL GAS
LA	NATURAL GAS
VAC	NATURAL GAS
N2	NATURAL GAS
FCO	FLOOR CLEAN OUT
ECO	EXTERIOR CLEANOUT
WCO	WALL CLEANOUT
FD	FLOOR DRAIN
FS	FLOOR SINK
	RISER IDENTIFICATION
	ELBOW UP
	ELBOW DOWN
	CAP AND SEAL
	BALL VALVE
B.V.	BALANCING VALVE
	GAS VALVE
C.V.	CHECK VALVE
	SOLENOID VALVE
	FLOW SWITCH
TP	AUTOMATIC TRAP PRIMER
BFP	BACKFLOW PREVENTER
VTR	VENT THROUGH ROOF
F.F.L.	FINISHED FLOOR LEVEL
I.L.	INVERT LEVEL
A.R.F.	ABOVE FINISHED ROOF
(E)	EXISTING TO REMAIN
(OF)	OVERFLOW STORM DRAINAGE
(P)	PRIMARY STORM DRAINAGE
T.A.S	TEXAS ACCESSIBILITY STANDARDS

PIPING MATERIALS

1. **SANITARY WASTE AND VENT PIPING** (BELOW GRADE)
SCHEDULE 40 PVC, CONFORM TO ASTM D-1785 SOIL AND WASTE VENT PIPING. FITTINGS SHALL BE COMPATIBLE MATERIAL WITH SOLVENT CEMENT TYPE JOINTS.

2. **SANITARY WASTE AND VENT PIPING** (ABOVE SLAB ONLY)
PIPE: CAST IRON PER CISPI STANDARD 301, HUBLESS, SERVICE WEIGHT.

JOINTS NO HUB, ASTM C 564 NEOPRENE GASKETS AND STANDARD STAINLESS STEEL CLAMP AND SOLID SHIELD ASSEMBLIES CONSTRUCTED OF TYPE 300 SERIES STAINLESS STEEL. CLAMP ASSEMBLIES SHALL CONFORM TO FM 1680 WHERE REQUIRED BY THE ADMINISTRATIVE AUTHORITY.

FITTINGS: CAST IRON, ASTM A 888 DRAINAGE PATTERN.

3. **STORM DRAINAGE** (BELOW GRADE)
SCHEDULE 40 PVC, CONFORM TO ASTM D-1785 SOIL AND WASTE VENT PIPING. FITTINGS SHALL BE COMPATIBLE MATERIAL WITH SOLVENT CEMENT TYPE JOINTS.

STORM DRAINAGE (ABOVE SLAB ONLY)
PIPE: CAST IRON PER CISPI STANDARD 301, HUBLESS, SERVICE WEIGHT.

JOINTS: NO HUB, ASTM C 564 NEOPRENE GASKETS AND STANDARD STAINLESS STEEL CLAMP AND SOLID SHIELD ASSEMBLIES CONSTRUCTED OF TYPE 300 SERIES STAINLESS STEEL. CLAMP ASSEMBLIES SHALL CONFORM TO FM 1680 WHERE REQUIRED BY THE ADMINISTRATIVE AUTHORITY.

FITTINGS: CAST IRON, ASTM A 888 DRAINAGE PATTERN.

4. **DOMESTIC WATER**
TYPE "L" COPPER TUBING WITH WROUGHT COPPER FITTINGS AND 95/5 (TIN/ANTIMONY) SOLDER JOINTS.

GENERAL NOTES

BOOK SPECIFICATION
SUPERCEDE ANY NOTES BELOW

1. THESE DRAWINGS ARE SCHEMATIC IN NATURE AND ARE NOT INTENDED TO SHOW ALL OFFSETS. INSTALL PIPING AS CLOSE AS POSSIBLE TO LOCATIONS SHOWN. WHERE INTERFERENCE'S WITH COMPONENTS OF OTHER TRADE'S WORK (STRUCTURAL FOUNDATIONS OR OTHER BUILDING ELEMENTS) REQUIRE ROUTINGS AND LOCATIONS THAT VARY FROM THOSE SHOWN, THE CONTRACTOR SHALL OBTAIN PROJECT ENGINEER'S APPROVAL PRIOR TO INSTALLATION. NO ADDITIONAL COST SHALL BE GRANTED FOR THESE CHANGES.

2. BEFORE BEGINNING EXCAVATIONS OR DEMOLITION OF ANY NATURE WHATSOEVER, CONTRACTOR SHALL LOCATE ALL SERVICES AND UTILITIES OCCURRING WITHIN THE BOUNDS OF THE PROJECT. THE CONTRACTOR SHALL THEN PROCEED WITH CAUTION IN HIS WORK SO THAT NO UTILITY OR LINE SERVING AREAS THAT ARE TO REMAIN BE DAMAGED WITH A RESULTANT LOSS OF SERVICE. VERIFY THE SOURCE AND SERVICE OF EACH AND EVERY LINE ENCOUNTERED AND RECORD SERVICE, SIZE AND LOCATION ON RECORD DRAWINGS.

3. ROUGH-IN PLUMBING PIPING USING DIMENSIONS SHOWN ON ARCHITECTURAL DRAWINGS. LOCATION OF ALL PIPING SHALL ALLOW INSTALLATION OF FIXTURES WITHOUT THE NEED TO FURR-OUT WALLS.

4. PROVIDE CLEANOUTS IN EXCESS OF THOSE SHOWN WHICH ARE REQUIRED BY THE PLUMBING CODE. CONTRACTOR SHALL PROVIDE A COVER STATING WHAT SYSTEM IT IS SERVING. (CLEANOUT SANITARY, CLEANOUT GREASE WASTE, CLEANOUT ACID WASTE.)

5. INDIVIDUAL FIXTURE SUPPLY AND DRAIN SERVICES ARE NOT SHOWN DUE TO DRAWING SPACE LIMITATIONS. THIS CONTRACTOR SHALL PROVIDE ALL SERVICES FOR A COMPLETE FIRST CLASS INSTALLATION.

6. FURNISH AND INSTALL ALL NECESSARY VALVES, TRAPS, GAUGES, STRAINERS, UNIONS, ETC. FOR EACH PIECE OF EQUIPMENT HAVING PLUMBING CONNECTIONS TO FACILITATE PROPER FUNCTIONING AND SERVICING.

7. SEAL ALL PENETRATIONS THROUGH RATED WALLS, FLOORS AND CEILINGS WITH A UL LISTED ASSEMBLY TO PROVIDE A RATING EQUAL TO OR GREATER THAN THE RATING OF THE WALL, FLOOR OR CEILING.

8. EACH CONTRACTOR SHALL VISIT THE SITE AND ASCERTAIN FOR HIMSELF THE CONDITIONS TO BE MET THERE IN IMPLEMENTING HIS WORK AND MAKE DUE PROVISIONS FOR THE SAME. IT IS ASSUMED THAT THE CONTRACTOR HAS VISITED THE PREMISES AND THAT HIS COST ESTIMATE COVERS ALL NECESSARY LABOR AND MATERIALS TO PROPERLY ACCOMPLISH HIS WORK. FAILURE ON THE PART OF THE CONTRACTOR TO COMPLY WITH THIS REQUIREMENT SHALL NOT BE CONSIDERED JUSTIFICATION FOR OMISSIONS OR FAULTY WORK OR FOR THE PAYMENT OF ADDITIONAL COMPENSATION.

9. FIELD VERIFY EXISTING AND FUTURE GRADES WITHIN AREAS WHERE WORK IS BEING DONE.

10. VERIFY EXACT LOCATION OF EQUIPMENT PRIOR TO INSTALLATION OF FLOOR DRAINS AND FLOOR SINKS. RELOCATION DUE TO MISPLACEMENT SHALL BE AT CONTRACTORS EXPENSE.

11. PROVIDE A KEYED ACCESS PANELS FOR ALL VALVES AND APPARATUSES THAT REQUIRE MAINTENANCE.

12. A WATER HAMMER ARRESTOR SHALL BE INSTALLED FOR ALL SINGLE AND MULTIPLE FIXTURE BRANCH LINES. WATER HAMMER ARRESTORS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS AND CONFORM TO ASSE 1010. PROVIDE FOR HOT WATER AND COLD WATER LINES AND REFER TO WATER HAMMER ARRESTOR DETAIL FOR MORE INFORMATION AND SIZING.

13. INSULATE PIPING AS FOLLOWS:
DOMESTIC COLD WATER PIPING:
INSULATE AND VAPOR SEAL ALL COLD AND SOFTENED WATER PIPE WITH GLASS FIBER PIPE INSULATION. (EXCEPTION - ALL PIPING EXPOSED TO THE EXTERIOR SHALL BE PROVIDED WITH ALUMINUM).

DOMESTIC HOT WATER PIPING:
INSULATE ALL HOT WATER PIPE WITH GLASS FIBER PIPE INSULATION WITH FACTORY-APPLIED WHITE JACKET.

DRAINS:
INSULATE AND VAPOR SEAL ALL ABOVEGROUND P-TRAPS AND HORIZONTAL DRAIN PIPING RECEIVING CONDENSATE OR ICE MAKER DRAINAGE WITH 1/2" GLASS PER FIBER INSULATION.
INSULATE AND VAPOR SEAL ROOF DRAIN AND OVERFLOW ROOF DRAIN SUMP, PIPING AND FITTINGS FROM DRAIN TO VERTICAL LEADER WITH 1/2" GLASS FIBER INSULATION.
A.D.A. ACCESSIBLE LAVATORIES AND SINKS:
INSULATE ALL EXPOSED DRAIN PIPING AND WATER SUPPLY PIPING BENEATH A.D.A. COMPLIANT LAVATORIES & SINKS WITH FULLY MOLDED CLOSED CELL VINYL INSULATION KIT AS MANUFACTURED BY TRUEBRO, BROCAR OR MCGUIRE.

14. SUPPORT UNBURIED PIPE AS FOLLOWS:
HORIZONTAL PIPING:
HUBLESS CAST IRON SOIL PIPING SHALL BE SUPPORTED AT LEAST AT EVERY OTHER JOINT EXCEPT THAT WHEN THE DEVELOPED LENGTH BETWEEN SUPPORTS EXCEEDS FOUR FEET, THEY SHALL BE PROVIDED AT EACH JOINT. SUPPORTS SHALL ALSO BE PROVIDED AT EACH HORIZONTAL BRANCH CONNECTION. SUPPORTS SHALL BE PLACED IMMEDIATELY ADJACENT TO THE COUPLING. SUSPENDED LINES SHALL BE BRACED TO PREVENT HORIZONTAL MOVEMENT.
COPPER TUBING SHALL BE SUPPORTED AT NOT MORE THAN SIX FOOT INTERVALS FOR PIPING 1-1/2" AND SMALLER AND NINE FOOT INTERVALS FOR PIPING 2" AND LARGER IN DIAMETER.
HANGERS FOR NON-INSULATED COPPER PIPING SHALL HAVE A COPPER FINISH. IN POTENTIALLY DAMP LOCATIONS, NON-INSULATED COPPER PIPING HANGERS OR SUPPORTS SHALL BE PLASTIC-COATED.
STEEL PIPING SHALL BE SUPPORTED AT INTERVALS OF NO GREATER THAN 6 FEET FOR 1/2" PIPING, 8 FEET FOR 3/4" & 1" PIPING AND 10 FEET FOR 1-1/4" AND LARGER PIPING.

VERTICAL PIPING:
PROVIDE RISER CLAMP AT BASE AND AT EACH FLOOR LEVEL

15. MARKING AND IDENTIFICATION:
IDENTIFY EACH PIPE WITH LABELING AT THE FOLLOWING LOCATIONS:
-AT EACH BRANCH TAKE-OFF FROM A MAIN
-ON EACH SIDE OF A WALL PENETRATION
-EVERY 20' OF STRAIGHT RUN OF PIPE
-AT EQUIPMENT CONNECTIONS IF MORE THAN 10' FROM A BRANCH TAKE-OFF

DOMESTIC HOT WATER:
INDICATE DELIVERED WATER TEMPERATURE ON DOMESTIC HOT WATER SUPPLY AND RETURN LINES.
INDICATE FLOW DIRECTION WITH ARROWS ON DOMESTIC HOT WATER SUPPLY AND RETURN LINES.

MEDIUM PRESSURE GAS PIPING:
MEDIUM PRESSURE GAS PIPING (¼" WIC TO 5 PI) SHALL BE IDENTIFIED BY THE STATEMENT, "WARNING TO 5 PI NATURAL GAS." THESE LABELS SHALL BE PLACED AT INTERVALS NOT EXCEEDING 30 FEET. ALL REGULATORS IN MEDIUM PRESSURE LINES SHALL HAVE IDENTIFICATION TAGS IN ACCORDANCE WITH APPLICABLE CODES.

16. SLEEVES:
FLOORS: PROVIDE UL FIRE RATED ASSEMBLIES WERE PIPES PENETRATE ABOVE GRADE FLOORS.
WALLS: PROVIDE UL FIRE RATED ASSEMBLIES WERE PIPES PENETRATE FIRE RATED WALLS.
WHERE PIPING PASSES THROUGH NON CEILING OR WALL, CLOSE OFF SPACE BETWEEN PIPE OR DUCT AND CONSTRUCTION WITH NORMAL GYPSUM WALLBOARD, REPAIR PLASTER SMOOTHED AND FINISHED TO MATCH REMAINDER OF WALL.
INSTALL CHROME OR STAINLESS STEEL ESCUTCHEONS WHERE PIPING PASSES THROUGH FINISHED SURFACES.

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NOTES AND LEGEND

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ANWAR HASSAN
64671
LICENSED
PROFESSIONAL ENGINEER

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P0.00

PLUMBING FIXTURE SCHEDULE

MARK	DESCRIPTION	SIZE OF CONNECTION TRAP	SS	SV	CW	HW	REMARKS
WC-1	WATER CLOSET (FLOOR MOUNTED)	-	4"	2"	1"	-	2234.001 AMERICAN STANDARD "MADERA", FLOOR MOUNTED, 12" ROUGHING-IN, 14"HIGH, ELONGATED BOWL, WITH 1-1/2 INCH INLET TOP SPUD. 1.28 GPF SLOAN ROYAL FLUSH VALVE WITH VACUUM BREAKER, AND 1-INCH SCREWDRIVER ANGLE STOP. 111-1.28 SLOAN "ROYAL". SYNTHETIC RUBBER DIAPHRAGM WITH DUAL FILTERED FIXED BYPASS, ADA COMPLIANT METAL OSCILLATING NON-HOLD-OPEN HANDLE WITH TRIPLE SEAL HANDLE PACKING, 1" I.P.S. SCREWDRIVER BAK-CHEK® ANGLE STOP WITH FREE SPINNING VANDAL RESISTANT STOP CAP, ADJUSTABLE TAILPIECE, HIGH BACK PRESSURE VACUUM BREAKER FLUSH CONNECTION WITH ONE-PIECE BOTTOM HEX COUPLING NUT, SPUD COUPLING AND FLANGE FOR 1-1/2" TOP SPUD, SWEAT SOLDER ADAPTER W/COVER TUBE & CAST WALL FLANGE W/SET SCREW, HIGH COPPER, LOW ZINC BRASS CASTINGS FOR DEZINCIFICATION RESISTANCE, NON-HOLD-OPEN HANDLE, FIXED METERING BYPASS AND NO EXTERNAL VOLUME ADJUSTMENT TO ENSURE WATER CONSERVATION, FLUSH ACCURACY CONTROLLED BY CID TECHNOLOGY, DIAPHRAGM, HANDLE PACKING, STOP SEAT AND VACUUM BREAKER MOLDED FROM PERMEX RUBBER COMPOUND FOR CHLORAMINE RESISTANCE. 9500C CHURCH, ELONGATED SEAT, OPEN FRONT LESS COVER, SOLID PLASTIC, CONCEALED CHECK STAINLESS STEEL HINGES.
WC-2	WATER CLOSET (FLOOR MOUNTED) (A.D.A.)	-	4"	2"	1"	-	3461.001 AMERICAN STANDARD "MADERA", FLOOR MOUNTED, 12" ROUGHING-IN, ADA 17"H ELONGATED BOWL, WITH 1-1/2 INCH INLET SPUD. 1.28 GPF. 111-1.28 SLOAN "ROYAL". SYNTHETIC RUBBER DIAPHRAGM WITH DUAL FILTERED FIXED BYPASS, ADA COMPLIANT METAL OSCILLATING NON-HOLD-OPEN HANDLE WITH TRIPLE SEAL HANDLE PACKING, 1" I.P.S. SCREWDRIVER BAK-CHEK® ANGLE STOP WITH FREE SPINNING VANDAL RESISTANT STOP CAP, ADJUSTABLE TAILPIECE, HIGH BACK PRESSURE VACUUM BREAKER FLUSH CONNECTION WITH ONE-PIECE BOTTOM HEX COUPLING NUT, SPUD COUPLING AND FLANGE FOR 1-1/2" TOP SPUD, SWEAT SOLDER ADAPTER W/COVER TUBE & CAST WALL FLANGE W/SET SCREW, HIGH COPPER, LOW ZINC BRASS CASTINGS FOR DEZINCIFICATION RESISTANCE, NON-HOLD-OPEN HANDLE, FIXED METERING BYPASS AND NO EXTERNAL VOLUME ADJUSTMENT TO ENSURE WATER CONSERVATION, FLUSH ACCURACY CONTROLLED BY CID TECHNOLOGY, DIAPHRAGM, HANDLE PACKING, STOP SEAT AND VACUUM BREAKER MOLDED FROM PERMEX RUBBER COMPOUND FOR CHLORAMINE RESISTANCE. 9500C CHURCH, ELONGATED SEAT, OPEN FRONT LESS COVER, SOLID PLASTIC, CONCEALED CHECK STAINLESS STEEL HINGES. WATER CLOSET RIM HEIGHT SHALL BE 17" ABOVE FINISHED FLOOR LEVEL PER A.D.A. REQUIREMENTS.
L-2	LAVATORY (WALL MOUNTED) (A.D.A.)	1 1/4"	2"	2"	1/2"	-	0355.012 AMERICAN STANDARD "LUCERNE", WALL HUNG LAVATORY, BARRIER FREE, VITREOUS CHINA, 3 HOLES 4" CENTER. UTILIZE WALL HANGER INCLUDED. 802-VE2805-317ABCP CHICAGO FAUCET, 4" FIXED CENTERS, E2805 – 0.5 GPM (1.9 L/MIN) VANDAL PROOF NON-AERATING SPRAY, 317-PR – 4" WRISTBLADE HANDLE. BV02 MCGUIRE, 1/2 IPS X 3/8 OD, QUARTER-TURN BRASS BALL VALVE ANGLE STOP. 149 MCGUIRE, FLAT GRID STRAINER WITH 4" TAILPIECE. 8872 MCGUIRE, HEAVY CAST BRASS 1 1/4 X 1 1/4 ADJUSTABLE TRAP WITH CLEANOUT PLUG. 102-EZ-W TRUEBRO. "P" TRAP AND SUPPLY INSULATION KIT. LFUSG-B-SC WATTS THERMOSTATIC MIXING VALVE, MIXING VALVE WITH DOUBLE THROTTLING DESING, TEMPERATURE SHALL BE SET TO 110°.
U-1	URINAL	3"	2"	2"	3/4"	-	6590.001 AMERICAN STANDARD "WASHBROOK", ULTRA HIGH EFFICIENCY, LOW CONSUMPTION. OPERATES IN THE, RANGE OF 0.125 GPF. FLUSHING RIM, ELONGATED 14" RIM FROM FINISHED WALL, WASHOUT FLUSH ACTION, EXTENDED SIDES FOR PRIVACY, 3/4" INLET SPUD, OUTLET CONNECTION READED 2" INSIDE (NPTF), STRAINER INCLUDED, MEETS ASME FLUSH REQUIREMENTS AT 0.125 GPF. 186-0.125 SLOAN "ROYAL", FOR FLUSHING VOLUME 0.125: DUAL LINEAR FILTERED BYPASS DIAPHRAGM, ADA COMPLIANT METAL OSCILLATING NON-HOLD-OPEN HANDLE WITH TRIPLE SEAL HANDLE PACKING, ⅜" I.P.S. SCREWDRIVER BAK-CHEK® ANGLE STOP W/ FREE SPINNING VANDAL RESISTANT STOP CAP, ADJUSTABLE TAILPIECE, HIGH BACK PRESSURE VACUUM BREAKER FLUSH CONNECTION W/ ONE-PIECE BOTTOM HEX COUPLING NUT, SPUD COUPLING AND FLANGE FOR 3/4" TOP SPUD, SWEAT SOLDER ADAPTER W/COVER TUBE & CAST WALL FLANGE W/SET SCREW, HIGH COPPER, LOW ZINC BRASS CASTINGS FOR DEZINCIFICATION RESISTANCE, NON-HOLD-OPEN HANDLE, FIXED METERING BYPASS AND NO EXTERNAL VOLUME ADJUSTMENT TO ENSURE WATER CONSERVATION, FLUSH ACCURACY CONTROLLED BY CID TECHNOLOGY, DIAPHRAGM, HANDLE PACKING, STOP SEAT AND VACUUM BREAKER MOLDED FROM PERMEX SYNTHETIC RUBBER COMPOUND FOR CHLORAMINE RESISTANCE. 0611 SERIES J.R. SMITH, CONCEALED CHAIR CARRIER WITH BEARING PLATE OR APPROVED EQUAL. URINAL RIM HEIGHT SHALL BE 24" ABOVE FINISHED FLOOR LEVEL.
U-2	URINAL A.D.A.	3"	2"	2"	3/4"	-	6590.001 AMERICAN STANDARD "WASHBROOK", ULTRA HIGH EFFICIENCY, LOW CONSUMPTION. OPERATES IN THE, RANGE OF 0.125 GPF. FLUSHING RIM, ELONGATED 14" RIM FROM FINISHED WALL, WASHOUT FLUSH ACTION, EXTENDED SIDES FOR PRIVACY, 3/4" INLET SPUD, OUTLET CONNECTION READED 2" INSIDE (NPTF), STRAINER INCLUDED, MEETS ASME FLUSH REQUIREMENTS AT 0.125 GPF. 186-0.125 SLOAN "ROYAL", FOR FLUSHING VOLUME 0.125: DUAL LINEAR FILTERED BYPASS DIAPHRAGM, ADA COMPLIANT METAL OSCILLATING NON-HOLD-OPEN HANDLE WITH TRIPLE SEAL HANDLE PACKING, ⅜" I.P.S. SCREWDRIVER BAK-CHEK® ANGLE STOP W/ FREE SPINNING VANDAL RESISTANT STOP CAP, ADJUSTABLE TAILPIECE, HIGH BACK PRESSURE VACUUM BREAKER FLUSH CONNECTION W/ ONE-PIECE BOTTOM HEX COUPLING NUT, SPUD COUPLING AND FLANGE FOR 3/4" TOP SPUD, SWEAT SOLDER ADAPTER W/COVER TUBE & CAST WALL FLANGE W/SET SCREW, HIGH COPPER, LOW ZINC BRASS CASTINGS FOR DEZINCIFICATION RESISTANCE, NON-HOLD-OPEN HANDLE, FIXED METERING BYPASS AND NO EXTERNAL VOLUME ADJUSTMENT TO ENSURE WATER CONSERVATION, FLUSH ACCURACY CONTROLLED BY CID TECHNOLOGY, DIAPHRAGM, HANDLE PACKING, STOP SEAT AND VACUUM BREAKER MOLDED FROM PERMEX SYNTHETIC RUBBER COMPOUND FOR CHLORAMINE RESISTANCE. 0611 SERES J.R. SMITH, CONCEALED CHAIR CARRIER WITH BEARING PLATE OR APPROVED EQUAL. URINAL RIM HEIGHT SHALL BE 17" ABOVE FINISHED FLOOR LEVEL.
EDF-1	ELECTRIC DRINKING FOUNTAIN (BI-LEVEL) (A.D.A.)	1 1/2"	2"	2"	1/2"	-	HAC8FSBL-WF-Q ADA HALSEY TAYLOR, WALL MOUNT WATER COLLER, BARRIER-FREE ACCESS BI-LEVEL, NO LEAD DRINKING FOUNTAIN, LIGHT TOUCH PUSHBAR ON FRONT, INSTALL COMPLETE WITH CUNO WATER FILTER. STAINLESS STEEL, VANDAL RESISTANT WATER COOLER. FOR MULTIPLE WATER COOLER INSTALLATION REFER TO ARCHITECTURAL DRAWINGS FOR MOUNTING HEIGHTS AND LOCATION. BV02 MCGUIRE'S, 1/2 IPS X 3/8 OD, QUARTER-TURN BRASS BALL VALVE ANGLE STOP, CHROME PLATED, CONVERTIBLE LOOSE KEY HANDLE. SUPPLY STOP VALVE SHALL BE CERTIFIED BY CSA OR OTHER RECOGNIZED TESTING AUTHORITY AND SHALL BEAR MANUFACTURER AND TESTING MARK. STOP TO BE CERTIFIED TO 200 PSI LINE PRESSURE. 8872 MCGUIRE, HEAVY CAST BRASS 1 1/4 X 1 1/4 ADJUSTABLE TRAP WITH CLEANOUT PLUG AND 1IINCH CENTER TO END. FURNISHED WITH SLIP NUTS, 17 GAUGE SEAMLESS TUBULAR BRASS WALL BEND, AND STEEL SHALLOW FLANGE. MLP100 HALSEY TAYLOR, IN WALL CARRIER MOUNTING SYSTEM.
	CANE TOUCH APRON	-	-	-	-	-	42522 HALSEY TAYLOR, STAINLESS STEEL APRON. PROVIDE APRON ONLY FOR UNITS MOUNTED AT NON-ADA HEIGHT TO MEET A.D.A. REQUIREMENTS OF 24" A.F.F.
WB-1	WASHING MACHINE DRAIN BOX	2"	2"	2"	1/2"	1/2"	B-200 GUY GRAY, WASHING MACHINE DRAIN BOX; FINISH: MINIMUM SPANGLE G90 HOT DIPPED GALVANIZED STEEL (UNPAINTED) VALVES: FURNISHED WITH DOMESTIC VALVES AND COMBINATION MIP OR SWEAT CONNECTION DRAIN: MALE THREAD FITTING AND LOCKNUT INCLUDED
MS-1	MOP SINK (FLOOR MOUNTED)	3"	3"	2"	3/4"	3/4"	HL-1800 STERN WILLIAMS HILOW 24"X24"X12" DRAIN SHALL CAST BRASS WITH STAINLESS STEEL STRAINER CAST INTEGRAL AND SHALL PROVIDE FOR CAULKED LEAD CONNECTION NOT LES THAN 1" DEEP TO A 3" PIPE. TERRAZZO RECEPTOR COMPOSED OF PEARL GREY MARBLE CHIPS AND WHITE PORTLAND CEMENT GROUND SMOOTH, GROUTED AND SEALED TO RESIST STAINS. STAINLESS STEEL CAP OF ONE PIECE 20 GA. 540-LD897SWXFCP CHICAGO FAUCETS, 8" FIXED CENTERS, 897-SJKCP - 5 3/4" RIGID VACUUM BREAKER SPOUT WITH 3/4" MALE HOSE THREAD AND PAIL HOOK, 369-PR - 2 3/8" LEVER HANDLE, XT - QUATURN COMPRESSION OPERATING CARTRIDGE, ATMOSPHERIC VACUUM BREAKER, NOT INTENDED FOR CONTINUOUS PRESSURE APPLICATIONS T-35 STERN WILLIAMS, HOSE AND WALL HOOK. HOSE 36" LONG, WITH 3/4" CHROME COUPLINGS. WALL BRACKET OF STAINLESS STEEL. T-40 STERN WILLIAMS, STAINLESS STEEL MOP HANGER OF STAINLESS STEEL WITH #4 FINISH. 24" LONG, WITH 3 RUBBER SPRING LOADED GRIPS. BP STERN WILLIAMS, SPLASH CATCHER PANELS OF 20 GA. TYPE 304 STAINLESS STEEL.

PLUMBING FIXTURE SCHEDULE

MARK	DESCRIPTION	SIZE OF CONNECTION TRAP	SS	SV	CW	HW	REMARKS
SK-1	SINGLE BOWL SINK (A.D.A)	1 1/2"	3"	2"	1/2"	1/2"	LRAD1716 ELKAY, SINGLE BOWL (16"L X 17"W X 6"D INSIDE BOWL), #18 GAUGE TYPE 304 NICKEL BEARING STAINLESS STEEL, SELF RIMMING, 2 HOLE 4" CENTER. 895-317GN2BE4ABCP CHICAGO FAUCETS, 4" FIXED CENTERS, GN2BAB - 5-1/4" RIGID / SWING GOOSENECK SPOUT, E4AB - 2.0 GPM (7.6 L/MIN) SPRAY, 317-PR - 4" WRISTBLADE HANDLE, XTAB – QUATURN COMPRESSION OPERATING CARTRIDGE, 1/2" NPSM SUPPLY INLETS AND COUPLING NUT FOR 3/8" OR 1/2" FLEXIBLE RISER, CHROME PLATE FINISH, WEIGHT: 5.000LBS, PACKAGE DIMENSIONS: 11.50"L X 6.00"W X 5.00"H, ECAST® CONSTRUCTION WITH EQUAL TO OR LESS THAN 0.25% LEAD CONTENT BY WEIGHTED AVERAGE, THIS ITEM SHIPS 10 BUSINESS DAYS FROM ORDER ACKNOWLEDGEMENT. 151 MCGUIRE, HEAVY DUTY FORGED BRASS BASKET STRAINER WITH A POLISHED AND CHROME PLATED BRASS STRAINER BODY, 1-1/2" X 4" SEAMLESS BRASS TAILPIECE, CAST BRASS LOCK AND COUPLING NUTS. 1151WC MCGUIRE, 1 1/2" ADA COMPLIANT OFFSET STAINER/DRAIN ASSEMBLY AND TAILPIECE, C8912 MCGUIRE, 1 1/2" CAST BODY P-TRAP AND CLEANOUT. INSULATE P-TRAP, TAILPIECE ASSEMBLY. BV02 MCGUIRE, 1/2 IPS X 3/8 OD, QUARTER-TURN BRASS BALL VALVE ANGLE STOP, CHROME PLATED, CONVERTIBLE LOOSE KEY HANDLE. SUPPLY STOP VALVE SHALL BE CERTIFIED BY CSA OR OTHER RECOGNIZED TESTING AUTHORITY AND SHALL BEAR MANUFACTURER AND TESTING MARK. STOP TO BE CERTIFIED TO 200 PSI LINE PRESSURE. 270-RF-STSTL-REC LEONARD, POINT OF USE THERMOSTATIC VALVE MIXING VALVE, BRONZE BODY, LOCKED TEMPERATURE ADJUSTMENT CAP (VANDAL RESISTANT), COPPER ENCAPSULATED THERMOSTAT ASSEMBLY WITH POLYMER THERMOPLASTIC SHUTTLE, STAINLESS STEEL SPRINGS, BUNA-N O'RINGS, INTEGRAL CHECK VALVES ON HOT AND COLD INLETS. SET TEMPERATURE TO 105°F
SK-2	3-COMPARTMENT SINK	3"	1 1/2"	2"	1/2"	1/2"	DI-3-1410 ADVANCE TABCO, THREE COMPARTMENT DROP-IN SINK 21"x50"x10", ONE PIECE SEAMLESS DEEP DRAWN SINK BOWL DESIGN. 18 GAUGE TYPE 304 SERIES STAINLESS STEEL. K-53 ADVANCE TABCO, 12" SWING SPOUT FAUCET, 4" O.C. 2165 MCGUIRE, 1/2" I.P.S. X 3/8" O.D. ANGLE STOP AND SUPPLY-WHEEL HANDLE. C8912 MCGUIRE, 1-1/4 CHROME PLATED "P" TRAP WITH CLEAN OUT
SK-3	HAND SINK	1 1/2"	3"	2"	1/2"	1/2"	7-PS-68 ADVANCE TABCO, WALL MOUNTED HAND SINK, ONE PIECE DEEP DRAWN SINK BOWL (10"WX14"LX8"D), KEYHOLE WALL MOUNT BRACKET, STAINLESS STEEL BASKET DRAIN 1 1/2"IPS, 4"O.C. SPLASH MOUNTED GOOSENECK FAUCET, CHROME PLATED FURNISHED WITH AERATOR. 2165 MCGUIRE, ANGLE SUPPLY/WHEEL HANDLE. 8872 MCGUIRE, CAST BODY P-TRAP AND CLEANOUT. INSULATE P-TRAP, TAILPIECE ASSEMBLY, AND HOT AND COLD WATER ANGLE VALVES WITH BROCAR PRODUCTS, INC. TRAP WRAP. LFUSG-B-SC WATTS THERMOSTATIC MIXING VALVE, MIXING VALVE WITH DOUBLE THROTTLING DESING, TEMPERATURE SHALL BE SET TO 110°.
FD-1	FLOOR DRAIN	3"-4"	3"-4"	2"	-	-	2005-B-NB, J.R. SMITH, DUCO CAST IRON BODY WITH FLASHING COLLAR AND ADJUSTABLE STRAINER HEAD 6" DIAMETER TYPE "A" NICKEL BRONZE STRAINER. INSTALL COMPLETE WITH PROSET TRAP GUARD, EXCEPT FOR SHOWER DRAIN.
FD-2	FLOOR DRAIN	3"-4"	6"	2"	-	-	FJ100-VD MIFAB, FLOOR DRAIN WITH SOLID HINGED ROUND COVER AND SECONDARY GRATE FOR NON-MEMBRANE FLOOR AREAS.
ECO-1	EXTERIOR CLEANOUT	-	-	-	-	-	4250 J.R. SMITH, ALL EXTERIOR CLEANOUTS SHALL BE SET AT FINISHED GRADE IN 6 INCH THICK CONCRETE PAD FINISHED SMOOTH ON TOP. HOUSING SHALL BE COMPLETELY FREE OF PIPING SO NO LOADING IS TRANSMITTED TO THE PIPE.
FCO-1	FLOOR CLEANOUT	-	-	-	-	-	4040 J.R. SMITH, WITH SCREWED PLUG AND FLASHING RING AND COVER PLATE WITH SECURING SCREW. COVER PLATE SHALL BE FLUSH TO FINISH FLOOR, AND SUITABLE FOR FLOOR COVERING INSTALLED.
WCO-1	WALL CLEANOUT	-	4"	2"	1"	-	4435 J.R. SMITH, WITH SCREWED PLUG AND FLASHING RING AND COVER PLATE WITH SECURING SCREW. COVER PLATE SHALL BE FLUSH TO FINISH WALL. COORDINATE WITH ARCHITECTURAL DRAWINGS FOR CASEWORK LOCATIONS, COVER PLATE SHALL THEN BE FLUSHED WITH CASE WORK'S FINISH BACK WALL.
FS-1	FLOOR SINK	4"	4"	2"	1/2"	-	3100C J.R. SMITH, 1/2 TOP GRATE, ACID RESISTANT INDIRECT WASTE FLOOR SINK, DUCO CAST IRON BODY, LOOSE GRATE WITH SEDIMENT BUCKET 8.5"SQ. – 6" DEEP AND TRAP PRIMER CONNECTION. FURNISH AND INSTALL WITH DEEP SEAL P-TRAP ASSEMBLY.
RVB-1	REFRIGERATOR/ ICE MAKER VALVE BOX	-	-	-	1/2"	-	BIM875 – GUY GRAY – REFRIGERATOR/ ICE MAKER VALVE BOX, FURNISHED WITH 1/2" FIP INLET X 1/4" OD OUTLET COMPERSSION ANGLE VALVE. PROVIDE FILTER WHEN MAKING FINAL CONNECTION. (FURNISH AND INSTALL AT ALL REFRIGERATORS AND ICE MACHINES)
WH-1	WALL HYDRANT (FREEZE POOF)	-	-	-	3/4"	-	5519 J.R. SMITH, BRONZE QUARTER TURN NON-FREEZE AUTOMATIC DRAINING HYDRANT WITH STAINLESS STEEL FACE, HOSE CONNECTION, INTEGRAL VACUUM BREAKER AND DUAL CHECK VALVE. "T" HANDLE KEY, WHEEL HANDLE AND STAINLESS STEEL BOX WITH FULL 180° COVER OPENING.
RD-1	ROOF DRAIN (PRIMARY)	-	-	-	-	-	1010-AD J.R. SMITH, DUCO CAST IRON BODY WITH COMBINED FLASHING CLAMP AND GRAVEL STOP WITH CAST IRON DOME.
RD-2	ROOF DRAIN (OVERFLOW)	-	-	-	-	-	1080C-AD J.R. SMITH, DUCO CAST IRON BODY WITH WIDE FLANGE, COMBINED FLASHING CLAMP AND WATER DAM WITH CAST IRON DOME.

ELECTRIC WATER HEATER SCHEDULE

MARK	MFR	MODEL	VOLTS	Ø	ELEMENT(S) QTY	ELEMENT(S) KW	RECOVERY GPH @ 100°F RISE	TANK CAPACITY GALLONS	LOCATION
EWH-1	A.O. SMITH	DRE-52-15	480	3	3	15	61	52	MEC/ELEC ROOM.

NOTES:
1. OUTLET TEMPERATURE SHALL BE 140°F.
2. PROVIDE TMV-1LEONARD MIXING VALVE MODEL 370. INLET SIZE 3/4" AND OUTLET SIZE 3/4". MIXING VALVE HOT WATER OUTLET TEMP SHALL BE SET TO (110°F) TO PREVENT BACTERIA GROWTH .
3. PROVIDE SIMULTANEOUS ELEMENT OPERATION.

HOT WATER CIRCULATING PUMP SCHEDULE

MARK	MFR.	MODEL NO.	TYPE	G.P.M.	HEAD	H.P.	VOLTAGE	MOTOR R.P.M.	LOCATION
HWCP-1	BELL & GOSSETT	PL-55	IN LINE BRONZE	15	40	1/12	120 / 1ø	1725	MECH. ROOMS

NOTES:
1. HOT WATER CIRCULATION PUMP SHALL BE PROVIDED WITH TIMER TO DE-ENERGIZE THE PUMP UNDER DURING UNOCCUPIED PERIODS PER THE CURRENT IECC.

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LJA ENGINEERING
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KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
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MEP ENGINEER
INFRASTRUCTURE ASSOCIATES
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HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023

DATE ISSUED: 02.29.2024

TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

FIXTURE SCHEDULE

100% Construction Documents
02.29.2024

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ANWAR HASSAN
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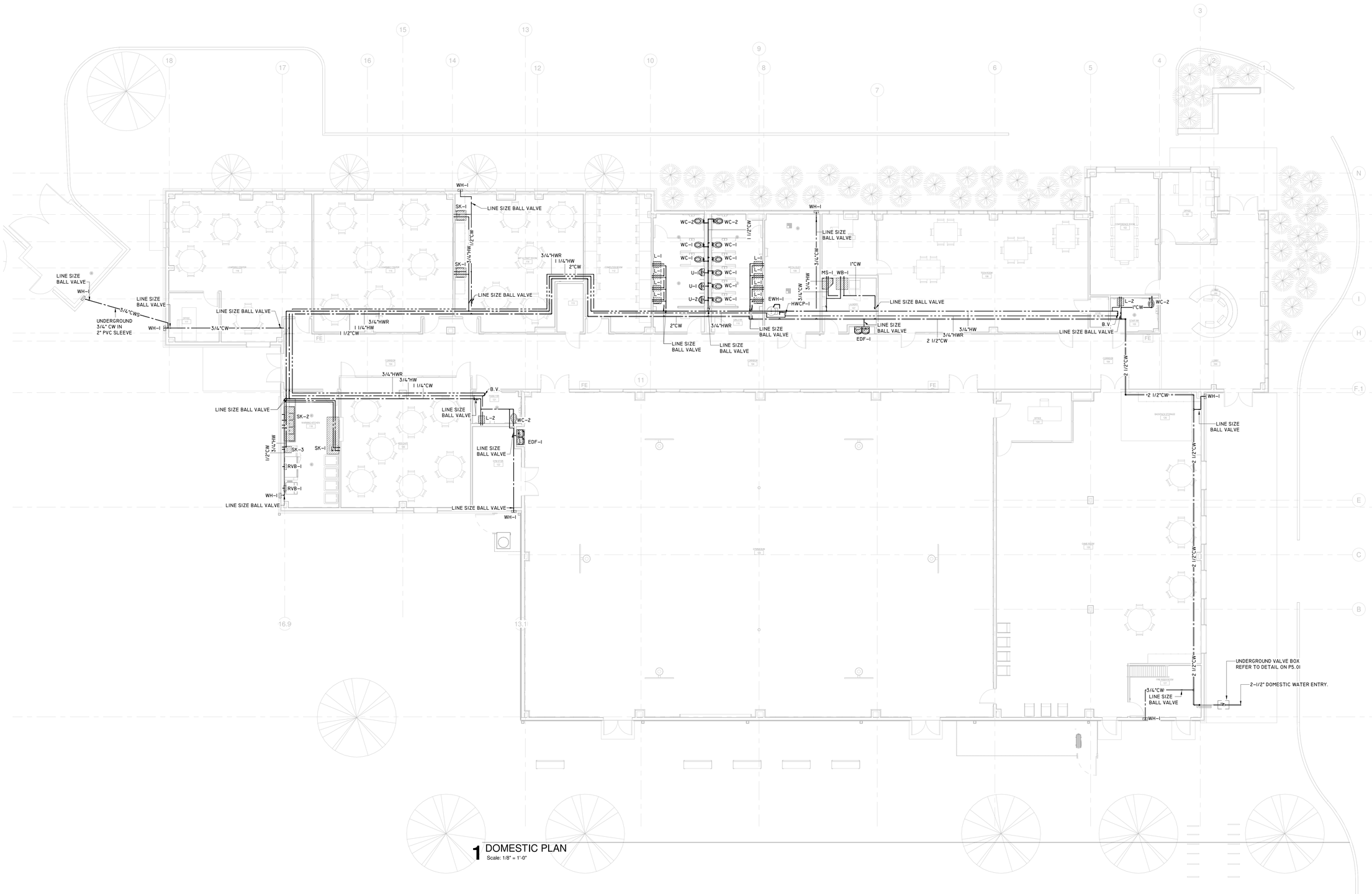

1 DOMESTIC PLAN
Scale: 1/8" = 1'-0"

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DOMESTIC PLAN

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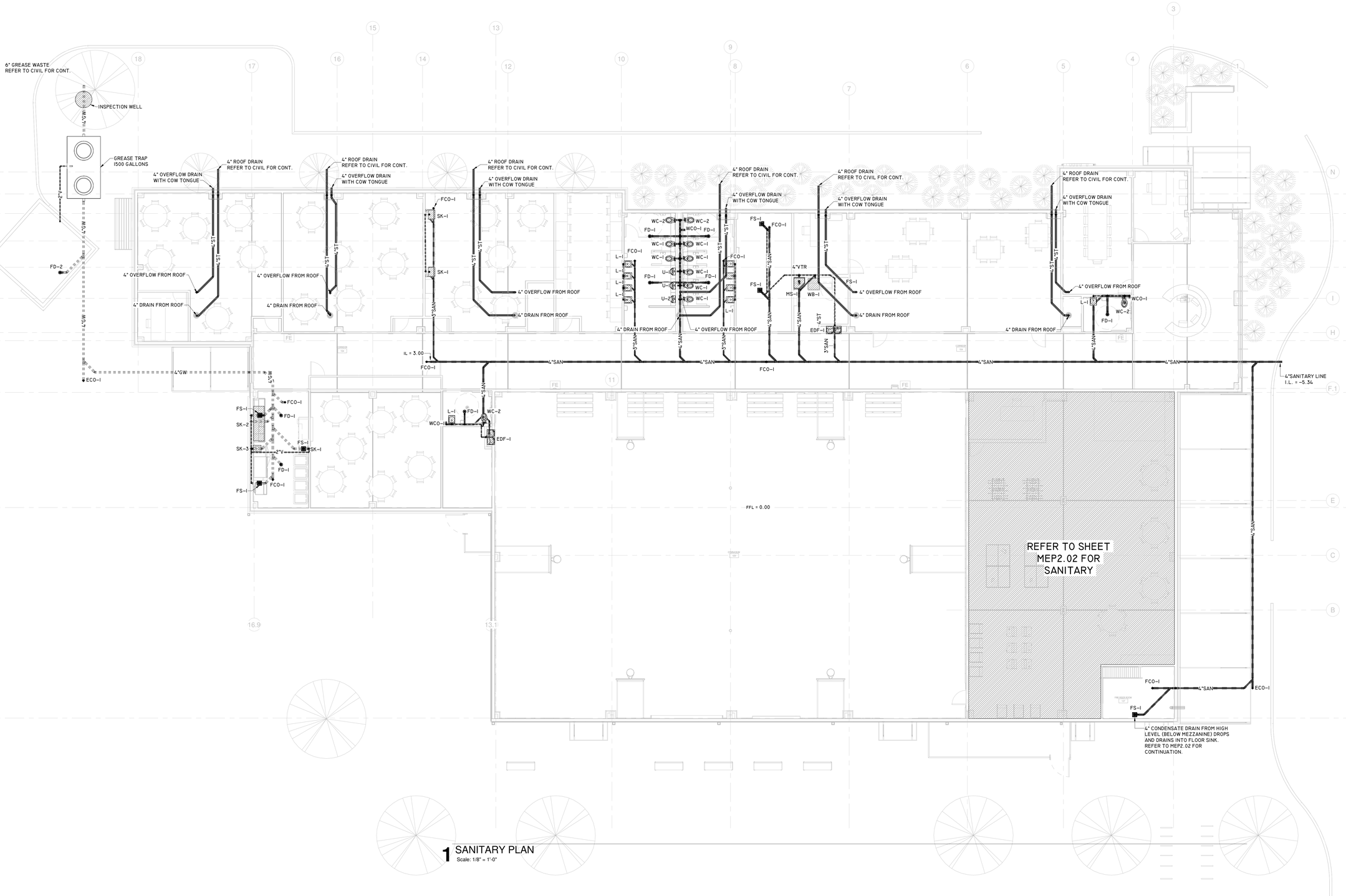

1 SANITARY PLAN
Scale: 1/8" = 1'-0"

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SANITARY PLAN

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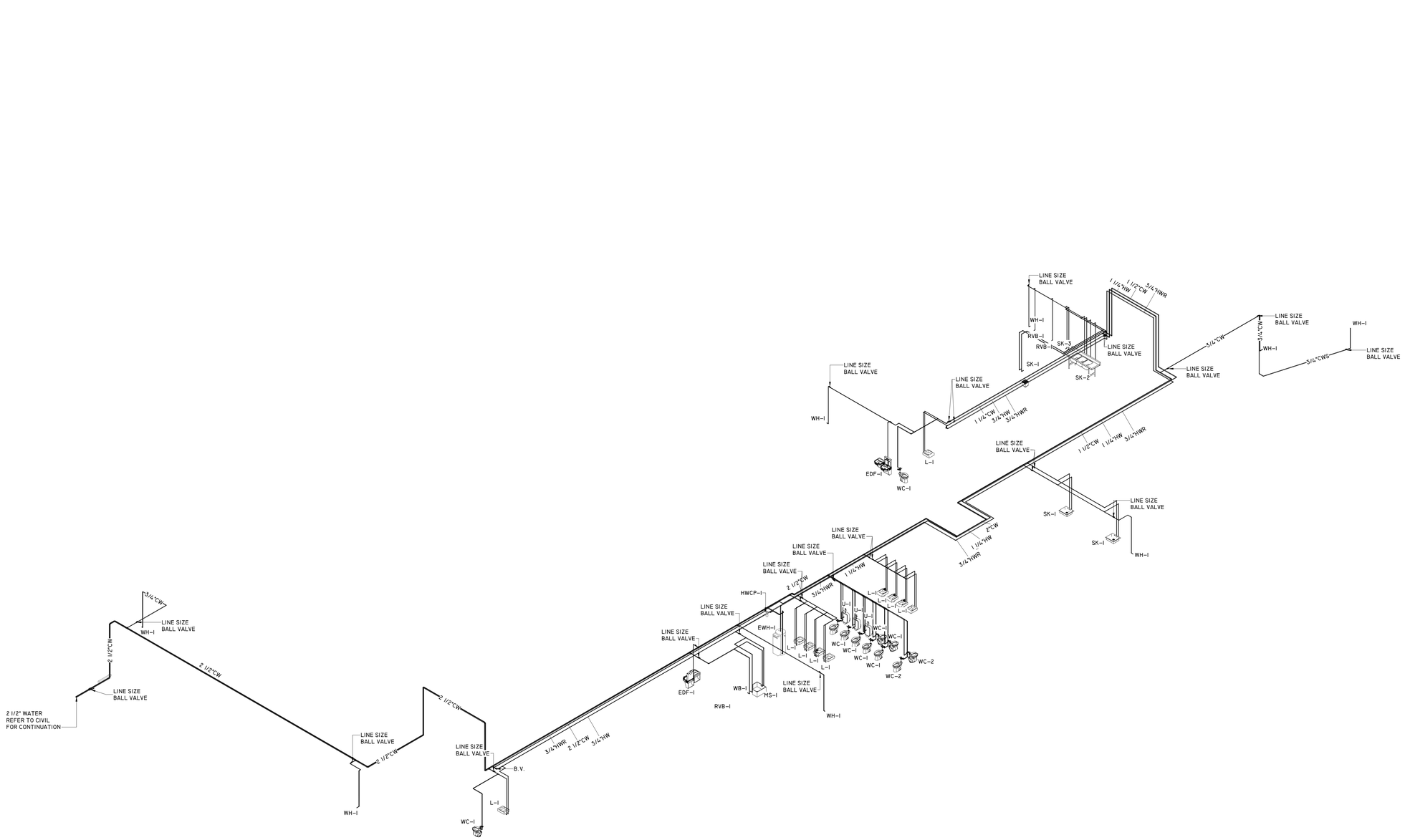

1 RISER DIAGRAM - DOMESTIC
Scale:

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RISER DIAGRAM – DOMESTIC

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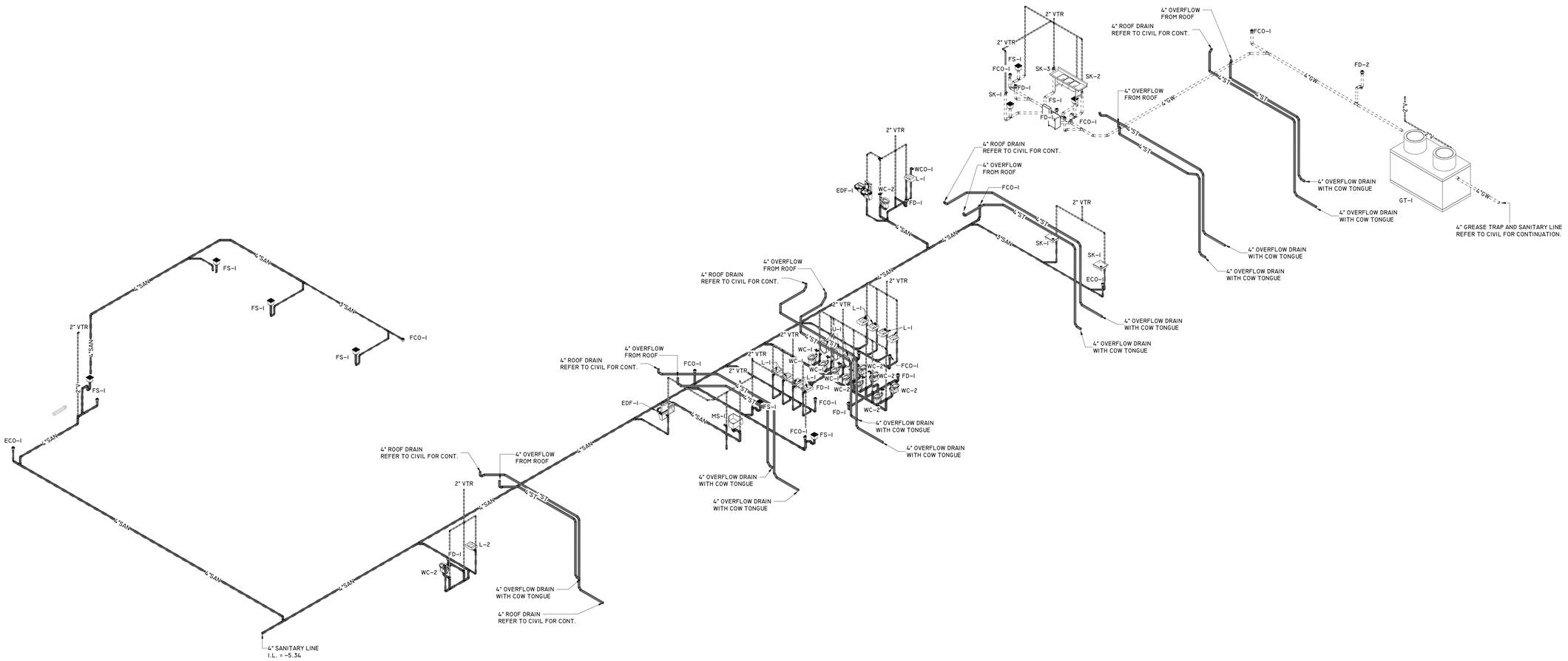

1 RISER DIAGRAM - SANITARY
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RISER DIAGRAM – SANITARY

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2024-02-29 #F-4506

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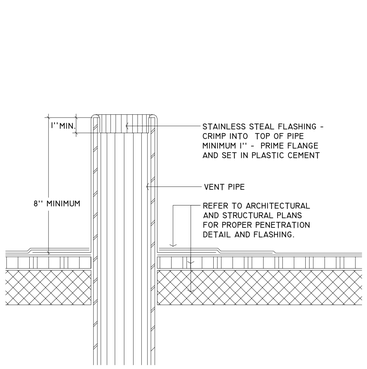
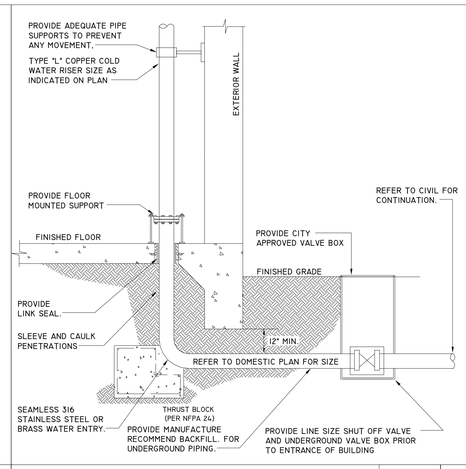
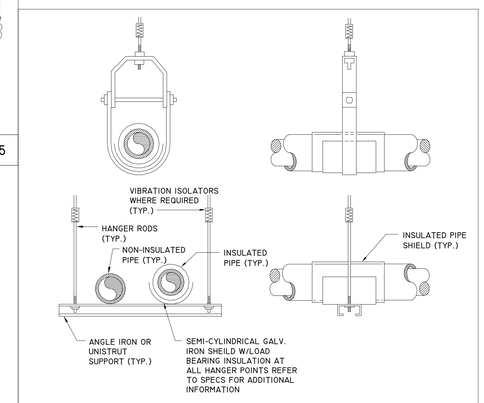


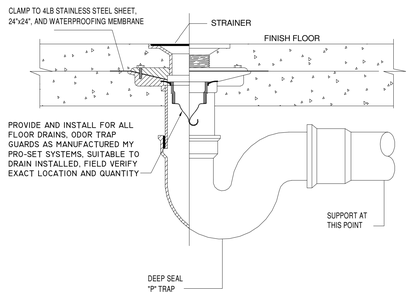
VENT THROUGH ROOF DETAIL | NOT TO SCALE | 8



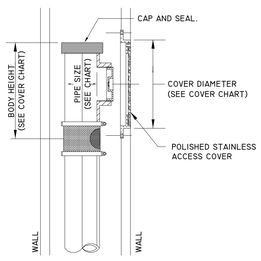
DOMESTIC WATER ENTRY DETAIL | NOT TO SCALE | 5



PIPE HANGER DETAIL | NOT TO SCALE | 2



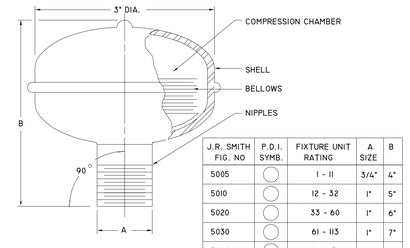
FLOOR DRAIN DETAIL WITH TRAP GUARD | NOT TO SCALE | 10



MIFAB WALL CLEAN OUT

MODEL NUMBER	PIPE SIZE (NO HUB)	BODY HEIGHT	STAINLESS STEEL ACCESS COVER	MIN. WALL CAVITY SIZE
C1462-R6-3	2"	6.5"	6"	4 1/2"
C1463-R6-3	3"	8.125"	6"	6 1/2
C1466-R6-3	4"	9.75"	6"	8"
C1466-R9-3	6"	14"	9"	11 1/2"
C1468-R9-3	8"	17"	9"	15"

WALL CLEANOUT DETAIL | NOT TO SCALE | 7

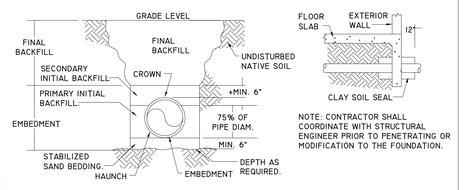


J.R. SMITH FIG. NO	P.D.I. SYMB.	FIXTURE UNIT RATING	A SIZE	B
5005		1 - 11	3/4"	4"
5010		12 - 32	1"	5"
5020		33 - 60	1"	6"
5030		61 - 113	1"	7"
5040		114 - 154	1"	8"
5050		155 - 330	1"	9"

NOTES:

1. ALWAYS INSTALL IN UPRIGHT POSITION
2. INSTALL AT AN ACCESSIBLE LOCATION. PROVIDE ACCESS PANEL WHERE REQUIRED.
3. COMPLY WITH THE LATEST UNIFORM PLUMBING CODE

WATER HAMMER ARRESTERS | NOT TO SCALE | 4



NOTE: CONTRACTOR SHALL COORDINATE WITH STRUCTURAL ENGINEER PRIOR TO PENETRATING OR MODIFICATION TO THE FOUNDATION.

UNDERGROUND INSTALLATION OF PLASTIC PIPE

PLASTIC PIPE SHOULD ALWAYS BE BURIED IN STRICT ACCORDANCE WITH THE ASTM STANDARD RELEVANT TO THE TYPE OF PLASTIC PIPING SYSTEM BEING INSTALLED. THOSE STANDARDS ARE:

ASTM D2321 STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY-FLOW APPLICATIONS.

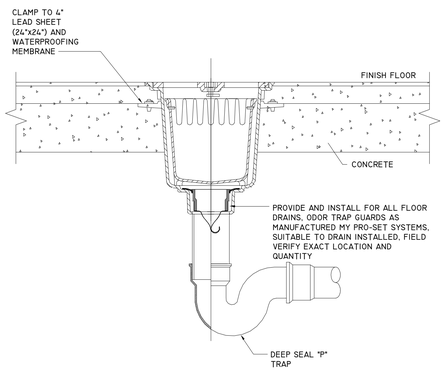
ASTM D2774 STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PRESSURE PIPING.

NOTE: IN ADDITION TO THESE STANDARDS, PIPE SHOULD ALWAYS BE INSTALLED IN ACCORDANCE WITH ALL LOCAL CODE REQUIREMENTS.

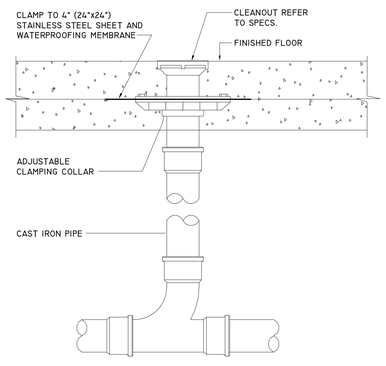
RECOMMENDATIONS FOR UNDERGROUND INSTALLATION OF PLASTIC DRAINAGE PIPE:

1. THE MINIMUM WIDTH OF THE TRENCH SHOULD BE THE PIPE OD (OUTSIDE DIAMETER) PLUS 16 INCHES THIS WILL ALLOW ADEQUATE ROOM FOR JOINING THE PIPE, SNAKING THE PIPE IN THE TRENCH TO ALLOW FOR EXPANSION AND CONTRACTION WHERE APPROPRIATE AND SPACE FOR BACKFILLING AND COMPACTION OF BACKFILL. THE SPACE BETWEEN THE PIPE AND TRENCH WALL MUST BE WIDER THAN THE COMPACTION EQUIPMENT USED TO COMPACT THE BACKFILL.
2. PROVIDE A MINIMUM OF 4 INCHES OF FIRM, STABLE AND UNIFORM BEDDING MATERIAL IN THE TRENCH BOTTOM. IF ROCK OR UNYIELDING MATERIAL IS ENCOUNTERED, A MINIMUM OF 6 INCHES OF BEDDING SHALL BE USED. BLOCKING SHOULD NOT BE USED TO CHANGE PIPE GRADE OR TO INTERMITTENTLY SUPPORT PIPE OVER LOW SECTIONS IN THE TRENCH.
3. THE PIPE SHOULD BE SURROUNDED WITH AN AGGREGATE MATERIAL WHICH CAN BE EASILY WORKED AROUND THE SIDES OF THE PIPE. BACKFILLING SHOULD BE PERFORMED IN LAYERS OF 6 INCHES WITH EACH LAYER BEING SUFFICIENTLY COMPACTED TO 85% TO 95% COMPACTION.
4. A MECHANICAL TAMPER IS RECOMMENDED FOR COMPACTING SAND AND GRAVEL. THESE MATERIALS CONTAIN FINE-GRAINS, SUCH AS SILT AND CLAY. IF A TAMPER IS NOT AVAILABLE, COMPACTING SHOULD BE DONE BY HAND.
5. THE TRENCH SHOULD BE COMPLETELY FILLED. THE BACKFILL SHOULD BE PLACED AND SPREAD IN UNIFORM LAYERS TO PREVENT ANY UNFILLED SPACES OR VOIDS. LARGE ROCKS, STONES, FROZEN CLODS, OR OTHER LARGE DEBRIS SHOULD BE REMOVED. STONE BACKFILL SHALL PASS THROUGH AN 1-1/2" SIEVE. ROCK SIZE SHOULD BE ABOUT ONE-TENTH OF THE PIPE OUTSIDE DIAMETER. HEAVY TAMPERS OR ROLLING EQUIPMENT SHOULD ONLY BE USED TO CONSOLIDATE THE FINAL BACKFILL.
6. TO PREVENT DAMAGE TO THE PIPE AND DISTURBANCE TO PIPE EMBEDMENT, A MINIMUM DEPTH OF BACKFILL ABOVE THE PIPE SHOULD BE MAINTAINED. PIPE SHOULD ALWAYS BE INSTALLED BELOW THE FROST LEVEL. TYPICALLY, IT IS NOT ADVISABLE TO ALLOW VEHICULAR TRAFFIC OR HEAVY CONSTRUCTION EQUIPMENT TO TRAVERSE THE PIPE TRENCH.

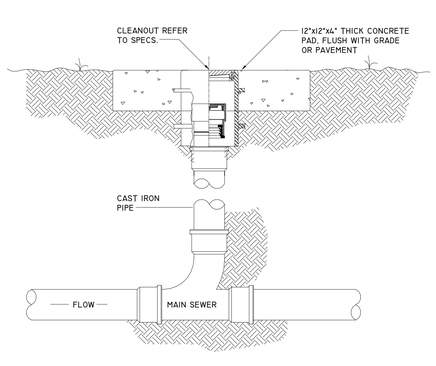
BACKFILL PIPING DETAIL | NOT TO SCALE | 1



FLOOR SINK WITH TRAP GUARD (FS-1) | NOT TO SCALE | 9



FLOOR CLEANOUT DETAIL (FCO-1) | NOT TO SCALE | 6



EXTERIOR CLEANOUT DETAIL | NOT TO SCALE | 3

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SPRING, TX 77379

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HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
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WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:

NO.	DATE	DESCRIPTION

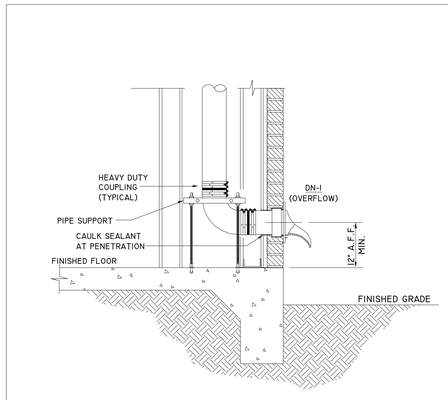
FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

DETAILS

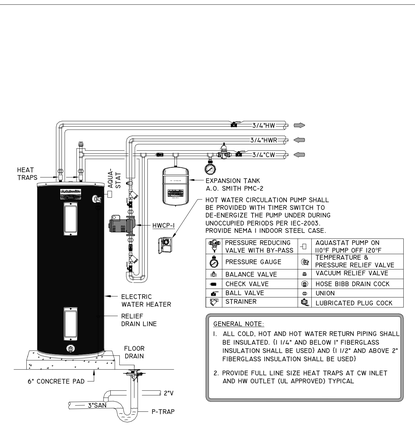
100% Construction Documents
02.29.2024

STATE OF TEXAS
ANWAR HASSAN
64671
LICENSED
PROFESSIONAL ENGINEER
2024-02-29 #F-4506

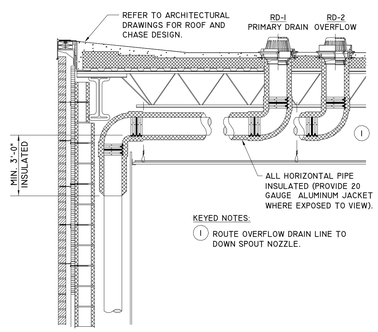
P5.01



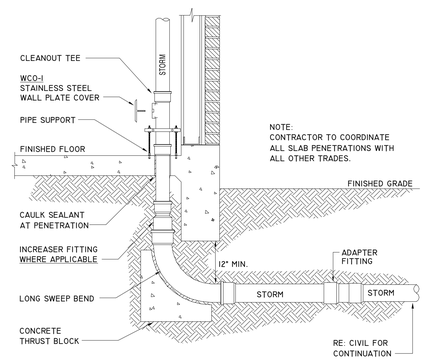
DOWNSPOUT NOZZLE DETAIL | NOT TO SCALE | 6



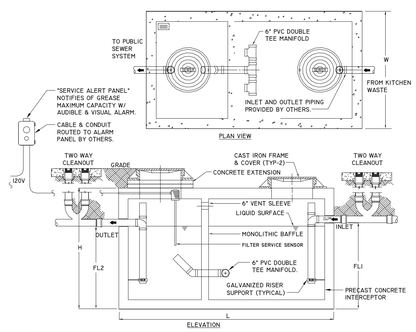
ELECTRIC WATER HEATER DETAIL - (EWH-1) | NOT TO SCALE | 4



ROOF DRAIN - PRIMARY AND OVERFLOW | NOT TO SCALE | 5



TYPICAL STORM DOWN SPOUT PIPE DETAIL | NOT TO SCALE | 3



GT BY PARK EQUIPMENT COMPANY GREASE INTERCEPTOR SCHEDULE

MODEL NO.	CAPACITY USGal	GREASE CAP. (LBS)	EMPTY WT (LBS)	LENGTH L	WIDTH W	HEIGHT H	INLET FL1	OUTLET FL2
GT-1500	1,500	3,500	16,050	9'-2"	5'-8"	7'-0"	5'-9"	5'-6"

SPECIFICATIONS

CONCRETE : CLASS I CONCRETE WITH DESIGN STRENGTH OF 4,500 PSI AT 28 DAYS. UNIT IS OF MONOLITHIC CONSTRUCTION AT FLOOR, FIRST STAGE OF WALL AND BAFFLE WITH SECTIONAL RISER TO REQUIRED DEPTH.

REINFORCEMENT: GRADE 60 REINFORCED WITH STEEL REBAR SHALL CONFORM TO ASTM A615 ON REQUIRED CENTERS OR EQUAL.

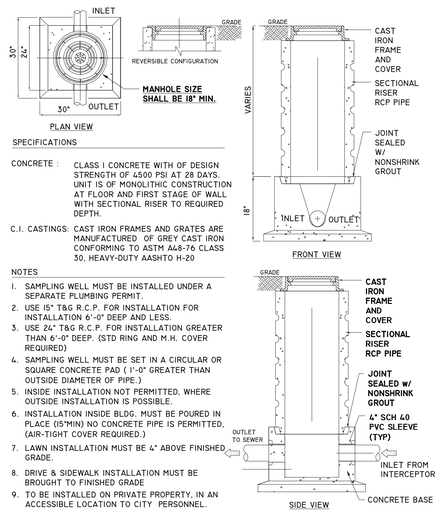
C.I. CASTINGS: MANHOLE FRAMES, COVERS OR GRATES SHALL BE MANUFACTURED OF GREY CAST IRON CONFORMING TO ASTM A48-76 CLASS 30. MANHOLE SHALL BE NOMINAL 24 INCH DIAMETER.

ENGINEERING DATA

THE GREASE INTERCEPTOR SHALL BE STRUCTURALLY & HYDRAULICALLY ENGINEERED TO CONFORM TO 2012 IPC.

NOTE: CONFORM TO STANDARDS OUTLINED IN EXCAVATION SPECIFICATION.

GREASE INTERCEPTOR (GT-1) | NOT TO SCALE | 2



SPECIFICATIONS

CONCRETE : CLASS I CONCRETE WITH OF DESIGN STRENGTH OF 4,500 PSI AT 28 DAYS. UNIT IS OF MONOLITHIC CONSTRUCTION AT FLOOR AND FIRST STAGE OF WALL WITH SECTIONAL RISER TO REQUIRED DEPTH.

C.I. CASTINGS: CAST IRON FRAMES AND GRATES ARE MANUFACTURED OF GREY CAST IRON CONFORMING TO ASTM A48-76 CLASS 30, HEAVY-DUTY AASHTO H-20

NOTES

1. SAMPLING WELL MUST BE INSTALLED UNDER A SEPARATE PLUMBING PERMIT.
2. USE 15" T&G R.C.P. FOR INSTALLATION FOR INSTALLATION 6'-0" DEEP AND LESS.
3. USE 24" T&G R.C.P. FOR INSTALLATION GREATER THAN 6'-0" DEEP. (STD RING AND M.H. COVER REQUIRED)
4. SAMPLING WELL MUST BE SET IN A CIRCULAR OR SQUARE CONCRETE PAD (1'-0" GREATER THAN OUTSIDE DIAMETER OF PIPE.)
5. INSIDE INSTALLATION NOT PERMITTED, WHERE OUTSIDE INSTALLATION IS POSSIBLE.
6. INSTALLATION INSIDE BLDG. MUST BE POURED IN PLACE (15"MIN) NO CONCRETE PIPE IS PERMITTED. (AIR-TIGHT COVER REQUIRED.)
7. LAWN INSTALLATION MUST BE 4" ABOVE FINISHED GRADE.
8. DRIVE & SIDEWALK INSTALLATION MUST BE BROUGHT TO FINISHED GRADE
9. TO BE INSTALLED ON PRIVATE PROPERTY, IN AN ACCESSIBLE LOCATION TO CITY PERSONNEL.

SAMPLE WELL DETAIL | NOT TO SCALE | 1

SMITH&COMPANY
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HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
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REVISIONS:

NO.	DATE	DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

DETAILS

100% Construction Documents
02.29.2024

STATE OF TEXAS
ANWAR HASSAN
64671
LICENSED
PROFESSIONAL ENGINEER
2024-02-29 #F-4506

P5.02

FIRE PROTECTION NOTES

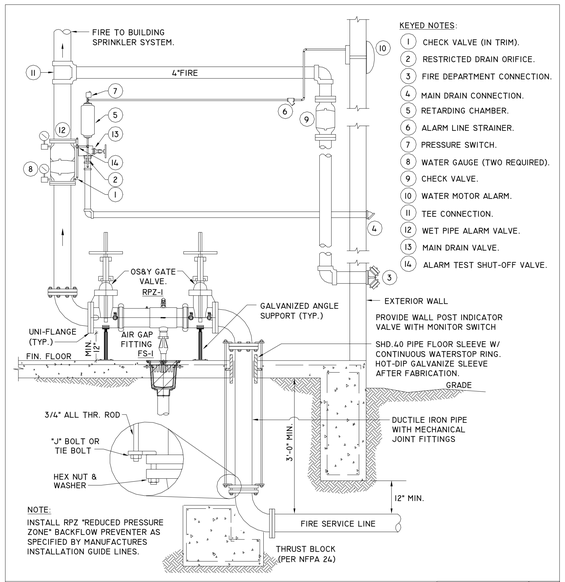
1. CONTRACTOR SHALL PROVIDE THE HYDRAULIC DESIGN BY A QUALIFIED FIRE PROTECTION ENGINEER IN STATE OF TEXAS. THE CONTRACTOR SHALL SUPPLY AND INSTALL THE SPRINKLER SYSTEM FOR THE ENTIRE AREA, IN ACCORDANCE WITH NFPA 13, AND CITY OF FRESNO FIRE DEPARTMENT. CONTRACTOR SHALL BE RESPONSIBLE TO COORDINATE THE WORK WITH ALL OTHER SERVICES INCLUDING, BUT NOT LIMITED TO MECHANICAL, ELECTRICAL, PLUMBING, STRUCTURE AND ARCHITECTURE SERVICES.
2. BEFORE INSTALLING ANY SPRINKLER ROWS AND HEADS, COORDINATE WITH OTHER SERVICES AND EQUIPMENT LOCATIONS.
3. MAIN ENTRY PIPING LINE INDICATED ON DRAWINGS IS SHOWN AS GENERAL GUIDE AND DOES NOT REPRESENT ACTUAL BID DOCUMENTS. CONTRACTOR SHALL BE RESPONSIBLE FOR A COMPLETE SYSTEM DESIGN AND INSTALLATION OF ALL THE FACILITY.
4. SPRINKLER SYSTEM SHALL BE WET PIPE SYSTEM FOR INDOOR AREA CO-ORDINATED WITH FIRE AND DETECHTION SYSTEM FOR INTERLOCK. IN ACCORDANCE WITH CODE REQUIRED HAZARD PROTECTION.
5. ALL FIRE PROTECTION PIPING EXPOSED TO VIEW SHALL BE PAINTED RED.

NOTE:

SPRINKLER SHOP DRAWINGS AND HYDRAULIC CALCULATIONS PREPARED BY A LICENSED SPRINKLER CONTRACTOR (TEXAS RME) SHALL BE SUBMITTED TO THE LOCAL FIRE MARSHALL AND OWNER'S INSURANCE CARRIER FOR REVIEW AND APPROVAL. NO WORK SHALL BEGIN UNTIL THE APPROVAL OF BOTH AUTHORITIES INDICATED ABOVE.

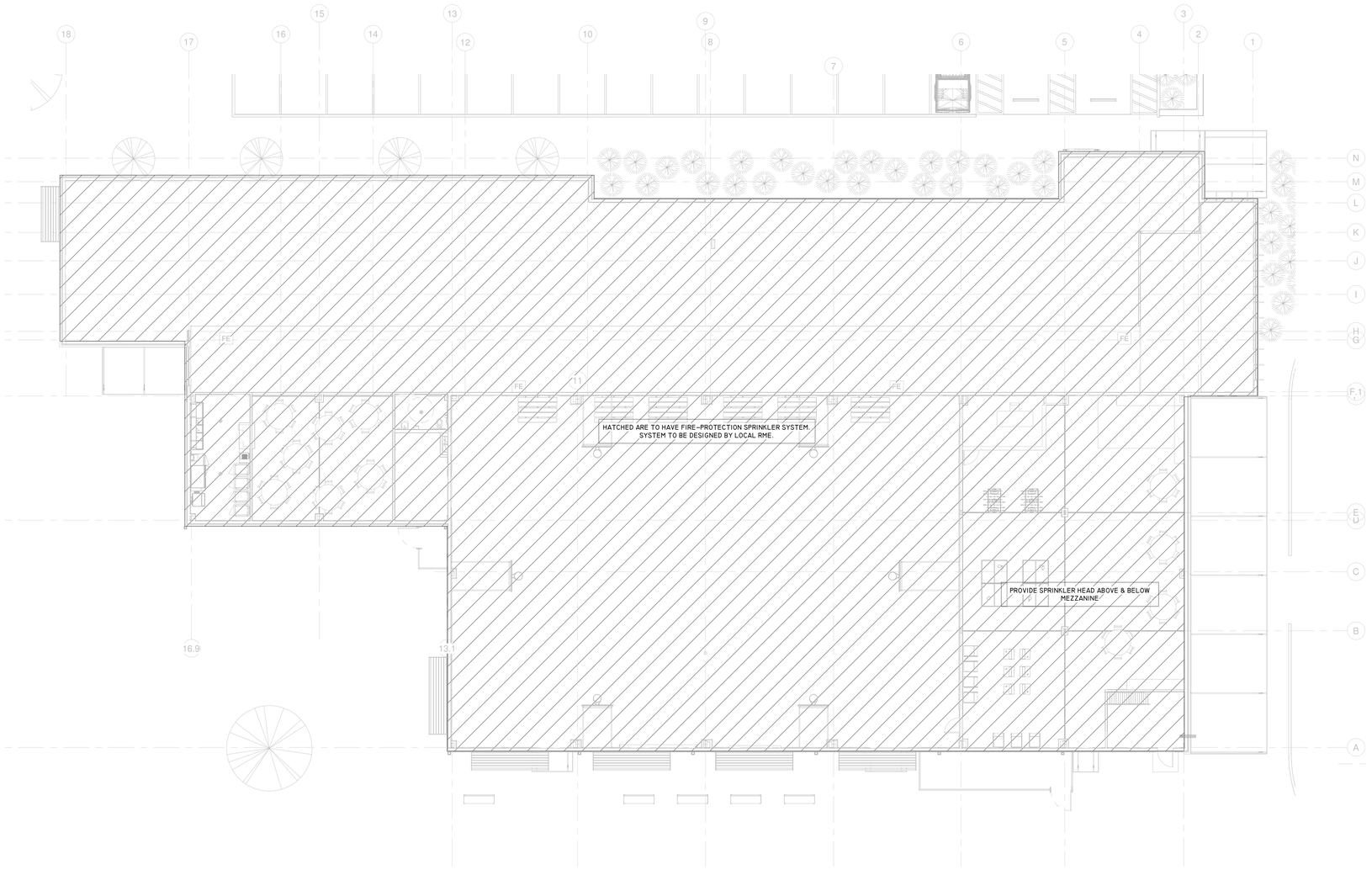
RPZ SCHEDULE

MARK	DESCRIPTION	SIZE OF CONNECTION					REMARKS
		TRAP	SS	SV	CW	HW	
RPZ-1	REDUCED PRESSURE ZONE ASSEMBLY	-	-	-	4"	-	957Z-QSY WATTS. THE REDUCED PRESSURE ZONE ASSEMBLY SHALL CONSIST OF TWO INDEPENDENT TORSION SPRING CHECK MODULES, A DIFFERENTIAL PRESSURE RELIEF VALVE LOCATED BETWEEN AND BELOW THE TWO MODULES, TWO DRIP TIGHT SHUTOFF VALVES, AND REQUIRED TORSION SPRING CHECK MODULES AND RELIEF VALVE SHALL BE CONTAINED WITH A SLEEVE ACCESSIBLE SINGLE HOUSING CONSTRUCTED FROM 304 (SCHEDULE 40) STAINLESS STEEL PIPE WITH GROOVE END CONNECTIONS. TORSION SPRING CHECKS SHALL HAVE REPLACEABLE ELASTOMER DISCS AND IN OPERATION PRODUCE DRIP TIGHT CLOSURE AGAINST THE REVERSE FLOW OF LIQUID CAUSED BY BACKPRESSURE OR BACKSIPHONAGE. ASSEMBLY SHALL BE A WATTS REGULATOR COMPANY SERIES 957, 957H, 957Z.

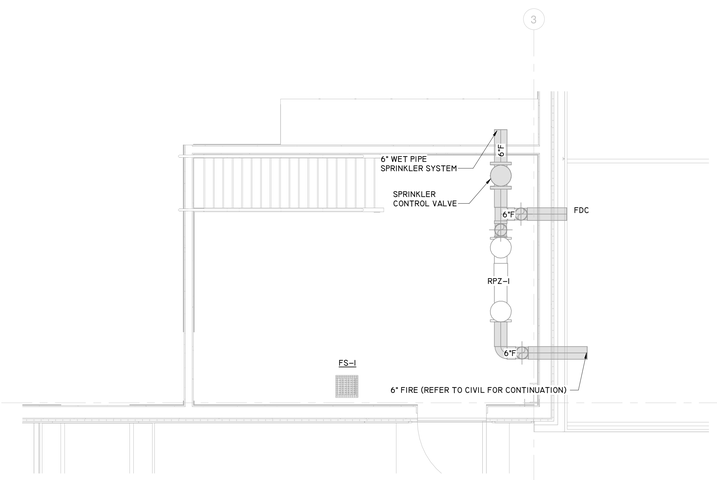


FIRE ALARM CHECK VALVE DETAIL
REDUCED PRESS. BACKFLOW PREVENTER DETAIL (RPZ-I)
FIRE SERVICE ENTRY DETAIL

NOT TO SCALE | I



1 FIRE PROTECTION
Scale: 1" = 10'-0"



2 ENLARGED FIRE PROTECTION
Scale: 3/8" = 1'-0"

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FIRE PROTECTION

100% Construction Documents
02.29.2024

STATE OF TEXAS
ANWAR HASSAN
64671
LICENSED
PROFESSIONAL ENGINEER
2024-02-29 #F-4506

FP1.01

AUDIO/VISUAL MULTIMEDIA LEGEND

SYMBOL	DESCRIPTION
A## V##	WALL AV ROUGH-IN DETAIL
A## V##	CEILING AV ROUGH-IN DETAIL
A## V##	FLOOR AV ROUGH-IN DETAIL
IWB IWB	INTERACTIVE WHITE BOARD - WALL - CEILING
PJ PJ	MULTIMEDIA PROJECTOR
FP# FP#	MULTIMEDIA FLAT PANEL DISPLAY
S# S#	LOUD SPEAKER, CEILING MOUNTED - # INDICATES TYPE
CP#	CONTROL PANEL
TP#	TOUCH PANEL
M#	MICROPHONE, CEILING MOUNTED - # INDICATES TYPE
VC	VOLUME CONTROL
WB	WALL BOX ENCLOSURE
D1 A1	D1 = DIGITAL SINGLE SIDED CLOCK / A1 = ANALOG SINGLE SIDED CLOCK
D2 A2	D2 = DIGITAL DOUBLE SIDED CLOCK / A2 = ANALOG DOUBLE SIDED CLOCK
CB	CEILING AV ENCLOSURE
C C	PRESENTATION CAMERA - CEILING - WALL MOUNTED

GENERAL ANNOTATION LEGEND

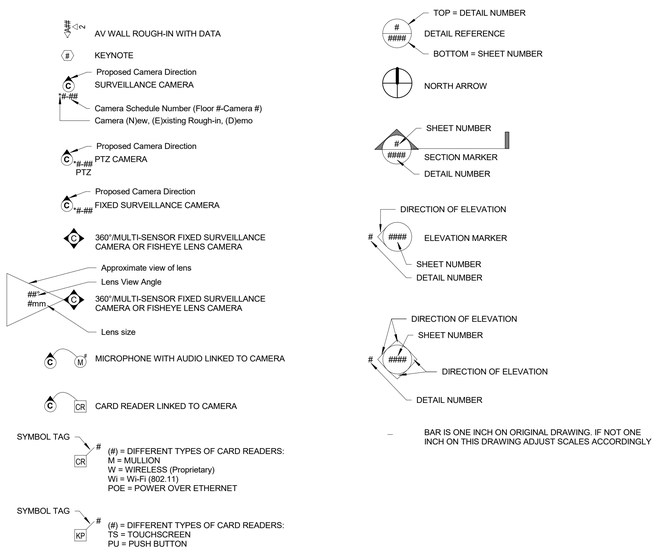
SYMBOL	DESCRIPTION
## T###	DETAIL REFERENCE (TOP = DETAIL NUMBER, BOTTOM = SHEET NUMBER)
	VIEWPORT/DETAIL NOTATION
	NORTH ARROW
00	KEYNOTES
MER	MAIN EQUIPMENT ROOM
TR	TELECOMMUNICATION ROOM
MDF	MAIN DISTRIBUTION FRAME
IDF	INTERMEDIATE DISTRIBUTION FRAME
ETR	EXISTING TO REMAIN
PBO	PROVIDED BY OTHERS
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AC	ABOVE COUNTER
EC	ELECTRICAL CONTRACTOR
SCC	STRUCTURAL CABLING CONTRACTOR
AVC	AV/MULTIMEDIA CONTRACTOR
UNO	UNLESS NOTED OTHERWISE

STRUCTURED CABLING LEGEND

SYMBOL	DESCRIPTION
#	TELECOMMUNICATIONS OUTLET, # =NUMBER OF DATA CABLE(S)/JACK(S)
#/#	TELECOMMUNICATIONS OUTLET, #/# = NUMBER OF VOICE CABLE(S)/JACK(S) AND NUMBER OF DATA CABLE(S)/JACK(S)
#	TELECOMMUNICATIONS OUTLET, # =NUMBER OF VOICE/DATA CABLE(S)/JACK(S), SURFACE MOUNT
#/#	TELECOMMUNICATIONS OUTLET, #/# = NUMBER OF VOICE CABLE(S)/JACK(S) AND NUMBER OF DATA CABLE(S)/JACK(S), SURFACE MOUNT
W	WALL MOUNT PHONE (1 CABLE/JACK)
W	WALL MOUNT PHONE, SURFACE MOUNT (1 CABLE/JACK)
#	FLOOR MOUNTED OUTLET, # =NUMBER OF VOICE/DATA CABLE(S)/JACK(S) (FLOOR BOX BY E.C.)
#/#	FLOOR MOUNTED OUTLET, #/# = NUMBER OF VOICE CABLE(S)/JACK(S) AND NUMBER OF DATA CABLE(S)/JACK(S) (FLOOR BOX BY E.C.)
#	CEILING MOUNTED DATA OUTLET, # =NUMBER OF VOICE/DATA CABLE(S)/JACK(S)
AP#	CEILING MOUNTED OUTLET FOR WIRELESS ACCESS POINT #=NUMBER OF CABLE(S)/JACK(S)
AP#	WALL MOUNTED OUTLET FOR WIRELESS ACCESS POINT #=NUMBER OF CABLE(S)/JACK(S)
	EZY-PATH CABLING SLEEVE(S)
	TYPICAL LADDER RACK
	TYPICAL CABLE TRAY, BASKET STYLE

TECHNOLOGY SYMBOLS LEGEND

NOT ALL SYMBOLS ARE USED



TECHNOLOGY SHEET INDEX

TECHNOLOGY - GENERAL NOTES

1. EACH KEYNOTE MAY NOT BE UTILIZED ON EVERY SHEET.
2. ALL CONDUIT MEASUREMENTS REFER TO STANDARD CONDUIT TRADE SIZES.
3. ALL CABLES SHALL BE CONCEALED.
4. EACH CONTRACTOR SHALL PROVIDE AND INSTALL ALL NECESSARY SLEEVES, WHETHER OR NOT SPECIFICALLY NOTED ON PROJECT DRAWINGS. ALL SLEEVES SHALL BE 2" UNLESS NOTED OTHERWISE ON THE DRAWINGS. CABLE FILL PERCENTAGE SHALL COMPLY WITH NEC.
5. DEVICE LOCATIONS ARE APPROXIMATE. CONTRACTOR SHALL REVIEW CONDITIONS AND COORDINATE WITH OTHER TRADES AS NECESSARY FOR EXACT PLACEMENT.

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TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
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PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

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FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
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TECHNOLOGY - INDEX SHEET

100% Construction Documents
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TECHNOLOGY KEYNOTES

1. (1) 36" x 48" x 48" FIBERGLASS REINFORCED IN-GROUND VAULT FOR ISP/BUILDING SERVICES.
2. ALTERNATE BUILDING SERVICES FIBER ROUTE: (1) 36" x 48" x 48" FIBERGLASS REINFORCED IN-GROUND PULL BOX.
3. TWO (2) 4" UNDERGROUND CONDUITS FROM MDF TO PULLBOX/VAULT, WITH DETECTABLE 3-CELL MAXCELL INNERDUCT, FOR BUILDING SERVICES FIBER AND TELECOM CONNECTIVITY. COORDINATE EXACT LOCATIONS WITH CIVIL AND ELECTRICAL CONTRACTORS.
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9. GYMNASIUM AV RACK LOCATION.
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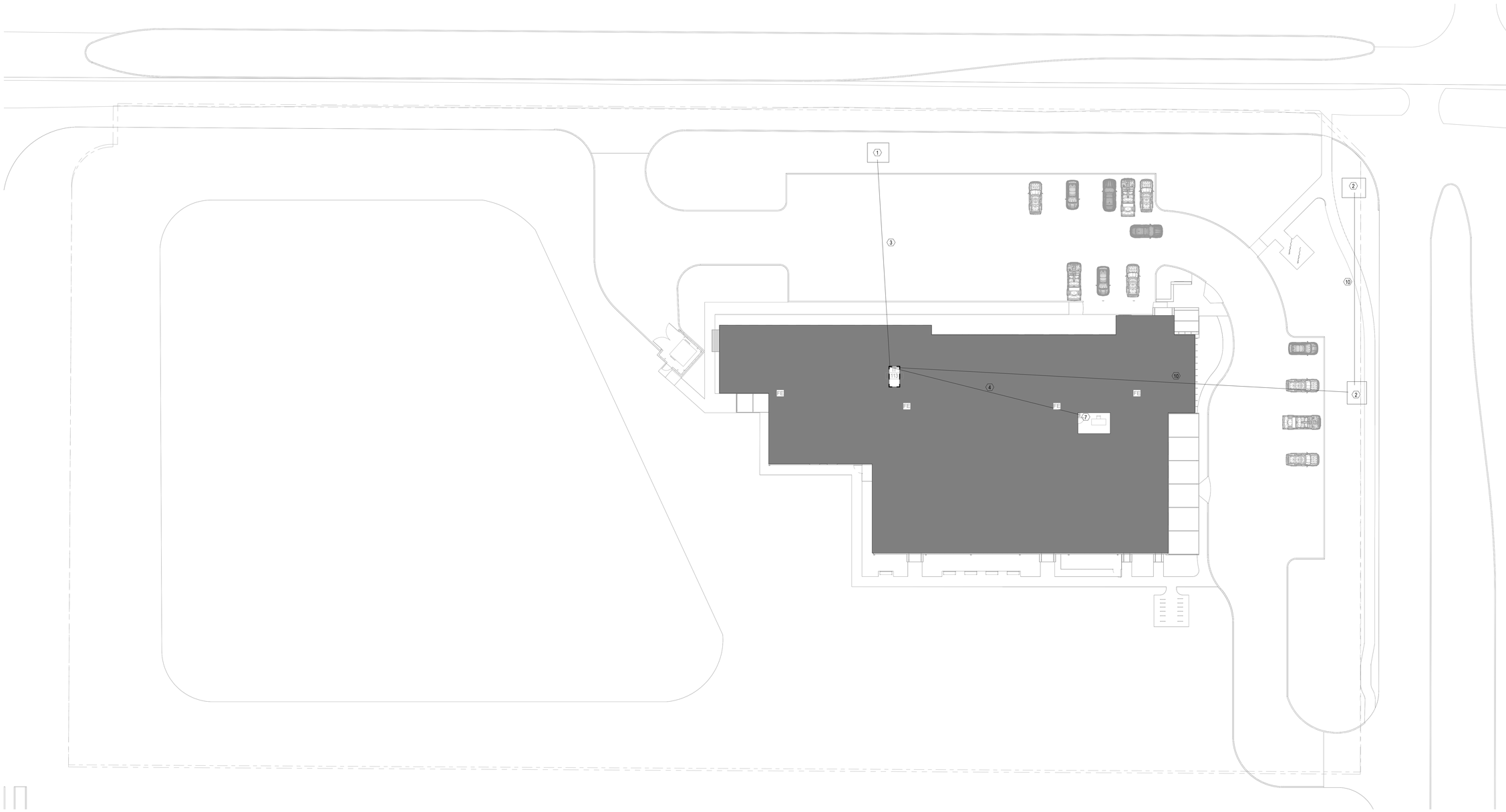

1 TECHNOLOGY - SITE PLAN
SCALE: 1" = 20'-0"

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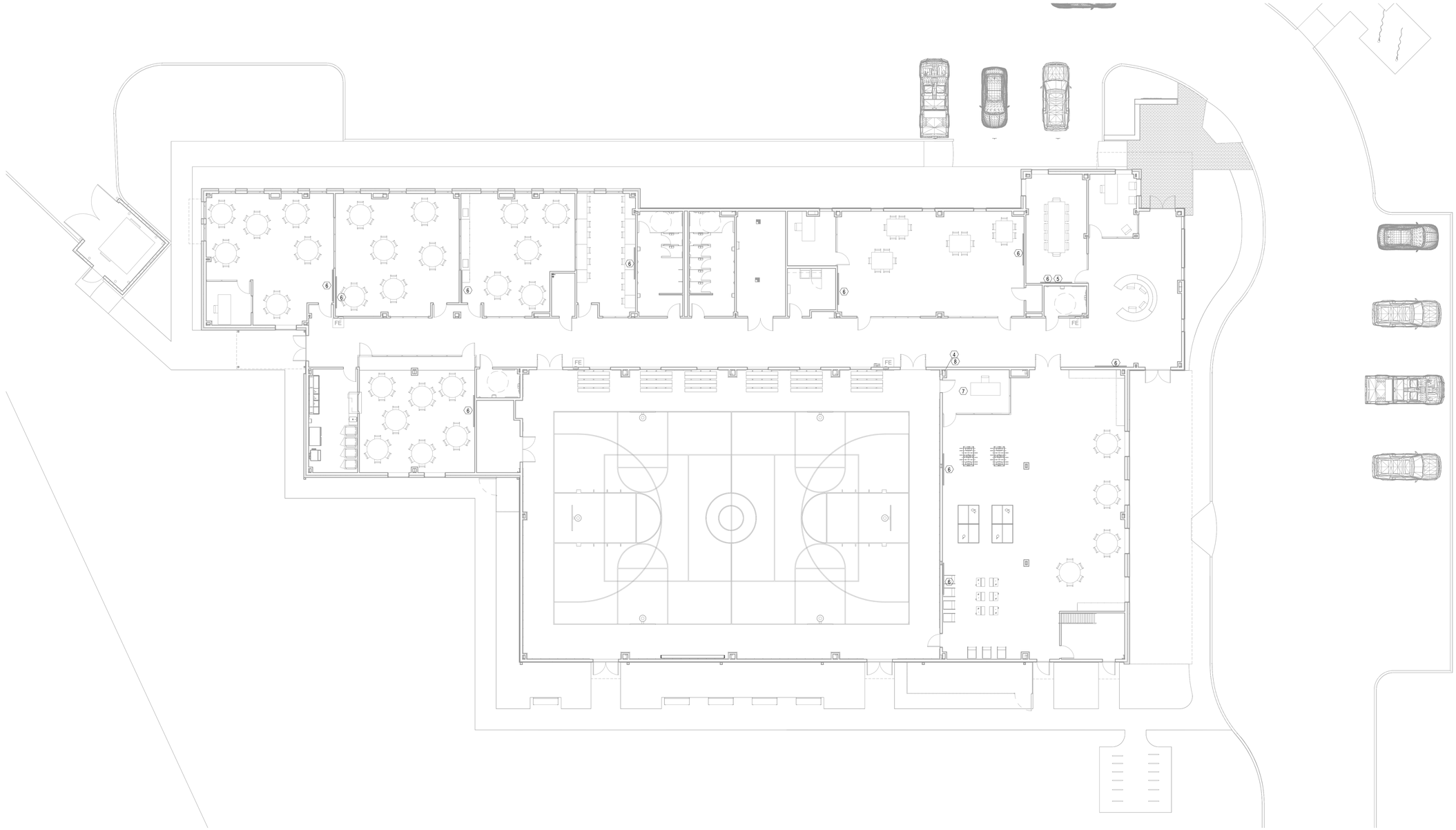

1 TECHNOLOGY - FIRST FLOOR OVERALL
SCALE: 1" = 10'-0"

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TECHNOLOGY - LEVEL ONE OVERALL

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1 TECHNOLOGY - FLOOR PLAN - AREA A
SCALE: 3/16" = 1'-0"

TECHNOLOGY KEYNOTES

1. (1) 36" x 48" x 48" FIBERGLASS REINFORCED IN-GROUND VAULT FOR ISP/BUILDING SERVICES.
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TECHNOLOGY - FLOOR PLAN - AREA A

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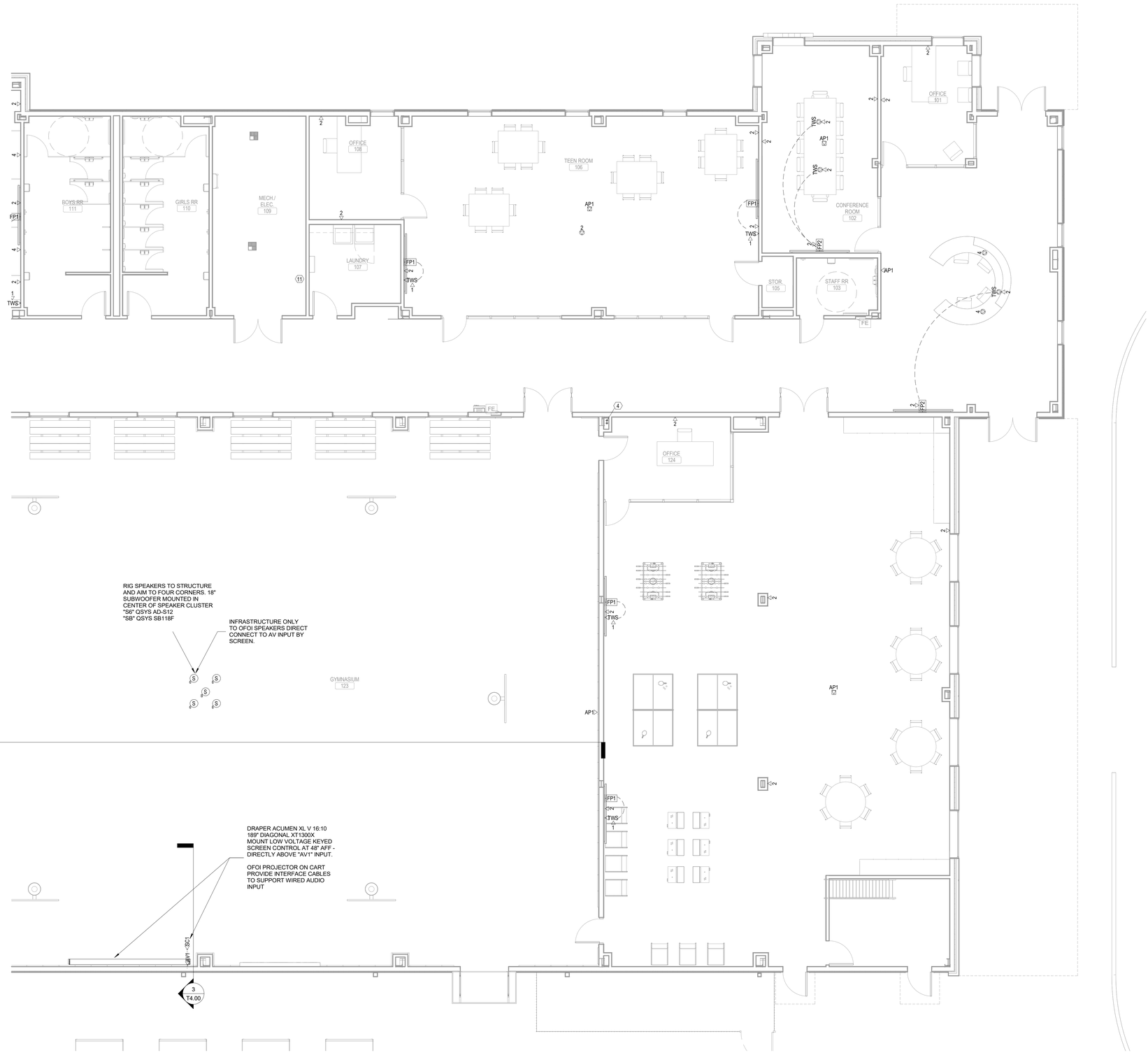

1 TECHNOLOGY - FLOOR PLAN - AREA B
SCALE: 3/16" = 1'-0"

TECHNOLOGY KEYNOTES

1. (1) 36" x 48" x 48" FIBERGLASS REINFORCED IN-GROUND VAULT FOR ISP/BUILDING SERVICES.
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GENERAL NOTES:

1. ANY WALL MOUNTED DEVICE IN GYM MUST BE INSTALLED WITH PROTECTIVE WIRE CAGE.

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TECHNOLOGY - FLOOR PLAN - AREA B

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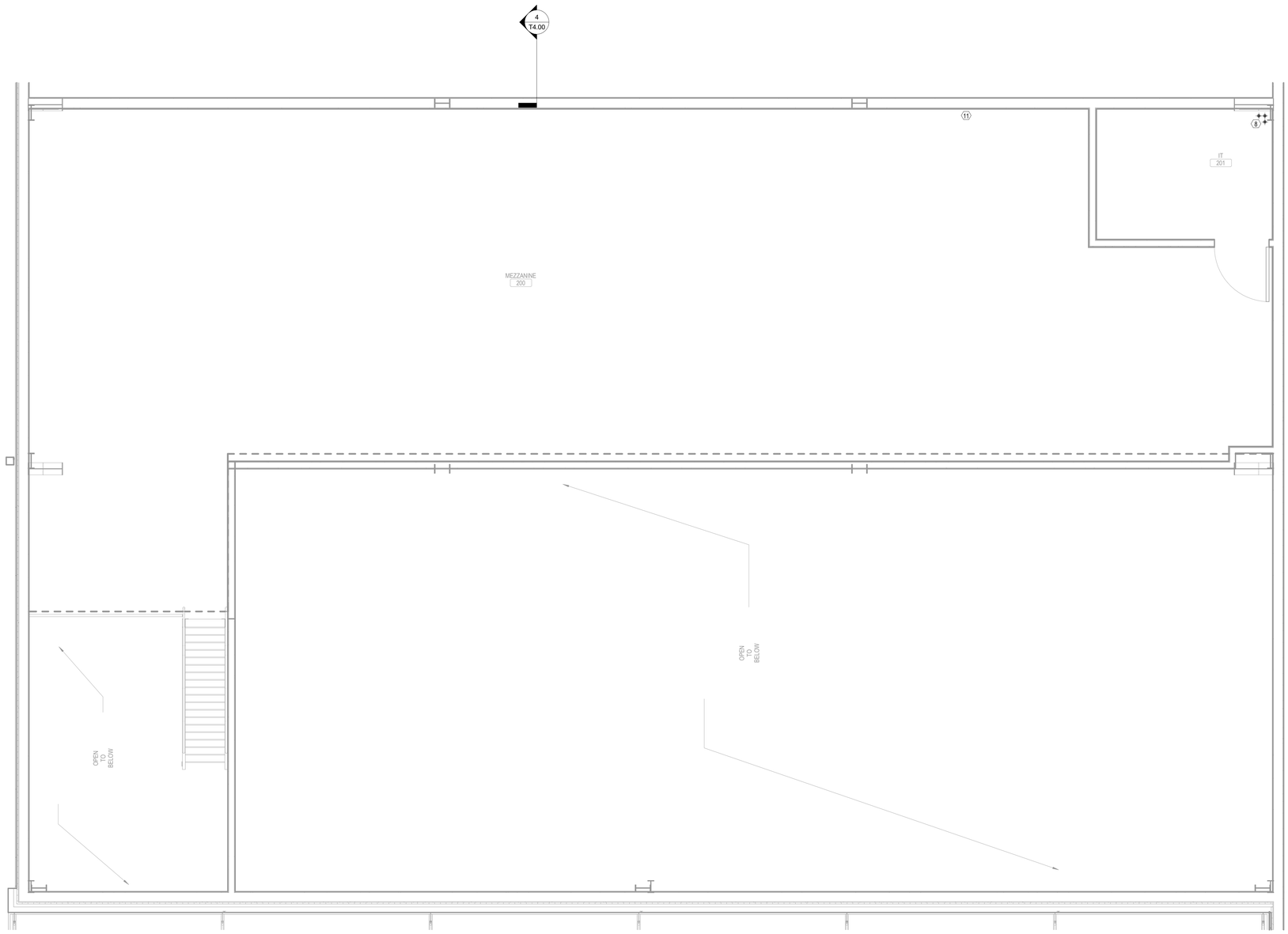

1 TECHNOLOGY - 2ND FLOOR MEZZANINE
SCALE: 3/8" = 1'-0"

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TECHNOLOGY - FLOOR PLAN - 2ND FLOOR MEZZANINE

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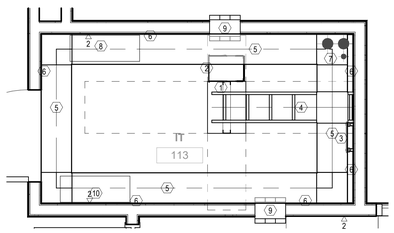
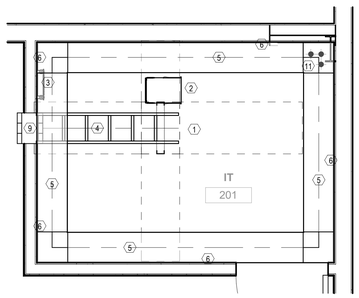


1 TECHNOLOGY - MDF 113
SCALE: 1/2" = 1'-0"



2 TECHNOLOGY- IT 201
SCALE: 1/2" = 1'-0"

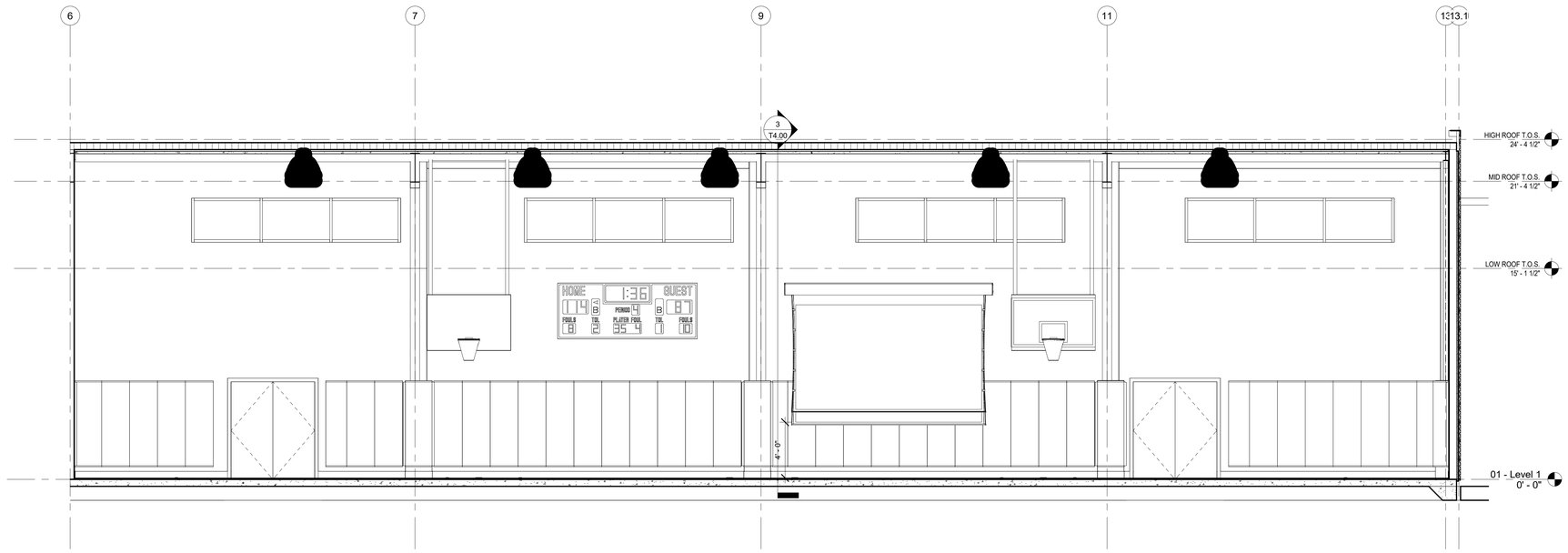
ENLARGEMENT KEYNOTES

1. 2-POST RACK, SECURED TO FLOOR WITH EXPANSION ANCHORS, FIRST RACK SHALL BE NO LESS THAN 6" FROM WALL, IF VERTICAL WIRE PRESENT BETWEEN RACK AND WALL THEN VERTICAL WIRE MANAGER ATTACHED TO WALL SIDE OF RACK SHALL BE NO LESS THAN 6" FROM WALL. (TYPICAL)
2. 10" VERTICAL WIRE MANAGER SECURED TO SIDE OF RACK (TYPICAL)
3. GROUND BUS BAR, MOUNTED 6' AFF, ELECTRON PLATED AND PREDRILLED TO ACCEPT STANDARD TWO-HOLE LUGS.
4. 18"x2" LADDER RACK SECURED TO TOP OF RACK WITH LADDER RACK MOUNTING PLATE AND BOLTED TO WALL, WITH WATER FALLS INTO VERTICAL WIRE MANAGERS (TYPICAL)
5. 12"x4" CABLE TRAY (BASKET STYLE) WITH 6" CLEARANCE FROM WALL (TYPICAL)
6. 3/4" FIRED RATED PLYWOOD SECURED TO WALL AT 22" AFF. IF THE PLYWOOD IS PAINTED, THE PAINT SHALL BE FIRE RETARDANT PAINT ON BOTH SIDES AND THE RATING STAMP ON THE PLYWOOD SHALL BE EXPOSED.
7. (2) 4" & (1) 2" CONDUIT SLEEVES STUBBED UP 4", FROM FLOOR BELOW, WITH UL-LISTED 2-HOUR RATED RE-ENTERABLE FIRE STOP SYSTEM.
8. SPACE RESERVED FOR FACP
9. FIRESTOP SLEEVES, STI EZPATH OR HILTI SPEED SLEEVES.
10. SPACE RESERVED FOR IDS PANEL
11. (3) 2" CONDUIT SLEEVES STUBBED UP 4", FROM FLOOR BELOW, WITH UL-LISTED 2-HOUR RATED RE-ENTERABLE FIRE STOP SYSTEM.

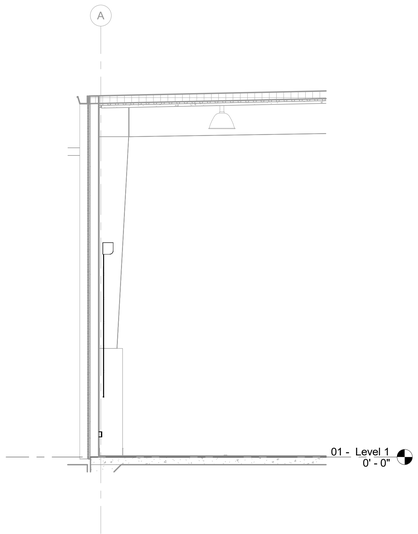
GENERAL NOTES:

- CONDUIT SLEEVES MUST BE EZPATH SLEEVES WITH FIRE PILLOWS.

- ZIP TIES NOT ALLOWED. ALL CABLE BUNDLES MUST BE SECURED USING FIRE-RATED VELCTRO. CABLE BUNDLES MUST BE SECURED TO STRUCTURE IN J-HOOKS WITH VELCRO CLOSURES. J-HOOKS MUST BE SECURED TO OVERHEAD STRUCTURE USING ITS OWN GRID WIRE. CEILING GRID WIRE, OR GRID WIRE USED BY OTHER TRADES SHALL NOT BE UTILIZED TO SUPPORT LOW VOLTAGE PATHWAYS/CABLE SUPPORT.



4 GYM PROJECTION SCREEN ELEVATION - FRONT
SCALE: 1/4" = 1'-0"



3 GYM PROJECTION SCREEN ELEVATION - SIDE
SCALE: 1/4" = 1'-0"

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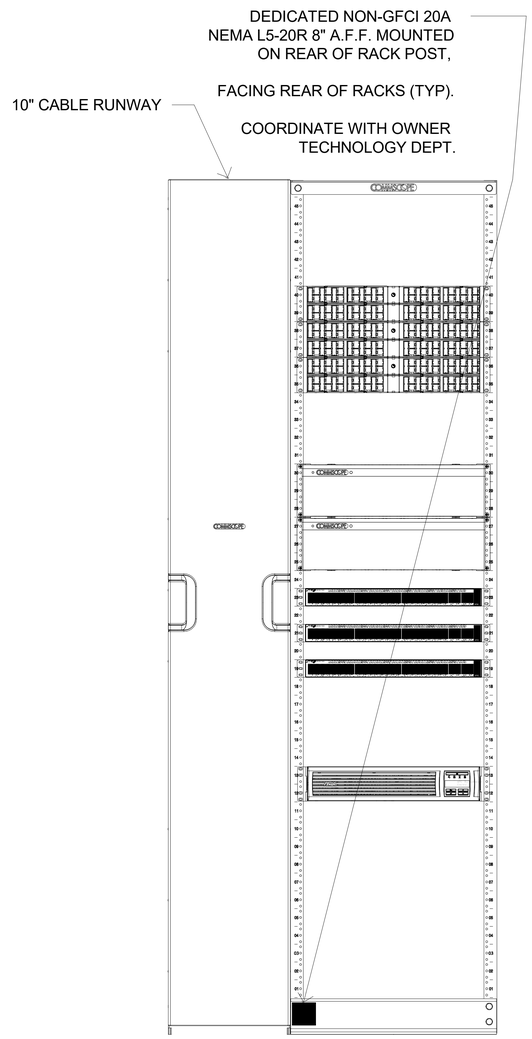
FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

TECHNOLOGY - ENLARGEMENTS

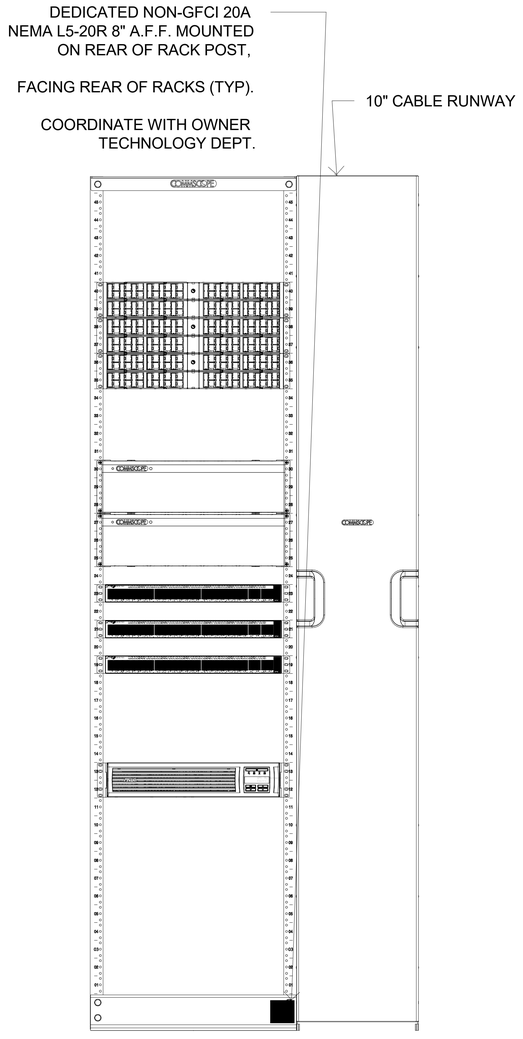
100% Construction Documents
02/29/2024

REGISTERED COMMUNICATIONS DISTRIBUTION DESIGNER
Bicsi
Jeff Scott Coombs
BICSI ID # 221090
EXPIRES 12-31-24
RCDD

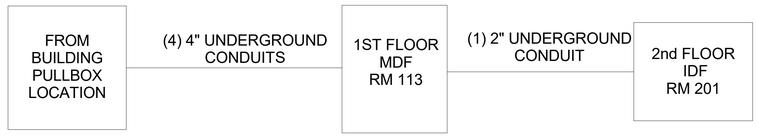
T4.00



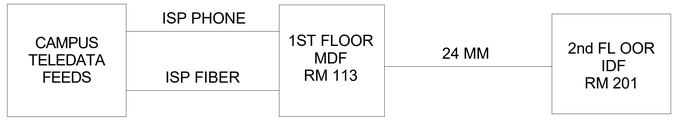
1 MDF RM 113 RACK ELIVATION
SCALE: NTS



2 IDF RM 201 RACK ELIVATION
SCALE: NTS



3 BACKBONE CONDUIT DETAIL
SCALE: NTS



NOTE: PA TO HIT GATEWAYS IN EACH IDF.

4 BACKBONE DIAGRAM
SCALE: NTS

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ARCHITECTS

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LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., #260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE ASSOCIATES
6117 RICHMOND AVE., SUITE 200
HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
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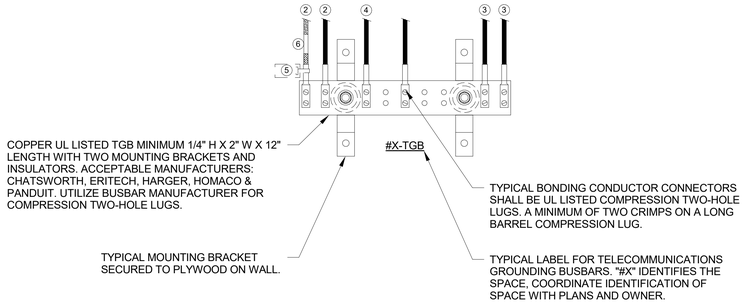
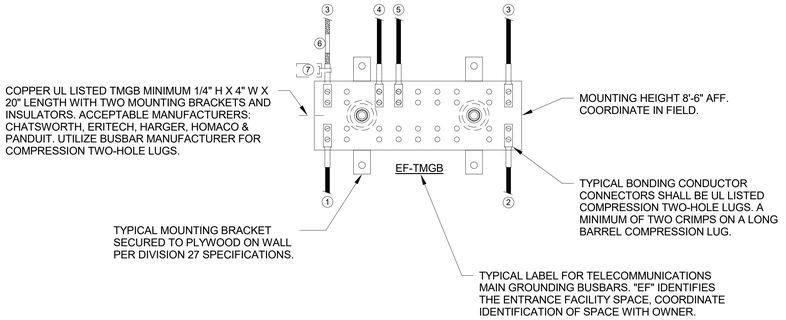


TGB GROUNDING & BONDING NOTES

1. BONDING CONDUCTOR FOR TELECOMMUNICATIONS (BCT) TO BUILDING MAIN ELECTRICAL GROUND SYSTEM.
2. BCT TO TELECOMMUNICATIONS CABLE RUNWAYS(S), RACK(S), CABINET(S) AND APPLICABLE EQUIPMENT. DAISY CHAINING OF BCT AT RELAY RACKS IS NOT ACCEPTABLE. EACH RACK IS TO HAVE A BCT TO A COMPRESSION LUGTAP TO DEDICATED HOME RUN ACT BACK TO THE TGB. SEE DETAILS.
3. TYPICAL TBB(S) THAT INTERCONNECTS ALL IDF TGB(S) WITH THE TMGB.
4. BONDING CONDUCTOR TO EACH ARMORED FIBER JACKET. IDF SIDE ONLY.
5. TYPICAL OF ALL BONDING CONDUCTORS WITH IDENTIFICATION LABEL NOTED BELOW AND SECURED WITH CABLE TIE TO EACH CONDUCTOR. (ANSI J-STD-607-B) "IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER".
6. TYPICAL OF ALL BONDING CONDUCTORS CABLE IDENTIFIER/ LABEL.

BONDING CONDUCTOR SIZING CHART

LENGTH (FEET)	SIZE (AWG)
LESS THAN (<) 13'	# 6
14' - 20'	# 4
21' - 26'	# 3
27' - 33'	# 2
34' - 41'	# 1
42' - 52'	# 1/0
53' - 66'	# 2/0
GREATER THAN (>) 66'	# 3/0



TMGB GROUNDING & BONDING RISER NOTES

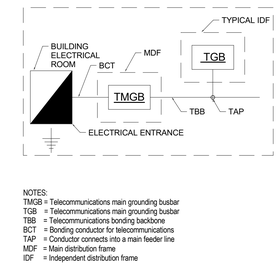
1. BONDING CONDUCTOR FOR TELECOMMUNICATIONS (BCT) TO BUILDING GROUNDING ELECTRODE. BCT SHALL NOT BE SMALLER THEN THE TBB.
2. BCT TO NEAREST BUILDING STEEL STRUCTURE. IF APPLICABLE UTILIZED EXOTHERMIC WELDING CONNECTION TO BUILDING STEEL.
3. TELECOMMUNICATIONS BONDING BACKBONE (TBB) FOR GROUNDING EQUALIZER (GE), IF APPLICABLE.
4. TYPICAL TBB(S) THAT INTERCONNECTS ALL TGB(S) WITH THE TMGB.
5. BCT TO TELECOMMUNICATIONS CABLE RUNWAYS(S), RACK(S), CABINET(S) AND APPLICABLE EQUIPMENT. DAISY CHAINING OF BCT AT RELAY RACKS IS NOT ACCEPTABLE. EACH RACK IS TO HAVE A BCT TO A COMPRESSION LUG TAP TO DEDICATED HOMERUN ACT BACK TO THE TGB. SEE DETAILS.
6. TYPICAL OF ALL BONDING CONDUCTORS CABLE IDENTIFIER/ LABEL.
7. TYPICAL OF ALL BONDING CONDUCTORS WITH IDENTIFICATION LABEL NOTED BELOW AND SECURED WITH CABLE TIE TO EACH CONDUCTOR. (ANSI J-STD-607-B) "IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER".

GROUNDING & BONDING GENERAL NOTES

1. ELECTRICAL CONTRACTOR RESPONSIBILITY -TELECOMMUNICATION MAIN GROUNDING BUSBAR (TMGB), TELECOMMUNICATION GROUNDING BUSBAR(S) (TGBS), AND THE BONDING CONDUCTORS TO THE BUILDING GROUNDING ELECTRODE, BUILDING STRUCTURAL STEEL, AND BONDING OF ALL TGBS TO THE TMGB SHALL BE FURNISHED AND INSTALLED BY THE ELECTRICAL CONTRACTOR.
2. ALL GROUNDING OF OF EQUIPMENT, RACKS, CABINETS, AND DEVICES SHALL BE THE RESPONSIBILITY OF THE DIVISION 27 TECHNOLOGY CONTRACTOR.
3. FASTENING BONDING CONNECTOR TWO -HOLE LUGS TO ALL BUSBARS SHALL BE CLEANED AND APPLY A COPPER ANTI-OXIDANT TO THE CONTACT AREA OF BOTH THE CONNECTOR LUG AND THE BUSBAR.
4. BONDING CONDUCTORS AND BUSBARS SHALL BE LABELED. WITH IDENTIFICATION IN ACCORDANCE WITH THE REQUIREMENTS OF ANSI/TIA/EIA-606-B.
5. BONDING CONDUCTORS SHALL BE LABELED WITH IDENTIFICATION LABEL NOTED BELOW AND SECURED WITH CABLE TIE TO EACH CONDUCTOR. (ANSI J-STD-607-B) "IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER".
6. STRUCTURED CABLING CONTRACTOR SHALL PERFORM CONTINUITY TESTING MEASUREMENTS OF THE GROUNDING RESISTANCE TO NOT EXCEED 0.1 OHM BETWEEN:

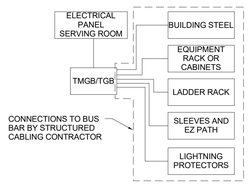
A. THE TMGB AND THE NEAREST GROUNDING ELECTRODE.
B. THE TGB AND THE NEAREST GROUNDING ELECTRODE.
C. EACH TGB AND THE PATHWAY(S), RACK(S), CABINETS(S) AND APPLICABLE EQUIPMENT.

1 GROUNDING AND BONDING DETAIL
SCALE: NS

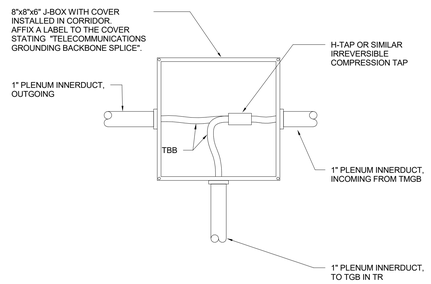


NOTES:
TMGB = Telecommunications main grounding busbar
TGB = Telecommunications main grounding busbar
TBB = Telecommunications bonding backbone
BCT = Bonding conductor for telecommunications
TAP = Conductor connects into a main feeder line
MDF = Main distribution frame
IDF = Independent distribution frame

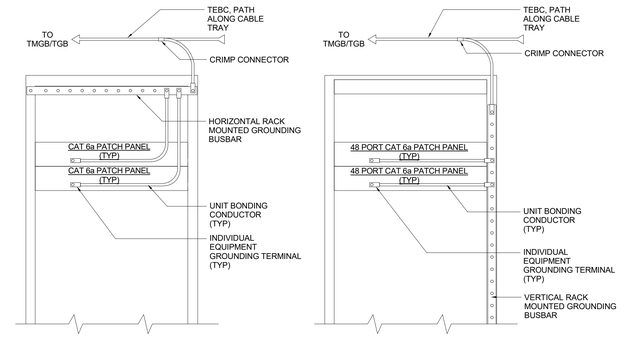
2 TYPICAL GROUNDING FLOW DIAGRAM
SCALE: NS



3 TELECOM ROOM BONDING DIAGRAM
SCALE: NS



4 TELECOM BONDING BACKBONE SPLICE DETAIL
SCALE: NS



5 RACK MOUNTED GROUNDING BAR DETAIL
SCALE: NS

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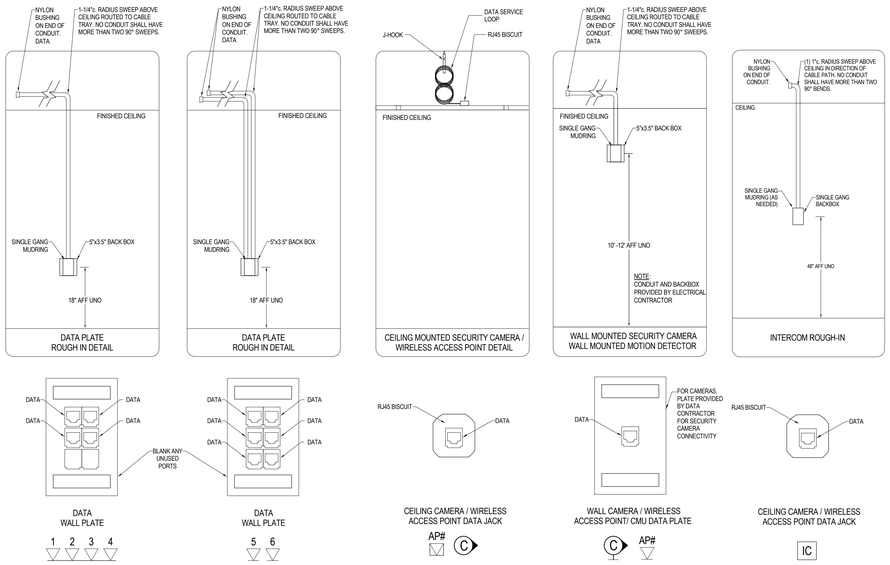
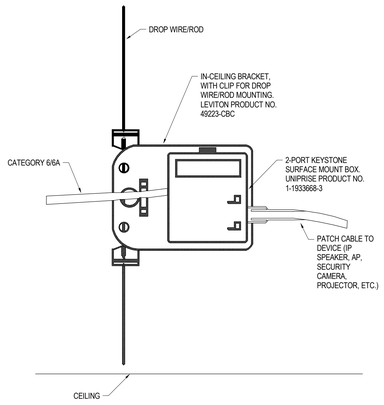
GENERAL NOTE

1. FACE PLATE DETAIL FOR OUTLET CONFIGURATION PURPOSES ONLY. CONTRACTOR TO SELECT TYPE OF FACE PLATE TO MATCH CONNECTIVITY HARDWARE, FLOOR BOX AND/OR MODULAR FURNITURE OPENING.

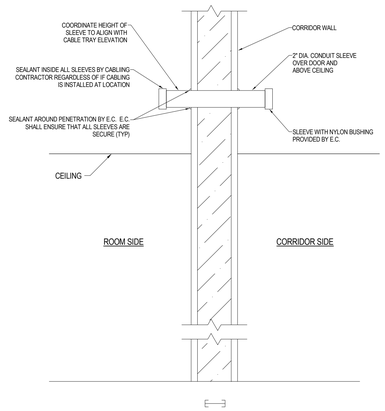


1 DATA ROUGH-IN DETAILS
SCALE: NS

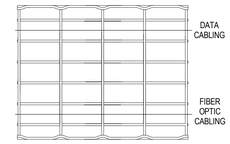


NOTE:
1. ALL ITEMS SHOWN IN THIS DETAIL SHALL BE PROVIDED AND INSTALLED BY THE STRUCTURED CABLING CONTRACTOR.
2. DROP WIRE SUPPORT SHALL BE DEDICATED TO THE OUTLET. DO NOT MOUNT TO CEILING GRID WIRE.
3. DATA OUTLET SHALL BE LOCATED WITHIN 3' OF THE CEILING.

2 ABOVE CEILING STAND ALONE DATA DROP
SCALE: NTS

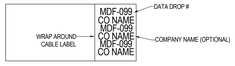


3 TYPICAL CABLING SLEEVE
SCALE: NTS

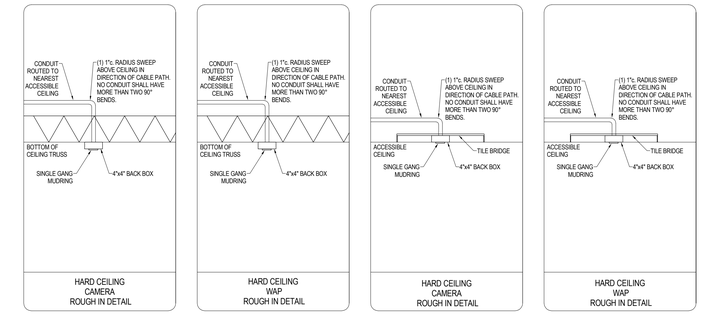


NOTES:
1. RF DISTRIBUTION SHOULD ROUTE ALONG PERIMETER WALLS. DO NOT INSTALL IN CABLE TRAY.
2. BASKET TRAY PROVIDED AND INSTALLED BY ELECTRICAL CONTRACTOR IN ALL AREAS EXCEPT IDFS AND MDF SPACES

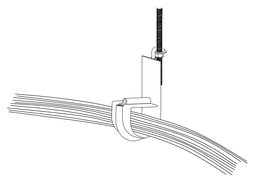
4 CABLE TRAY LAYOUT
SCALE: NTS



WIRE LABELING SCHEME

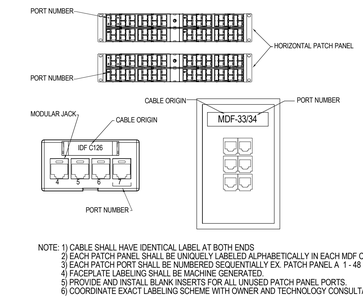


5 HARD AND OPEN CEILING DETAILS FOR CAMERAS AND DATA OUTLETS
SCALE: NTS

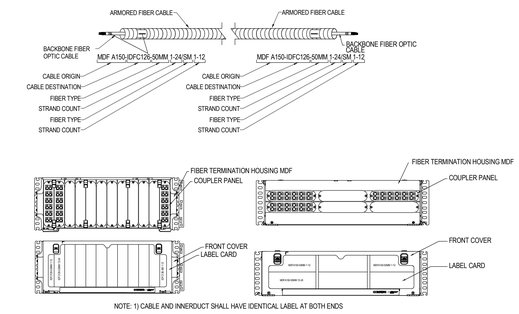


NOTE: 1) STACKED J-HOOKS ON SINGLE SUPPORT NOT PERMITTED.

6 STANDARD J-HOOK DETAIL
SCALE: NTS

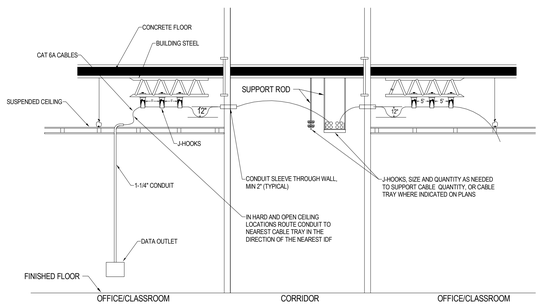


NOTE: 1) CABLE SHALL HAVE IDENTICAL LABEL AT BOTH ENDS
2) EACH PATCH PANEL SHALL BE UNIQUELY LABELED ALPHABETICALLY IN EACH MDF OR IDF.
3) EACH PATCH PORT SHALL BE NUMBERED SEQUENTIALLY EX. PATCH PANEL A 1 - 48 , PATCH PANEL B 49 - 96.
4) FACEPLATE LABELING SHALL BE MACHINE GENERATED.
5) PROVIDE AND INSTALL BLANK INSERTS FOR ALL UNUSED PATCH PANEL PORTS.
6) COORDINATE EXACT LABELING SCHEME WITH OWNER AND TECHNOLOGY CONSULTANT.

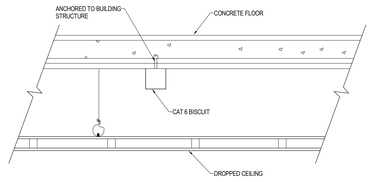


NOTE: 1) CABLE AND INNERDUCT SHALL HAVE IDENTICAL LABEL AT BOTH ENDS

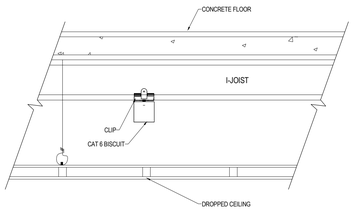
7 LABELING & CABLING SCHEMES
SCALE: NTS



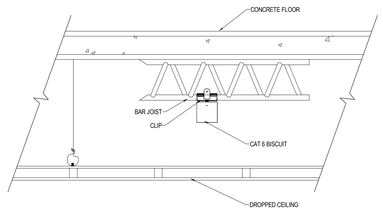
8 CABLE PATHWAY CROSS SECTION
SCALE: NTS



9 DROPPED CEILING MOUNTING DETAIL
SCALE: NS



10 I-JOIST MOUNTING DETAIL
SCALE: NS



11 BAR JOIST MOUNTING DETAIL
SCALE: NS

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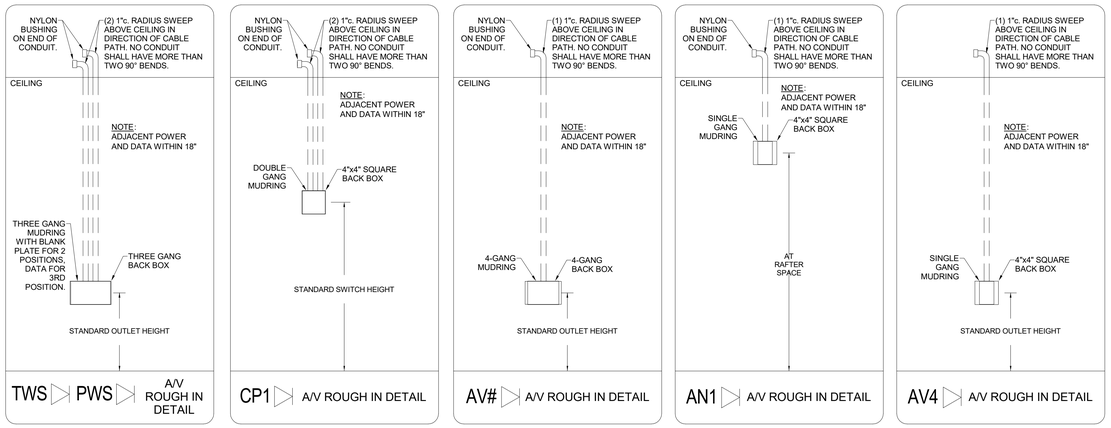
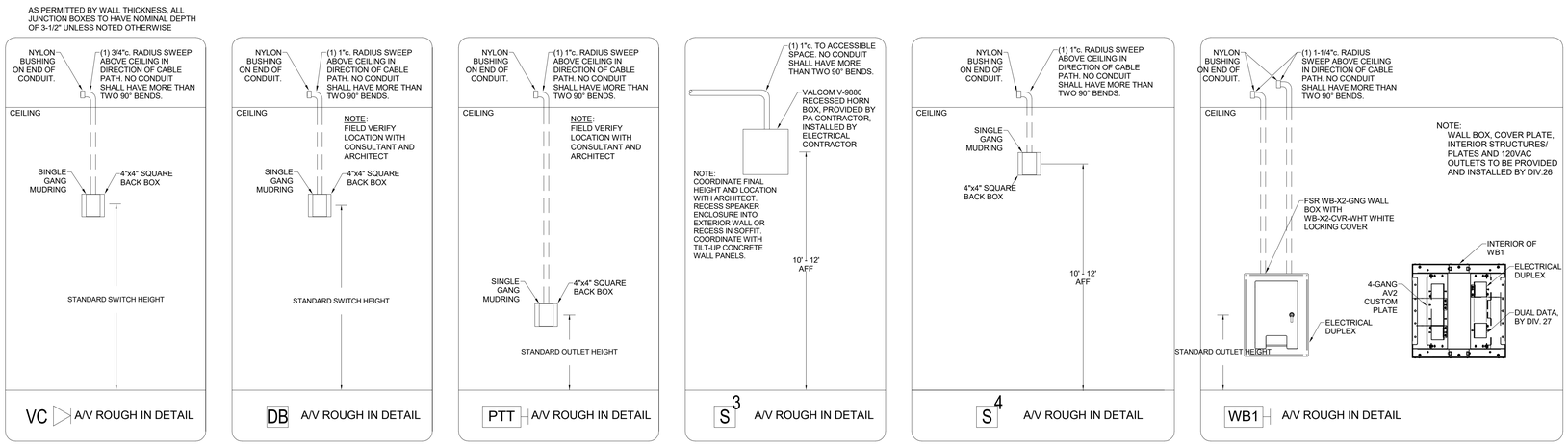


1 A/V ROUGH-IN DETAILS, PROVIDED AND INSTALLED BY ELECTRICAL CONTRACTOR UNLESS NOTED OTHERWISE
SCALE: NTS



2 A/V ROUGH-IN DETAILS, PROVIDED AND INSTALLED BY ELECTRICAL CONTRACTOR UNLESS NOTED OTHERWISE
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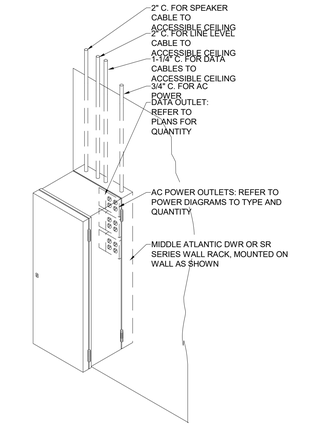
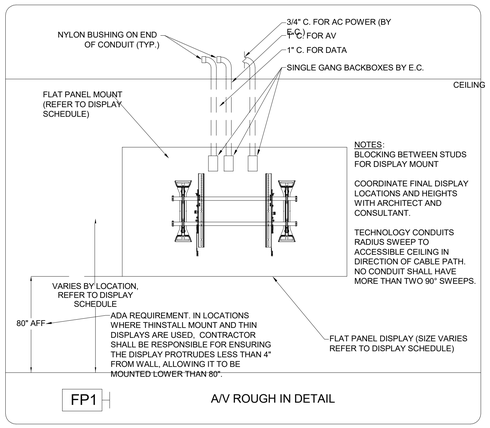
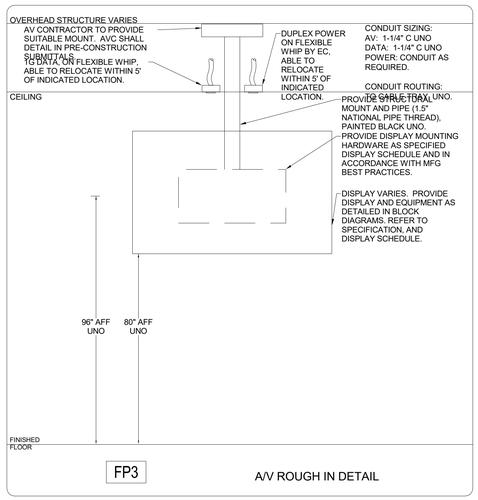




3 A/V ROUGH-IN DETAILS, BY ELECTRICAL CONTRACTOR
SCALE: NTS



4 CEILING MOUNT DISPLAY - A/V ROUGH-IN DETAIL
SCALE: NTS

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RCDD

T7.00

REFER TO FOODSERVICE DESIGN PROFESSIONALS SPECIFICATIONS AND SUBSEQUENT SHEETS FOR ADDITIONAL COORDINATION INFORMATION

EXISTING EQUIPMENT NOTES (IF EXISTING EQUIPMENT IS PROVIDED IN THIS PROJECT):

1. EXISTING EQUIPMENT NOT SCHEDULED FOR RE-USE TO BE RELOCATED BY THE K.E.C. COORDINATE WITH OWNER FOR NEW LOCATION.
2. ALL UTILITIES NOT SCHEDULED FOR RE-USE TO BE CAPPED & COVERED BY REQUIRED DISCIPLINE.
3. K.E.C. TO VERIFY ALL EXISTING UTILITY LOCATIONS & COORDINATE WITH ALL EQUIPMENT AS REQUIRED.

8 EXISTING EQUIPMENT NOTES
NOT TO SCALE

ARCHITECT TO VERIFY/COORDINATE THE AESTHETIC OPTIONS BELOW (FOOD SERVICE COLOR, MATERIAL, OR SIGNAGE SELECTIONS) IF THESE ITEMS ARE PROVIDED IN THIS PROJECT:

1. COUNTERTOPS: STONE (STAINLESS STEEL IS PROVIDED UNLESS OTHERWISE SPECIFIED).
2. TRAY SLIDES: CORIAN OR STONE (STAINLESS STEEL IS PROVIDED UNLESS OTHERWISE SPECIFIED).
3. COUNTER FRONTS: CERAMIC TILE, 3 FORM, OR PLASTIC LAMINATE.
4. SNEEZE GUARDS: STONE INSETS.
5. GENERAL COLOR, MATERIAL AND GRAPHIC SELECTIONS:
   - A. DISPLAY AIR SCREEN MERCHANDISERS - COLOR SELECTION: POWDER COAT OR PLASTIC LAMINATE (S/S IS PROVIDED UNLESS OTHERWISE SPECIFIED).
   - B. BAKERY DISPLAY CASES - COLOR SELECTION: POWDER COAT OR PLASTIC LAMINATE (S/S IS PROVIDED UNLESS OTHERWISE SPECIFIED).
   - C. PASS THRU OR REACH IN HOLDING CABINETS - COLOR SELECTION: POWDER COAT (MFG.: TRUE) OR PLASTIC LAMINATE (MFG.: TRAULSEN) (S/S IS PROVIDED UNLESS OTHERWISE SPECIFIED).
   - D. HANGING HEAT LAMPS - TRACK AND FIXTURE COLOR SELECTION.
   - E. HEATED MERCHANDISERS.
   - F. PORTABLE GUIDE RAILS - STANCHION AND BELT COLOR SELECTION.
   - G. POPCORN MACHINE - SIGNAGE SELECTION.
   - H. BOTTLE COOLER - SIGNAGE SELECTION.
   - I. GRAPHICS PACKAGE INFORMATION.
   - J. HOT FOOD WELL COVERS.
6. ARCHITECT TO VERIFY/COORDINATE THE FINISHES BELOW:
   - A. WALLS: CERAMIC TILE, FLAT FRP, OR MOLDED FRP (SMOOTH, IMPERVIOUS, AND EASILY CLEANABLE AS APPROVED BY LOCAL JURISDICTION).
   - B. CEILINGS: REMOVABLE VINYL FACE TILE (SMOOTH, IMPERVIOUS, AND EASILY CLEANABLE AS APPROVED BY LOCAL JURISDICTION).
   - C. FLOORS: TILE, EPOXY, OR RUBBERIZED FLOORING SYSTEM (SMOOTH, IMPERVIOUS, EASILY CLEANABLE AND SLIP RESISTANT AS APPROVED BY LOCAL JURISDICTION) (COORDINATE FLOOR TILE TRANSITION AT SERVING LINES).
   - D. FLOORS: WALK-IN ASSEMBLY - EXTEND KITCHEN FLOOR FLUSH INTO WALK-IN ASSEMBLY WITH COVED BASE.
   - E. FURR DOWNS ABOVE SERVING COUNTERS.

5 ARCHITECTURAL COORDINATION NOTES
NOT TO SCALE

CRITICAL NOTES:

1. CONTRACTOR MUST COORDINATE AND VERIFY ALL DIMENSIONS WITH FOOD SERVICE EQUIPMENT SHOP DRAWINGS AND MANUFACTURER'S DATA. DIMENSIONS SHOWN ARE FOR DESIGN AND BIDDING PURPOSES ONLY.
2. WALK-IN ASSEMBLY DOORS MUST BE LEFT OPEN WHILE INTERIOR CONCRETE FLOOR CURES.
3. INSTALL PROTECTIVE COVER ON WALK-IN ASSEMBLY WALL PANELS BEFORE INSTALLING CONCRETE FLOORS AND CURBS.
4. REFER TO GENERAL SPECS - DIVISION 27 TO PROVIDE CONDUIT, DATA, AND INTERCONNECT THE PANIC ALARM INSIDE FREEZER TO THE BUILDING AUTOMATION SYSTEM FOR NOTIFICATION TO DISTRICT PERSONNEL IN THE EVENT OF STAFF ENTRAPMENT.
5. PIPING AND DRAINAGE SYSTEMS (SANITARY AND GREASE-LADEN). SYSTEMS MUST BE CLEANED AND FLUSHED BEFORE THE FINAL CONNECTION WITH FOOD SERVICE EQUIPMENT - CRITICAL (DIV. 22).

7 CRITICAL NOTES
NOT TO SCALE

DIVISION 26 (ELECTRICAL) IS RESPONSIBLE FOR BUT NOT LIMITED TO:

1. **DO NOT ROUGH IN FROM FDP DRAWINGS. REFER TO THE KITCHEN EQUIPMENT CONTRACTOR'S DIMENSIONED SHOP DRAWINGS. DIMENSIONS INDICATED ARE TO BE VERIFIED BY KITCHEN EQUIPMENT CONTRACTOR AND ADJUSTED AS REQUIRED BY EQUIPMENT AND FIELD CONDITIONS.**
2. SECTION 11 40 00 TO VERIFY UTILITY REQUIREMENTS OF ANY EXISTING EQUIPMENT.
3. ALL CONNECTIONS SHALL BE MADE FOLLOWING LOCAL CODES AND NATIONAL STANDARDS, EXCEPT WHERE PLANS AND SPECIFICATIONS EXCEED THOSE CODES AND STANDARDS.
4. VERIFY ALL ELECTRICAL REQUIREMENTS WITH ENGINEERING DRAWINGS.
5. ROUGH-IN AND FINAL CONNECTION OF ELECTRICAL SYSTEMS TO FOOD SERVICE EQUIPMENT, WALK-IN ASSEMBLIES, AND BETWEEN COMPONENTS (INCLUDING MATERIALS AND LABOR). ACCESSORIES PROVIDED LOOSE WITH FOOD SERVICE EQUIPMENT BY SECTION 11 40 00 TO BE FIELD INSTALLED BY DIVISION 26.
6. EMPTY EMT CONDUIT WITH PULL-WIRE AND WIDE-SWEEP BENDS FOR REFRIGERANT PIPING TO REMOTE FOOD SERVICE EQUIPMENT REFRIGERATION SYSTEMS.
7. EMPTY EMT CONDUIT WITH PULL-WIRE AND WIDE-SWEEP BENDS FOR INTERCONNECT CABLES BETWEEN LAN AND POS TERMINALS, CHANGE-MAKERS, PRE-CHECK UNITS, PRINTERS, CPUS, ETC. DIVISION 26 TO VERIFY WHERE THE CONDUIT IS TO RUN FOR POS SYSTEM (I.E., MANAGER'S OFFICE OR IDF ROOM).
8. EMPTY EMT CONDUIT WITH PULL-WIRE AND WIDE-SWEEP BENDS FOR FIRE SUPPRESSION SYSTEMS. INTERCONNECT FIRE PROTECTION SYSTEM TO PANEL BOX SHUNT TRIPS AND BUILDING ALARM.
9. WALK-IN LIGHT FIXTURE INSTALLATION (PROVIDED LOOSE BY SECTION 11 40 00) (IF WALK-IN IS PROVIDED IN THIS PROJECT).
10. TABLE LIMIT SWITCH INSTALLATION (PROVIDED LOOSE BY SECTION 11 40 00) (IF DISHMACHINE IS PROVIDED IN THIS PROJECT).
11. ELECTRICAL MATERIALS AND DEVICES (SHUNT-TRIP BREAKERS, SURGE PROTECTORS, LIGHTING CONTROL DEVICES, CONDUIT, WIRE, ETC.).
12. SWITCHES AND STAINLESS STEEL DISCONNECTS AS REQUIRED (PROVIDE, LOCATE, AND INSTALL – TO BE IN AN ACCESSIBLE LOCATION).
13. CHARGING STATIONS FOR FORKLIFTS, PALLET STACKERS, AND PALLET JACKS (SIZE, PROVIDE, LOCATE, AND INSTALL) (IF EQUIPMENT IS PROVIDED IN THIS PROJECT).
14. INTERCONNECTION BETWEEN CONDENSATE FAN AND DISHMACHINE CONTROL PANEL (IF EQUIPMENT IS PROVIDED IN THIS PROJECT).
15. INTERCONNECTION BETWEEN EXHAUST HOOD FANS AND SWITCH (IF EQUIPMENT IS PROVIDED IN THIS PROJECT).
16. INTERCONNECTION BETWEEN EXHAUST HOOD LIGHTS AND SWITCH (IF EQUIPMENT IS PROVIDED IN THIS PROJECT).
17. DOOR HEATERS, LIGHTS, COILS, AND PRESSURE RELIEF PORTS PRE-WIRED TO JUNCTION BOX AT TOP OF WALK-IN ASSEMBLIES (IF EQUIPMENT IS PROVIDED IN THIS PROJECT) PROVIDED BY SECTION 11 40 00. FINAL CONNECTION BY DIV. 26.
18. IF ANY ELECTRICAL ACCESSORIES, FITTINGS, AND CORD/PLUGS ARE PROVIDED LOOSE WITH EQUIPMENT BY 11 40 00, DIV.26 IS TO ATTACH TO EQUIPMENT AND PROVIDE FINAL CONNECTION.
19. PROVIDE WATERPROOF RECEPTACLES IN WET AREAS.
20. ALL ELECTRICAL CONNECTIONS BENEATH EXHAUST HOODS (IF EQUIPMENT IS PROVIDED IN THIS PROJECT) TO EXTEND TO SHUNT TRIP BREAKERS WITH ELECTRICAL PANEL BOX FOR SHUTDOWN DURING FIRE MODE.
21. RECEPTACLES ARE TO BE PRE-WIRED TO THE JUNCTION BOX OR LOAD CENTER FOR FINAL CONNECTION BY DIVISION 26.
22. ALL ELECTRICAL LIGHTING, POWER, AND DISTRIBUTION SYSTEMS.
23. DO NOT INTERCONNECT MORE THAN THREE (3) CONVENIENCE OUTLETS ON ONE (1) BREAKER.
24. OTHER THAN CONVENIENCE OUTLETS, ALL ELECTRICAL CONNECTIONS SHOWN ON FOOD SERVICE PLANS ARE DEDICATED BREAKERS.
25. DOORBELL AT RECEIVING DOOR (PROVIDE AND INSTALL – TO BE AUDIBLE THROUGHOUT KITCHEN, OFFICE, AND DRY STORAGE ROOM).
26. ADEQUATE LIGHTING AT RECEIVING DOOR.
27. PROVIDE AND INSTALL TWO EMERGENCY STROBE BEACONS THAT INTERCONNECT TO PANIC ALARM IN WALK-IN FREEZER. ONE (1) IN KITCHEN ABOVE WALK-IN FREEZER DOOR ONE (1) IN CAFETORIUM (IF WALK-IN IS PROVIDED IN THIS PROJECT). REFER TO GENERAL SPECIFICATIONS FOR ADDITIONAL DETAILS.
27. DEDICATED CIRCUIT FOR HEATED DRAIN LINE CONNECTION IN WALK-IN FREEZER AT EACH COIL (IF WALK-IN IS PROVIDED IN THIS PROJECT).

NOTE: ELECTRICAL CONNECTIONS INDICATED ARE THOSE REQUIRED FOR THE FOOD SERVICE EQUIPMENT AND THOSE REQUIRED FOR SUPPORT EQUIPMENT FURNISHED BY DIVISION 26. FOR ADDITIONAL REQUIREMENTS, REFER TO THE ELECTRICAL ENGINEER'S DRAWINGS.

6 ELECTRICAL COORDINATION NOTES
NOT TO SCALE

DIVISION 22 (PLUMBING) RESPONSIBLE FOR BUT NOT LIMITED TO:

1. **DO NOT ROUGH-IN FROM FDP DRAWINGS. REFER TO THE KITCHEN EQUIPMENT CONTRACTOR'S DIMENSIONED SHOP DRAWINGS. DIMENSIONS INDICATED ARE TO BE VERIFIED BY KITCHEN EQUIPMENT CONTRACTOR AND ADJUSTED AS REQUIRED BY EQUIPMENT AND/OR FIELD CONDITIONS.**
2. SECTION 11 40 00 TO VERIFY UTILITY REQUIREMENTS OF ANY EXISTING EQUIPMENT.
3. ALL CONNECTIONS SHALL BE MADE IN ACCORDANCE WITH LOCAL CODES AND NATIONAL STANDARDS, EXCEPT WHERE PLANS AND SPECIFICATIONS EXCEED THOSE CODES AND STANDARDS.
4. VERIFY ALL PLUMBING REQUIREMENTS WITH ENGINEERING DRAWINGS.
5. EMPTY PVC CONDUIT WITH WIDE-SWEEP BENDS FOR REFRIGERANT PIPING TO BEVERAGE LINES, CO2 LINES, AND REMOTE FOOD SERVICE EQUIPMENT REFRIGERATION SYSTEMS.
6. ROUGH-IN AND FINAL PLUMBING CONNECTIONS TO FOOD SERVICE EQUIPMENT AND BETWEEN COMPONENTS (INCLUDING MATERIALS AND LABOR). ACCESSORIES PROVIDED LOOSE WITH FOOD SERVICE EQUIPMENT BY SECTION 11 40 00 TO BE FIELD INSTALLED BY DIVISION 22. THIS INCLUDES BUT IS NOT LIMITED TO INSTALLATION OF ALL FAUCETS (WATER FILL FAUCETS, PRE-RINSE FAUCETS, ETC.), HOSES, GAS DISCONNECTS, AND DRAINS FROM EQUIPMENT POINT OF CONNECTION TO BUILDING PLUMBING SYSTEMS. ALL DRAIN LINES ARE PROVIDED AND INSTALLED BY DIV. 22.
7. KITCHEN EQUIPMENT CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL FAUCETS (WATER FILL FAUCETS, PRE-RINSE FAUCETS, ETC.), DRAIN FITTINGS, MIXING VALVES, CONTROL VALVES, WATER PRESSURE REGULATORS, VACUUM BREAKERS, AND ALL ACCESSORIES FOR EQUIPMENT SPECIFIED UNDER 11 40 00. DIVISION 22 IS RESPONSIBLE FOR INSTALLATION.
8. INDIRECT DRAIN LINE RUNS FROM EQUIPMENT TO NEAREST DRAIN OR FLOOR SINK. LINES TO BE TYPE 'K' COPPER.
9. IF ANY PLUMBING ACCESSORIES OR FITTINGS ARE PROVIDED LOOSE WITH EQUIPMENT BY 11 40 00, DIV. 22 IS TO ATTACH TO EQUIPMENT AND PROVIDE FINAL CONNECTION.
10. GAS SUPPLY SYSTEMS WITH ALL COMPONENTS AND FITTINGS AS REQUIRED FOR A COMPLETE SYSTEM.
11. WATER SUPPLY SYSTEMS WITH ALL COMPONENTS AND FITTINGS AS REQUIRED FOR A COMPLETE SYSTEM.
12. COMPRESSED AIR SYSTEMS WITH ALL COMPONENTS AND FITTINGS AS REQUIRED FOR A COMPLETE SYSTEM (IF REQUIRED FOR THIS PROJECT).
13. PIPING AND DRAINAGE SYSTEMS (SANITARY AND GREASE-LADEN). SYSTEMS MUST BE CLEANED AND FLUSHED BEFORE THE FINAL CONNECTION WITH FOOD SERVICE EQUIPMENT - CRITICAL.
14. FLOOR SINKS (PROVIDE AND INSTALL). FLANGE AND GRATES TO BE FLUSH WITH FINISHED FLOOR.
15. FLOOR DRAINS (PROVIDE AND INSTALL). FLANGE AND GRATES TO BE FLUSH WITH FINISHED FLOOR.
16. TRENCH DRAINS (PROVIDE AND INSTALL). TRENCH LINERS PROVIDED BY 11 40 00. FLANGE AND LINERS TO BE FLUSH WITH FINISHED FLOOR.
17. GREASE TRAPS AS REQUIRED. VERIFY WITH LOCAL CODES TO BYPASS OR PIPE THRU GREASE TRAP AND/OR INTERCEPTOR.
18. P-TRAPS AS REQUIRED (INCLUDING ALL DISPOSERS).
19. INTERCONNECT WATER THRU WATER FILTER (FILTER PROVIDED BY 11 40 00 UNLESS OTHERWISE SPECIFIED) TO EQUIPMENT.
20. GAS QUICK DISCONNECT INSTALLATION (QUICK DISCONNECT PROVIDED BY 11 40 00).
21. SAFETY RESTRAINT CABLE INSTALLATION (SAFETY RESTRAINT CABLE PROVIDED BY 11 40 00).
22. SPECIFIED COUPLINGS AND PIPING TO ALL EQUIPMENT FURNISHED BY 11 40 00.
23. AIR COMPRESSORS (IF REQUIRED FOR THIS PROJECT) (SIZE, PROVIDE, AND INSTALL, UNLESS OTHERWISE SPECIFIED).
24. WATER SOFTENERS (IF REQUIRED FOR THIS PROJECT) (SIZE, PROVIDE, AND INSTALL, UNLESS OTHERWISE SPECIFIED).
25. PRESSURE BOILERS (IF REQUIRED FOR THIS PROJECT) (SIZE, PROVIDE, AND INSTALL, UNLESS OTHERWISE SPECIFIED).
26. HAND SINKS (PROVIDE (UNLESS OTHERWISE SPECIFIED) AND INSTALL). PROVIDE HOT WATER TEMPERING VALVE IF REQUIRED. WATER TEMPERATURE TO BE AT LEAST 100 DEGREES AND FLOW FOR AT LEAST 20 SECONDS.
27. ICE BIN DRAIN INSULATION (IF ICE MACHINE IS PROVIDED IN THIS PROJECT) (PROVIDE AND INSTALL).
28. UNIONS AT DISPOSER SOLENOID VALVES (IF DISPOSER IS PROVIDED IN THIS PROJECT) (PROVIDE AND INSTALL).
29. BACK FLOW PREVENTION AS REQUIRED (PROVIDE AND INSTALL - INCLUDING ALL DISPOSERS). BACK- SIPHONAGE SHALL BE INSTALLED AT ALL FIXTURES AND EQUIPMENT WHERE BACKFLOW AND/OR BACK-SIPHONAGE MAY OCCUR AND WHERE A MINIMUM AIR GAP CANNOT BE PROVIDED BETWEEN THE WATER TO THE FIXTURE OR EQUIPMENT AT ITS FLOOD/LEVEL RIM. VACUUM BREAKERS, WHEN FURNISHED WITH EQUIPMENT, SHALL OVERRIDE THE ABOVE, IF ACCEPTABLE WITH APPLICABLE CODES. DIVISION 22 RESPONSIBLE FOR VERIFYING REQUIREMENT WITH LOCAL CODES.
30. JANITOR SINK WITH FAUCET (PROVIDE AND INSTALL).
31. FREEZE PROOF HOSE BIBB AT EXTERIOR OF BUILDING BY RECEIVING DOOR (IF SHOWN ON FOOD SERVICE PLANS) (PROVIDE AND INSTALL).
32. REVERSE OSMOSIS SYSTEMS (SIZE, PROVIDE (UNLESS OTHERWISE SPECIFIED), LOCATE AND INSTALL).
33. ALL PIPING WITHIN COUNTER BODY OR UNDER FABRICATED COUNTERS TO BE RUN TO A CONNECTION POINT BELOW COUNTER BODY BY SECTION 11 40 00. FINAL CONNECTION BY DIVISION 22.
34. EXHAUST HOOD CONDENSATE DRAIN CONNECTIONS (IF EXHAUST HOOD IS PROVIDED IN THIS PROJECT) (PROVIDE AND INSTALL).
35. INTERCONNECTION OF 1/2" CW TO PRE-RINSE AND DISPOSERS CONE/BODY INLETS PIPED THROUGH SOLENOID AND VACUUM BREAKER (IF DISPOSER IS PROVIDED IN THIS PROJECT).
36. FIRE SYSTEM PIPING. EXPOSED PIPING TO BE CHROME PLATED.
37. PIPE 1/2" COLD WATER TO SWIRL INLETS AT DISPOSERS (IF DISPOSER IS PROVIDED IN THIS PROJECT).
38. WATER TREATMENT FOR ICE BUILDERS (NON-CHLORINATED WATER WITH A PH LEVEL OF 10 OR HIGHER) AND ANY DRAINS AND OVERFLOWS. PIPING FROM ICE BUILDERS TO TUMBLE CHILLERS BY DIV. 23 (IF ICE BUILDERS AND TUMBLE CHILLERS ARE PROVIDED IN THIS PROJECT).

NOTE: WATER AND DRAIN CONNECTIONS INDICATED ARE THOSE REQUIRED FOR THE FOOD SERVICE EQUIPMENT AND THOSE REQUIRED FOR SUPPORT EQUIPMENT FURNISHED BY DIVISION 22. FOR ADDITIONAL WATER AND DRAIN REQUIREMENTS REFER TO MECHANICAL DRAWINGS.

NOTE: REFER TO ELECTRICAL/MECHANICAL DRAWINGS FOR REQUIREMENTS OF EXHAUST FANS AND MAKE-UP AIR HANDLERS AND LOCATION OF AN INTERLOCK AND START/STOP CONTROLS TO BE LOCATED WITHIN FOOD SERVICE AREA BY DIVISION 26.

4 PLUMBING COORDINATION NOTES
NOT TO SCALE

DIVISION 23 (MECHANICAL) RESPONSIBLE FOR BUT NOT LIMITED TO:

1. **DO NOT ROUGH-IN FROM FDP DRAWINGS. REFER TO THE KITCHEN EQUIPMENT CONTRACTOR'S DIMENSIONED SHOP DRAWINGS. DIMENSIONS INDICATED ARE TO BE VERIFIED BY KITCHEN EQUIPMENT CONTRACTOR AND ADJUSTED AS REQUIRED BY EQUIPMENT AND/OR FIELD CONDITIONS.**
2. SECTION 11 40 00 TO VERIFY UTILITY REQUIREMENTS OF ANY EXISTING EQUIPMENT.
3. ALL CONNECTIONS SHALL BE MADE FOLLOWING LOCAL CODES AND NATIONAL STANDARDS, EXCEPT WHERE PLANS AND SPECIFICATIONS EXCEED THOSE CODES AND STANDARDS.
4. VERIFY ALL MECHANICAL REQUIREMENTS WITH ENGINEERING DRAWINGS.
5. EMPTY EMT CONDUIT WITH PULL-WIRE AND WIDE-SWEEP BENDS FOR REFRIGERANT PIPING TO REMOTE FOOD SERVICE EQUIPMENT REFRIGERATION SYSTEMS.
6. ROUGH-IN AND FINAL CONNECTION OF MECHANICAL SYSTEMS TO FOOD SERVICE EQUIPMENT, WALK-IN ASSEMBLIES, AND BETWEEN COMPONENTS (INCLUDING MATERIALS AND LABOR).
7. TESTING AND BALANCING FOR ROOMS AND EXHAUST HOODS TO BE PERFORMED BY MECHANICAL CONTRACTOR. BALANCE REPORT FOR FOOD SERVICE EXHAUST HOODS TO BE PROVIDED TO FOODSERVICE DESIGN PROFESSIONALS (FDP) IMMEDIATELY UPON COMPLETION (SEND TO HOUSTON.SUBMITTAL@FDP.ORG FOR HOUSTON OFFICE AND DALLAS.SUBMITTAL@FDP.ORG FOR DALLAS OFFICE) AND MUST BE SUBMITTED WITH O&M MANUALS.
8. EXHAUST HOODS, CONDENSATE HOODS, FIRE SUPPRESSION SYSTEMS, CONNECTIONS AND CONTROLS (PROVIDE AND INSTALL – *UNLESS OTHERWISE SPECIFIED*). PROVIDE TEMPERED AIR AT ALL SUPPLY DUCTS.
   - A. IF EXHAUST/CONDENSATE HOODS AND FIRE SUPPRESSION SYSTEMS ARE SPECIFIED UNDER SECTION 11 40 00, DIVISION 23 IS RESPONSIBLE FOR ALL EXHAUST AND CONDENSATE HOOD CONNECTIONS (PROVIDE AND INSTALL).
9. VFD SYSTEM AND CONTROLLERS, WHEN REQUIRED BY CODE (PROVIDE AND INSTALL).
10. PROVIDE AND INSTALL ALL VENTILATION (DIRECT OR INDIRECT), AIR CONDITIONING AND HEATING SYSTEMS (UNLESS OTHERWISE SPECIFIED).
11. COORDINATE SUPPLY AND RETURN DUCTS ABOVE SERVING COUNTERS OR OPEN-AIR REFRIGERATED MERCHANDISERS. NO COLD AIR TO BLOW DIRECTLY ON HOT FOOD COUNTERS.
12. COORDINATE SUPPLY AND RETURN DUCTS AWAY FROM EQUIPMENT WITH TOP MOUNTED REFRIGERATION. NO COLD AIR TO BLOW DIRECTLY ON COMPRESSORS.
13. MECHANICAL CONTRACTOR TO LOCATE TEMPERATURE MONITORS WITHIN RETURN DUCTS.
14. CIRCULATING AIR ABOVE WALK-IN ASSEMBLIES (PROVIDE AND INSTALL).
15. CIRCULATING AIR ABOVE AND IN AIR GAPS AT WAREHOUSE COLD STORAGE ASSEMBLIES (PROVIDE AND INSTALL).
16. WATER CHILLERS AS REQUIRED (IF EQUIPMENT IS PROVIDED IN THIS PROJECT) (PROVIDE, SIZE AND LOCATE).
17. PIPING FROM ICE BUILDERS TO TUMBLE CHILLERS (IF EQUIPMENT IS PROVIDED IN THIS PROJECT) (PROVIDE, SIZE AND LOCATE).

3 MECHANICAL COORDINATION NOTES
NOT TO SCALE

GENERAL CONTRACTOR RESPONSIBLE FOR BUT NOT LIMITED TO:

1. ANY WALL PENETRATION REQUIRED FOR FOOD SERVICE EQUIPMENT UTILITIES. ESCUTCHEON PLATES OR S/S SLEEVES TO BE PROVIDED AND INSTALLED AS NEEDED.
2. BULK FREEZER VENTILATION PIPE (IF BULK FREEZER IS PROVIDED IN THIS PROJECT) (PROVIDE AND INSTALL, UNLESS OTHERWISE SPECIFIED).
3. CORE DRILLING FOR GUIDE RAILS (IF GUIDE RAILS ARE PROVIDED IN THIS PROJECT).
4. REFRIGERATION ROOF CURBS / ROOF JACK (IF REFRIGERATION SYSTEM IS PROVIDED IN THIS PROJECT AND LOCATED ON ROOF).
5. INTERIOR BOLLARDS (IF REQUIRED FOR THIS PROJECT) – TO BE EPOXY PAINTED PER LOCAL CODES (PROVIDE AND INSTALL).
6. FURNISH AND INSTALL 3/4" PLYWOOD BLOCKING IN THE WALL FOR MOUNTING EQUIPMENT FURNISHED BY SECTION 11 40 00 AS REQUIRED.
7. WALK-IN DEPRESSIONS (TO BE DEAD LEVEL) AND SAND LEVELING BED (IF WALK-IN IS PROVIDED IN THIS PROJECT AND RECESS IS SHOWN).
8. STRUCTURAL BRACING FOR BULK WALK-IN CEILING PANELS IF REQUIRED.
9. MENU SYSTEM VIDEO MONITORS IN SERVERY (UNLESS OTHERWISE SPECIFIED).
10. STRUCTURAL BRACING FOR MENU SYSTEM VIDEO MONITORS IF REQUIRED.
11. INTERIOR/EXTERIOR REFRIGERATION PENETRATIONS AND SLEEVES AT BUILDING PENETRATIONS.
12. DOORSCOPE VIEWER (PEEPHOLE) WITH WIDE VIEWING ANGLE AT RECEIVING DOOR.
13. CANOPY AT RECEIVING DOOR. COORDINATE HEIGHT WITH THE HEIGHT OF RECEIVING DOOR (8') AND THE MOUNTING HEIGHT OF AIR SCREEN ABOVE THE DOOR.
14. SOAP AND TOWEL DISPENSER PROVIDED BY OWNER. G.C. RESPONSIBLE FOR INSTALLATION.
15. WASHER AND DRYER (PROVIDE AND INSTALL, UNLESS OTHERWISE SPECIFIED).
16. DWARF WALL AT EXPOSED FRONT/ENDS OF CAFETERIA SERVING COUNTERS WITH FINISH AS SELECTED BY ARCHITECT (IF REQUIRED IN THIS PROJECT).

2 GENERAL CONTRACTOR COORDINATION NOTES
NOT TO SCALE

HEALTH DEPARTMENT REQUIREMENTS (VERIFY WITH LOCAL JURISDICTIONS):

1. FLOORS: VERIFY WITH DIVISION 9. FLOORS TO BE SMOOTH, IMPERVIOUS, EASILY CLEANABLE AND SLIP RESISTANT.
2. WALLS: VERIFY WITH ARCHITECTURAL DOCUMENTS. WALLS TO BE SMOOTH, IMPERVIOUS, AND EASILY CLEANABLE.
3. CEILING: LAY-IN TILES. CEILING TILES TO BE SMOOTH, IMPERVIOUS, AND EASILY CLEANABLE.
4. EMPLOYEE TOILET: TO BE LOCATED OFF MAIN CORRIDOR AND ADJACENT TO MAIN KITCHEN. RESTROOM MUST HAVE A VESTIBULE AND NOT OPEN TO KITCHEN / PREP AREAS. TOILETS TO BE WELL VENTILATED.
5. LAVATORIES: WALL HUNG LAVATORIES LOCATED WITHIN ALL FUNCTIONAL WORKING AREAS.
6. UTENSIL CLEANING/SANITIZING: ACCOMPLISHED IN UTENSIL WASH AREA WITH (3) 2'-0" x 2'-2" x 15" MINIMUM DEEP SINKS AND WAREWASH MACHINE.
7. MECHANICAL CLEANING/SANITIZING OF TABLEWARE: ACCOMPLISHED BY WAREWASH MACHINE.
8. STOREROOMS: AMPLE DAILY STORAGE PROVIDED IN ENCLOSED STORE ROOMS. STORE ROOMS TO BE VENTILATED AND MAINTAIN PROPER TEMPERATURE.
9. WATER HEATER: LOCATED IN THE MECHANICAL ROOM ADJACENT TO KITCHEN. TO BE SIZED TO PROVIDE AMPLE WATER TO MAINTAIN PROPER WATER TEMPERATURE THROUGHOUT HOURS OF OPERATION.
10. GREASE TRAP: LOCATED AT EXTERIOR OF BUILDING. REFER TO ENGINEER'S DRAWINGS.
11. FOOD SERVICE EQUIPMENT: ALL FLOOR-MOUNTED EQUIPMENT IS TO BE SEALED TO THE FLOOR TO PROVIDE AN EASILY CLEANABLE SURFACE AND PREVENT SEEPAGE. EQUIPMENT NOT MOUNTED TO THE FLOOR IS TO BE WALL MOUNTED ON WALL CARRIERS, OR ELEVATED ON LEGS TO PROVIDE AT LEAST A SIX-INCH CLEARANCE BETWEEN FLOOR AND EQUIPMENT.
12. MOP SINK: LOCATED IN JANITOR CLOSET OFF MAIN KITCHEN CORRIDOR, AND LOCATED IN CLOSE PROXIMITY TO THE SERVERY WAREWASH AREA.
13. EXHAUST HOODS: EXHAUST HOODS PROVIDED OVER COOKING EQUIPMENT WITH LIQUID CHEMICAL ANSUL FIRE EXTINGUISHING SYSTEM.
14. LIGHTING AND PROTECTIVE SHIELDING: RECESSED CEILING-MOUNTED FLUORESCENT LIGHT FIXTURES FITTED WITH CLEAR LEXAN DIFFUSERS.
15. GARBAGE AND REFUSE: CENTRAL TRASH COLLECTION PROVIDED FOR BUILDING LOCATED NEAR RECEIVING AREA ON SMOOTH CONCRETE SURFACE.
16. POISONOUS AND TOXIC MATERIAL STORAGE: LOCATED IN RESPECTIVE JANITOR CLOSETS WITH LOCKING HARDWARE.

1 HEALTH DEPARTMENT COORDINATION NOTES
NOT TO SCALE

SMITH&COMPANY
ARCHITECTS

ARCHITECT
SMITH & COMPANY ARCHITECTS
720 N POST OAK, SUITE 124
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STANLEY SPURLING & HAMILTON INC.
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CIVIL ENGINEER
LJA ENGINEERING
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KATY, TX 77449

LANDSCAPE ARCHITECT
STUDIO AVID
6046 FM 2920 RD., #260
SPRING, TX 77379

MEP ENGINEER
INFRASTRUCTURE
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HOUSTON, TX 77057
TBPE FIRM REG.#F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
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WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:
NO. DATE DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

FS GENERAL
COORDINATION NOTES

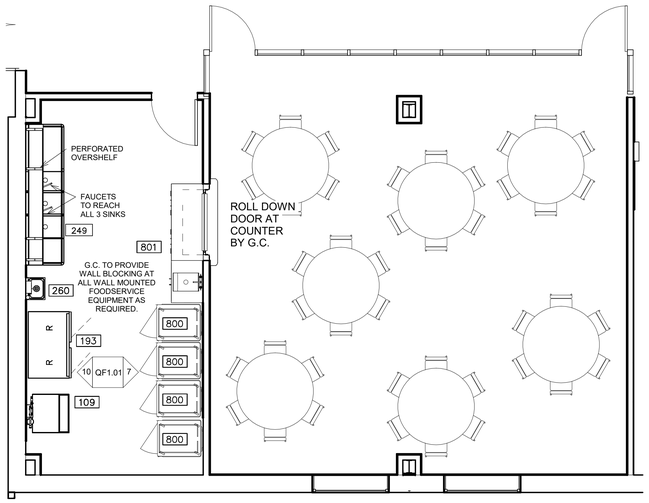
100% Construction Document
02.29.2024

FDP FOODSERVICE DESIGN PROFESSIONALS

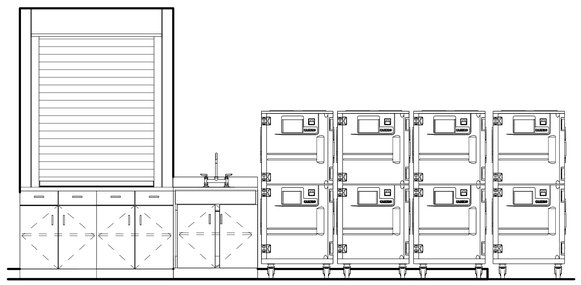
QF1.00

FOOD SERVICE DRAWING INDEX	
FDP SHEET NUMBER	FDP SHEET NAME
QF1.00	FS GENERAL COORDINATION NOTES
QF1.01	FS EQUIPMENT PLAN
QF1.10	FS FACILITY MODEL

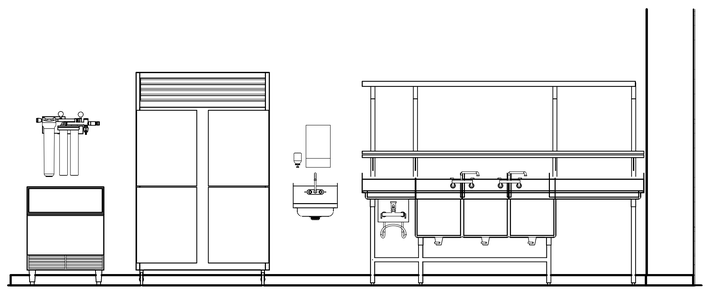
FOOD SERVICE EQUIPMENT SCHEDULE - KITCHEN			
REFER TO SHEET QF1 FOR GENERAL CONTRACTOR & HEALTH DEPARTMENT COORDINATION NOTES			
FDP ITEM	FDP QTY	FDP DESCRIPTION	FDP REMARKS
	64		
109	1	ICE MACHINE W/ BIN	OWNER FURNISHED / CONTRACTOR INSTALLED
193	1	REACH-IN REFRIGERATOR - 2DR	OWNER FURNISHED / CONTRACTOR INSTALLED
249	1	THREE COMPARTMENT SINK	15" X 26" X 15" DEEP SINK WITH ROUNDED INTERNAL EDGES
260	1	HAND SINK	
800	4	INSULATED ENCLOSED TRAY CARTS	OWNER FURNISHED OWNER INSTALLED
801	1	COUNTER WITH SINK & PASS THRU WINDOW	MILLWORK BY ARCHITECT



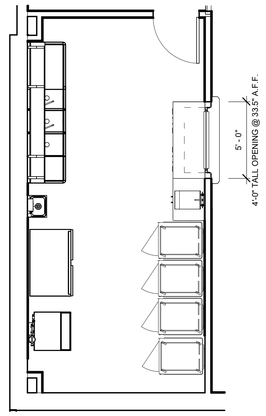
1 FOOD SERVICE EQUIPMENT PLAN
1/4" = 1'-0"



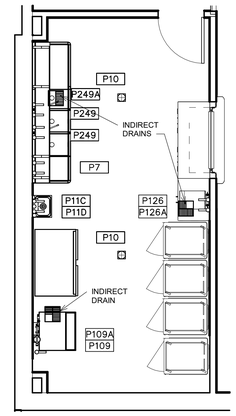
7 ELEVATION AT FRONT COUNTER
1/2" = 1'-0"



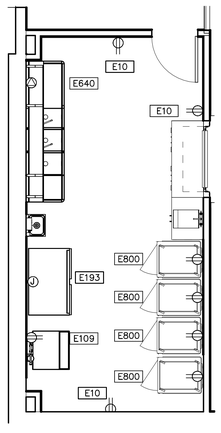
10 ELEVATION AT KITCHEN REAR
1/2" = 1'-0"



2 FOOD SERVICE SPECIAL CONDITIONS PLAN
1/4" = 1'-0"



3 FOOD SERVICE PLUMBING PLAN
1/4" = 1'-0"



4 FOOD SERVICE ELECTRICAL PLAN
1/4" = 1'-0"

FOOD SERVICE PLUMBING SCHEDULE						
REFER TO SHEET QF1 FOR PLUMBING COORDINATION NOTES						
FDP PNO	FDP PSIZE	FDP PCONN	FDP PSERVICE TO	FDP PLOC	FDP PAFF	FDP PREMARKS
						<varies>
P7	3/4"	H & C WATER	HOSE BIBB	WALL	18"	BTC: RE: NOTE #3
P10	VERIFY	FLOOR DRAIN	GENERAL AREA DRAIN	FLOOR	VERIFY	---
P11C	1/2"	H & C WATER	FAUCET	WALL	18"	PROVIDED BY 11 40 00 & INSTALLED BY DIV. 22
P11D	1 1/2"	DIRECT DRAIN	HAND SINK	WALL	15"	PROVIDED BY 11 40 00 & INSTALLED BY DIV. 22
P109	3/4"	COLD WATER	WATER FILTER / ICE	WALL	60"	BTC
P109A	12"SQ.	FLOOR SINK	ICE MACHINE	FLOOR	0"	3/4 GRATE
P126	3/4"	H & C WATER	FAUCET	WALL	13"	BTC
P126A	12" SQ.	FLOOR SINK	SINK	FLOOR	0"	3/4 GRATE
P249	3/4"	H & C WATER	FAUCET	WALL	13"	BTC
P249A	12" SQ.	FLOOR SINK	SINK	FLOOR	0"	1/2 GRATE

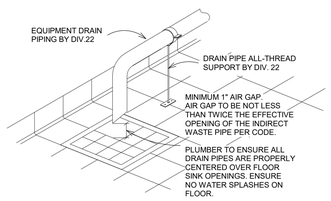
FOOD SERVICE ELECTRICAL SCHEDULE								
REFER TO SHEET QF1 FOR ELECTRICAL COORDINATION NOTES								
FDP ENO	FDP ECONN	FDP ELOAD	FDP EVOLT	FDP EPH	FDP ESERVICE TO	FDP ELOC	FDP EAFF	FDP EREMARKS
E10	DR	16.0A	120	1	CONVENIENCE	WALL	24"	MOUNT HORIZONTAL
E109	DR	10.0A	120	1	ICE MACHINE	WALL	18"	---
E193	JB	8.5A	120	1	REFRIGERATOR	WALL	84"	BTC - OMIT PLUG. UNIT TO BE HARDWIRED.
E640	SR	30.5A	120/208	1	UNDERCOUNTER DISHMACHINE	WALL	13"	---
E800	DR	4.6A	120	1	HOLDING CABINET	WALL	18"	

	SCR	CONDUIT STUB BTC ON RECEPT FURNISH WITH EQUIPMENT		CC	CONDUIT FOR COMPUTER CABLES
•	CS	CONDUIT STUB UP/OUT FOR DIRECT CONNECTION		BTC	BRANCH TO CONNECTION ON EQUIPMENT
	DR	DUPLEX RECEPTACLE		WPR	WATERPROOF RECEPTACLE (SPRING COVER)
	SR	SINGLE PURPOSE RECEPTACLE-1PH		FPB	FIRE PROTECTION BUZZER
	SR	SINGLE PURPOSE RECPTACLE-3PH		BSC	BEVERAGE SYSTEM CONDUIT
	FR	FLUSH FLOOR RECEPTACLE		DFA	DROP FROM ABOVE
	PMR	PEDESTAL MOUNTED RECEPTACLE		AFF	ABOVE FINISH FLOOR
	DCR	DROP CORD RECEPTACLE		CSJB	JUNCTION BOX ON PEDESTAL
	JB	JUNCTION BOX ON CEILING		SW	SWITCH
	JB	JUNCTION BOX IN WALL		D	DATA
	JB/DS	JUNCTION BOX WITH DISCONNECT BY DIV.26			

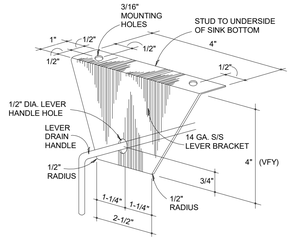
5 ELECTRICAL SYMBOLS
NOT TO SCALE

	HW	HOT WATER		FFD	FUNNEL FLOOR DRAIN
	CW	COLD WATER		EVC	EXHAUST VENT CONNECTION
	HTW	180 F HOT WATER		SVC	SUPPLY VENT CONNECTION
		CHILLED WATER		FR	DIRECT-CONNECTED FLUE RISER
	W	DIRECT WASTE		PS	PIPE SLEEVE
	IW	INDIRECT WASTE			COMPRESSED AIR
		GAS SUPPLY			CO2
		STEAM SUPPLY		AFF	ABOVE FINISHED FLOOR
	CR	CONDENSATE RETURN		BTC	BRANCH TO CONN. ON EQUIP
	DR	DRAIN		DFA	DROP FROM ABOVE
	FD	FLOOR DRAIN		CLG	CEILING
	FST	FLOOR SINK 3/4 GRATE			
	FSH	FLOOR SINK 3/4 GRATE			

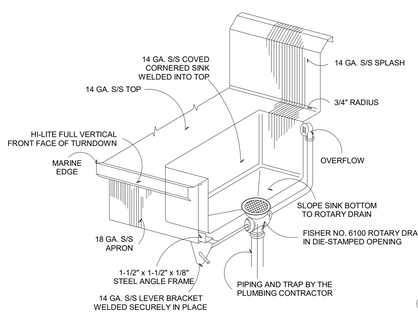
8 PLUMBING SYMBOLS
NOT TO SCALE



11 DRAIN PIPING FASTENER DETAIL
NOT TO SCALE

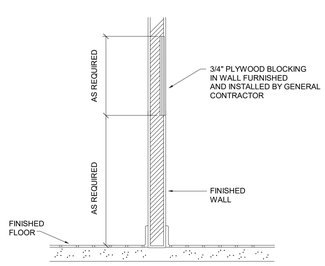


12 SINK DRAIN LEVER BRACKET DETAIL
NOT TO SCALE

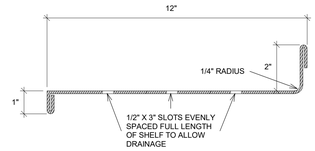


13 SINK ASSEMBLY DETAIL
NOT TO SCALE

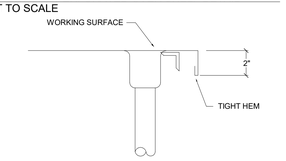
NOTE:
SECTION 11 40 00 TO COORDINATE FINAL LOCATION AND SIZE OF WALL BLOCKING.

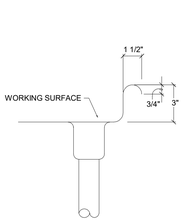


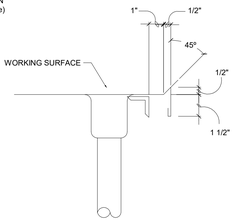
14 WALL BLOCKING DETAIL
NOT TO SCALE



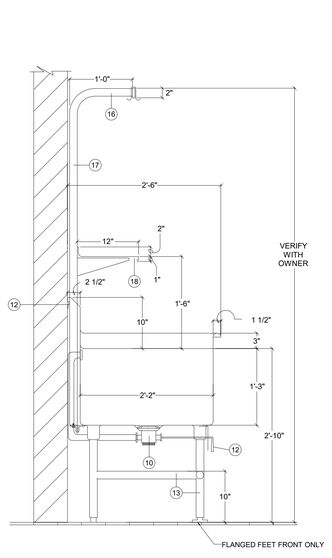
6 WAREWASH - PERFORATED OVER SHELF DETAIL
NOT TO SCALE



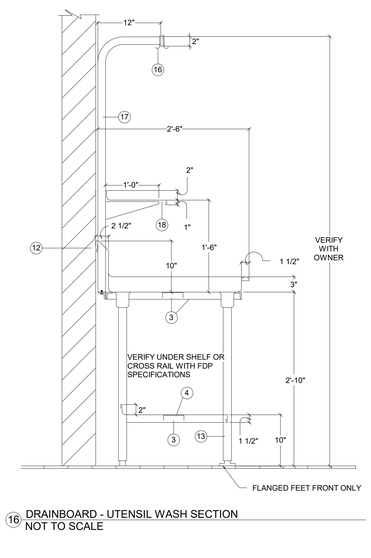




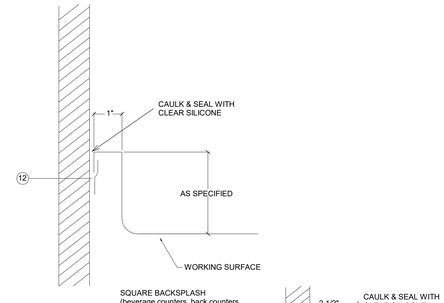
9 EDGE DETAILS
NOT TO SCALE

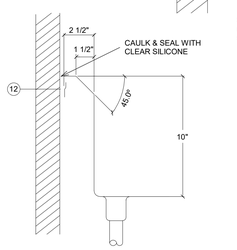


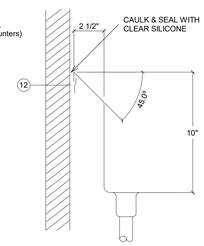
15 SINK - UTENSIL WASH SECTION
NOT TO SCALE



16 DRAINBOARD - UTENSIL WASH SECTION
NOT TO SCALE



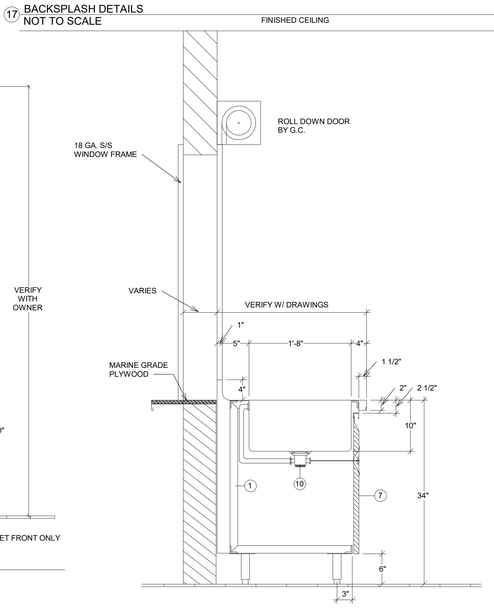




CHAMFERED 45° ANGLE BACKSPLASH
(with post mounted over shelf)

45° ANGLE BACKSPLASH
(without post mounted over shelf)

17 BACKSPLASH DETAILS
NOT TO SCALE



18 COUNTER - BACK CLOSED BASE W/ SINK & ROLL DOWN DOOR SECTION
NOT TO SCALE

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SPRING, TX 77379

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INFRASTRUCTURE
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TBPE FIRM REG #F-4506

TECHNOLOGY CONSULTANT
TRUE NORTH CONSULTANT GROUP
3408 HILLCREST DR.
WACO, TX 76708

PROJECT #: N032023
DATE ISSUED: 02.29.2024
TDLR #: TABS2024011699

REVISIONS:
NO. DATE DESCRIPTION

FRESNO BOYS & GIRLS CLUB
1031 W SYCAMORE RD
FRESNO, TX 77545

FS EQUIPMENT PLAN

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02.29.2024

FOODSERVICE DESIGN PROFESSIONALS

QF1.01

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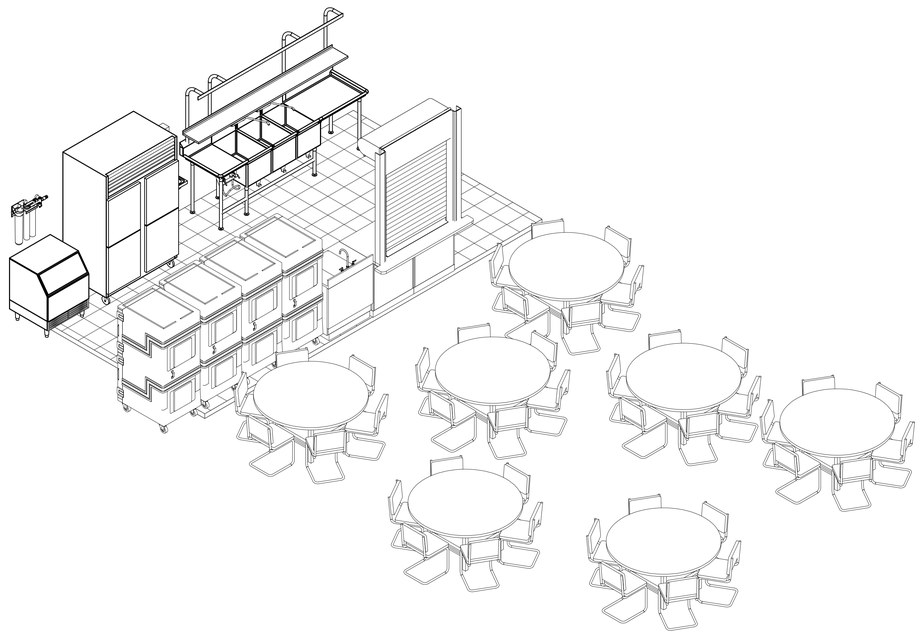
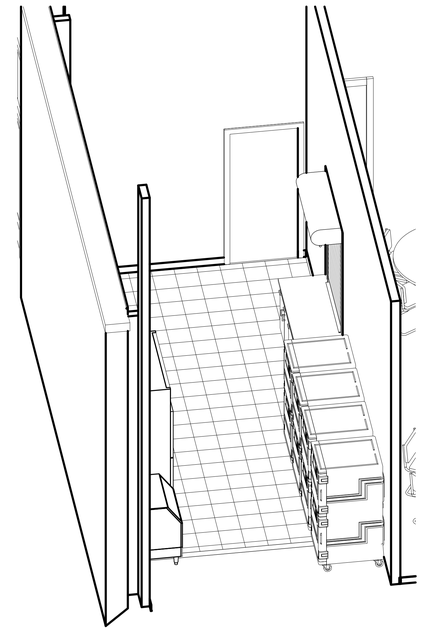


2 FS EQUIPMENT MODEL



1 FS FACILITY MODEL

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FS FACILITY MODEL

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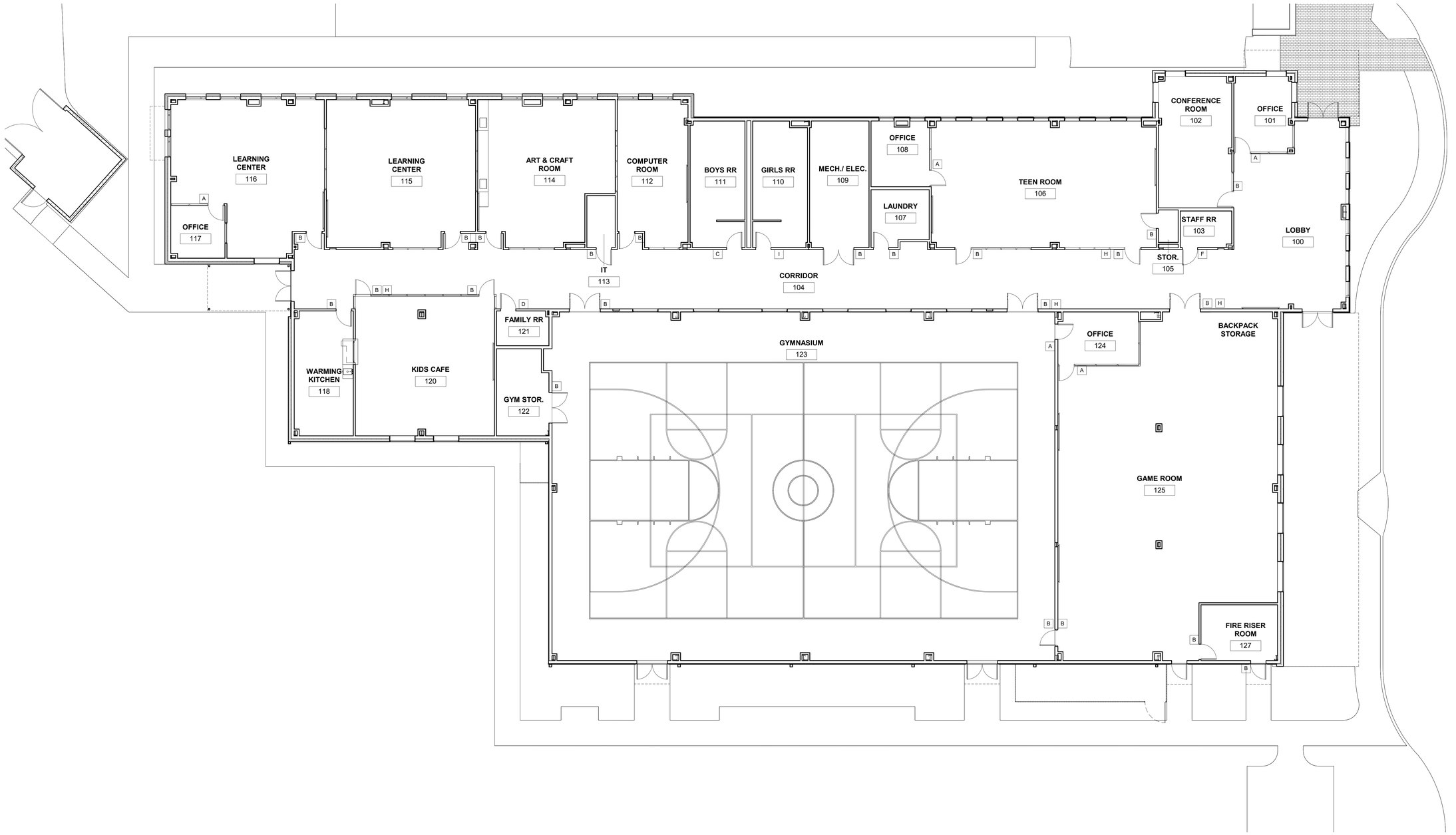
FOODSERVICE DESIGN PROFESSIONALS

QF1.10



GRAPHIC PLAN | 1/8" = 1'-0" | 1

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GRAPHIC PLAN

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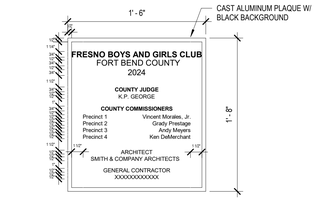
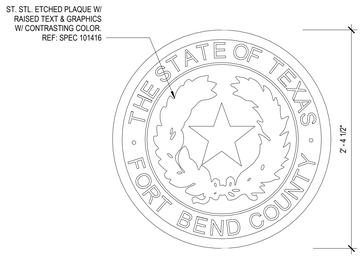
02.29.2024

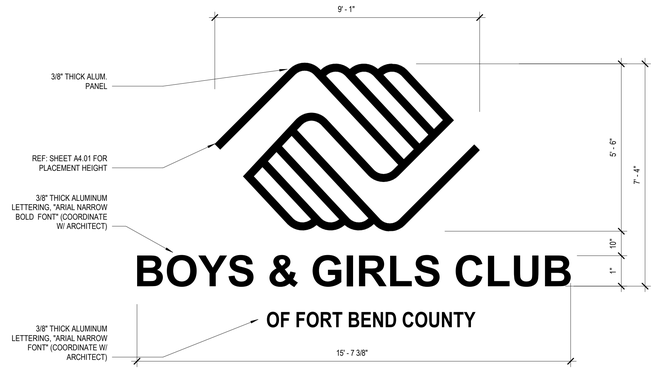
G1.01



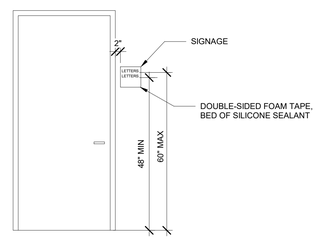
CAST DECICATION PLAQUE | 1 1/2" = 1'-0" | 18



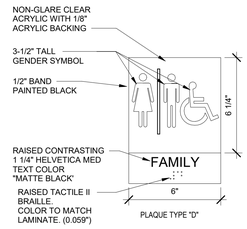
FT. BEND COUNTY ETCHED PLAQUE | 1 1/2" = 1'-0" | 16

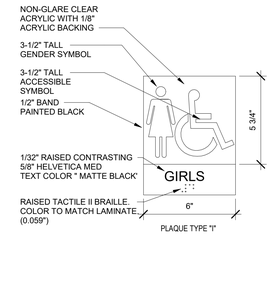


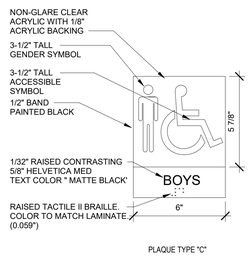
EXTERIOR GRAPHIC DETAILS | 1/4" = 1'-0" | 15

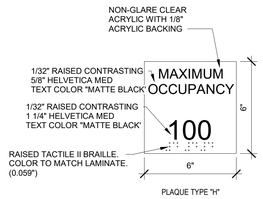


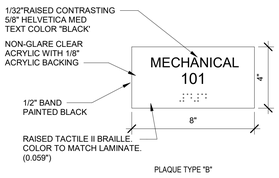
GRAPHIC MOUNTING DETAIL | 1/2" = 1'-0" | 13

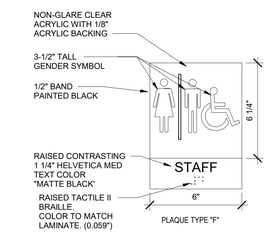


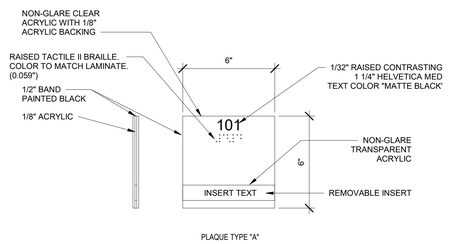












GRAPHIC DETAILS | 3" = 1'-0" | 1

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GRAPHIC DETAILS

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G1.11