Bastrop County

REQUEST FOR BID

Bid Reference Number: RFB 25BCP04J

Project Title: Bastrop County Precinct 2 Road and Bridge Facility Construction

Bid Closing Date: 2 :00 P.M. (CST), May 15, 2025

Pre-Bid Meeting: 10:00 A.M. (CST), April 29, 2025

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Bastrop County

Request for Bids

1. Introduction

A. Project Overview: Bastrop County is requesting Bids with the intent of awarding a contract for the purchase of goods and services contained in Appendix A – Scope of Services.

B. RFB Questions:

i. RFB Clarifications: All questions related to requirements, processes or scope of work for this RFB should be submitted in writing to the Purchasing Agent identified in section 2 below. The County is the final judge of the meaning of any word(s), sentences, paragraphs or other parts of the solicitation documents. Bidders are encouraged to seek clarification, before submitting a Bid, of any portion of the Bid documents that appears to be ambiguous, unclear, inconsistent, or otherwise in error. Clarifications will be in writing.

ii. Replies: Responses to inquiries, which directly affect an interpretation or effect a change to this RFB will be issued in writing by addendum and will be uploaded to the Bastrop County website (http://www.co.bastrop.tx.us/page/pur.Bids). All such addenda issued by County prior to the submittal deadline shall be considered part of the RFB. The County shall not be bound by any reply to an inquiry unless such reply is made by such a formal written addendum.

iii. Acknowledgement of Addenda: The Bidder must acknowledge all Addenda by signing and returning such document(s) or by initialing appropriate area of the Bid.

C. Notification of Errors or Omissions: Bidders shall promptly notify the County of any omissions, ambiguity, inconsistency or error that they may discover upon examination of this RFB. The County shall not be responsible for or liable for any errors and/or misrepresentation that result from the solicitations which are inadvertently incomplete, ambiguous, inconsistent or obviously erroneous.

D. Conflict of Interest Questionnaire (Form CIQ): A person or business, and their agents, who seek to contract or enter into an agreement with the County, are required by Texas Local Government Code, Chapter 176, to file a conflict-of-interest questionnaire (FORM CIQ) which is found in Appendix C.

E. Certificate of Interested Parties (1295 Form): A person or business, and their agents, who seek to contract or enter into an agreement with the County, are required by Texas Local Government Code Chapter 2252, Subtitle F, Title 10, Section 2252.908, to file a disclosure of interested parties with the Texas Ethics Commission (https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm). A sample form and instruction sheet can be found in Appendix D.

F. House Bill 89 Verification Form: A person or business, and their agents, who seek to contract or enter into an agreement with the County, are required by Texas Local Government Code Chapter 2270 Section 1, Subtitle F, Title 10, Section 2270.001to submit a verification form to the County. This Chapter reads “Prohibition on Contracts with Companies Boycotting Israel”. This form is found in Appendix E.

G. Texas Senate Bill 13 (Sb 13): Energy Company Boycotts: If contractor is required to make a verification pursuant to section 2274.002 of the Texas Government Code, contractor verifies that it does not boycott energy companies and will not boycott energy companies during the term of the contract. If contractor does not make that verification, contractor must so indicate in its response and state why the certification is not required.

H. Texas Senate Bill 19 (Sb 19): Firearm Entities And Trade Associations Discrimination: If contractor is required to make a verification pursuant to Section 2274.002 of the Texas Government Code, contractor verifies that it (1) does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association and (2) will not discriminate during the term of the contract against a firearm entity or firearm trade association. If contractor does not make that verification, contractor must so indicate in its Response and state why the verification is not required.

I. 2 CFR 200: In accordance with PART 200 of the UNIFORM ADMINISTRATIVE REQUIREMENTS, COST PRINCIPLES, AND AUDIT REQUIREMENTS FOR FEDERAL AWARDS, Bastrop County follows the procurement standards in the Code of Federal Regulations of 2 CFR 200.317 – 2CFR 200.327 and Appendix II to Part 200 for procurement actions to be funded with Federal funds.

2. Definitions

Bid: The signed and executed submittal of the entirety of Appendix B – Bid.

Bidder: The Bidder and the Bidder's designated contact signing the first page of the Bid.

County of Bastrop ("County"): The County of Bastrop, Texas.

Bastrop County Purchasing Office: The Bastrop County Purchasing Office is located at 1501 Business Park Drive, Bastrop County78602. PH: (512) 581-7110; Fax: (512) 581-4228.

Project: The name is identified on the cover sheet

Purchasing Agent: Bastrop County Purchasing Agent is Leon Scaife:
Phone: (512) 581-7110
E-Mail: leon.scaife@co.bastrop.tx.us

Request for Bids (RFB): The entirety of this document, including all Appendices and Addenda.

Scope of Services: The entirety of the attached specifications and drawings.

3. General Information

A. Tax Exempt Status: County purchases are exempt from State Sales Tax and Federal Excise Tax. Do not include tax in the Bid. County will furnish Excise Tax Exemption Certificate upon request.

B. Public Inspection of Bids: The County strictly adheres to the Texas Public Information Act (Texas Government Code Chapter 552.001, et seq.) and all other governing statutes, regulations, and laws regarding the disclosure of RFB information. Bids are not available for public inspection until after the contract award. If the Bidder has notified the County, in writing, that the Bid contains trade secrets or confidential information, the County will generally take reasonable steps to prevent disclosure of such information, in accordance with the Public Information Act. This is a statement of general policy only, and in no event shall the County be liable for disclosure of such information by the County in response to a request, regardless of the County's failure to take any such reasonable steps, even if the County is negligent in failing to do so.

C. Legal Relations and Responsibilities: Bidder shall maintain adequate records to justify all charges, expenses and costs incurred in performing the Services for a period of at least Five (5) years following the termination date of the contract. The County shall have full and complete access to all records, documents and information collected and/or maintained by Bidder in the course of the administration and performance of

the Contract. This information shall be made accessible at Bidder's local place of business in the County's jurisdiction, for purposes of inspection, reproduction, and audit without restriction.

D. Application: These standard terms and conditions shall apply to all County of Bastrop (hereafter "County" or "Owner") solicitations and procurements, unless specifically accepted in the solicitation specifications.

E. Requirements: By submitting a Bid, the Bidder agrees to provide the County of Bastrop with the specified goods or services described in the solicitation in accordance with these standard terms and conditions, at the agreed upon Bid price and in compliance with the stated specifications and any subsequent addendums issued prior to the date of the Bid opening.

F. Legal Compliance: Bidder must comply with all Federal, State and Local laws, statutes, ordinances, regulations and standards in effect at the time of delivery of goods and services and must maintain any and all required licenses and certificates required required under the same laws, statutes, ordinances, regulations and standards for services and/or goods provided in response to this solicitation. The Bidder certifies that he/she holds all licenses required by the State of Texas for a provider of the goods and/or services described by the Scope of Services herein.

G. Right to Refuse Bid: The County reserves the right to refuse any and/or all parts of any and or/all Bids and to waive formalities in the best interest of the County. Bastrop County does not discriminate on the basis of race, color, national origin, sex, religion, and age or disability status in employment, procurement or provisions of service.

H. Estimated Quantities: If the solicitation calls for unit pricing on specific items, the quantities described for each item are estimates only and not guaranteed amounts. The actual amount ordered over the contract period may be more or less than the estimate. Quantities represent the County's best estimate, based on history and anticipated purchases.

I. Independent Contractor: Bidder agrees that Bidder and Bidder's employees and agents have no employer-employee relationship with County. Bidder agrees that if Bidder is selected and awarded a contract, County shall not be responsible for the Federal Insurance Contribution Act (FICA) payments, Federal or State unemployment taxes, income tax withholding, Workers Compensation Insurance payments, or any other insurance payments, nor will County furnish any medical or retirement benefits or any paid vacation or sick leave.

J. Assignments: The rights and duties awarded the successful Bidder shall not be assigned to another without the written consent of the Bastrop County Purchasing Agent. Such consent shall not relieve the assigner of liability in the event of default by the assignee.

K. Liens: Bidder shall indemnify and save harmless the County against any and all liens and encumbrances for all labor, goods, and services which may be provided to the County by Bidder or Bidder's vendor(s), and if the County requests, a proper release of all liens or satisfactory evidence of freedom from liens shall be delivered to the County.

L. Gratuities/Bribes: Bidder certifies that no bribes in the form of entertainment, gifts, or otherwise, were offered or given by the successful Bidder, or its agent or representative, to any County officer, employee or elected representative, with respect to this RFB or any contract with the County, and that if any such bribe is found to have been made this shall be grounds for voiding of the contract

M. Financial Participation: Bidder certifies that it has not received compensation from the County to participate in preparing the specifications or RFB on which the Bid is based and acknowledges that this contract may be

terminated and/or payment withheld if this certification is inaccurate.

N. Responsiveness of Bids: The County desires to receive competitive Bids but will declare any Bids "non-responsive" if they fail to meet the significant requirements outlined in this solicitation document.

O. Discrepancies and Errors: The lump sum price of a Bid that has been opened may not be changed for the purpose of correcting an error in the Bid price.

P. Identical Bids: In the event two or more identical Bids are received, and are the lowest, responsible, and responsive, award will be made as prescribed in the Texas Local Government Code, Chapter 2.62.027(b).

Q. Withdrawal of Bids: Bidders may withdraw any submitted Bids prior to the Bid submission deadline. Bidders may not withdraw once the Bids have been publicly opened, without the approval of the County's Purchasing Agent. Bidders will be allowed to withdraw Bids that contain substantial mathematical errors in extension. However, once a Bid has been withdrawn, it can no longer be considered.

R. Disqualification of Bidder: The County may disqualify Bidders, and their Bids not be considered, for any of the following reasons: Collusion among Bidders; Bidder's default on an existing or previous contract with the County, including failure to deliver goods and/or services of the quality and price Bid; Bidder's lack of financial stability; any factor concerning the Bidder's inability to provide the quantity, quality, and timeliness of services or goods specified in the solicitation; Bidder involved in a current or pending lawsuit with the County; Bidder's attempt to influence the outcome of the solicitation through unauthorized contact with County officials outside of those listed in the solicitation documents; and Bidder's attempt to offer gifts, gratuities, or bribes to any County employee or elected official in connection with a solicitation.

S. Waiver of Formalities: County reserves the right to reschedule, extend, or cancel this RFB at any time. County reserves the right to reject any or all responses, and to waive formalities or irregularities in connection with this RFB and may consider submissions not made in compliance with this request for Bids if it elects to do so, to the extent permitted by law, although the County will have no obligation for such consideration. The County reserves the right to waive any minor irregularities that do not materially affect the scope or pricing of submitted Bids.

T. Outstanding Liabilities: Bidders shall not have outstanding, unpaid liabilities owed to the County. Liabilities may include, but are not limited to, property taxes, hotel occupancy taxes, and license or permit fees. Bids will be considered non-responsive and not given further consideration if submitted by a Bidder with such outstanding liabilities.

U. Offset: The County may, at its option, offset any amounts due and payable under contract award under this solicitation against any debt lawfully due the County from a vendor, whether or not the amount due arises pursuant to the terms of the contract and whether or not the debt has been reduced to judgment by a court.

V. Solicitation Results: The County normally posts solicitation results online after Bids are received and approved in the Commissioner's Court. The County's website is www.co.bastrop.tx.us. Results are on the Purchasing Solicitation page, in the same place as the original solicitation documents. Posted results are for informational purposes only, not a notice of award.

W. Control of The Work: Bidder shall furnish all materials and perform the work in reasonably close conformity with the scope of work referenced in this request for Bid. Bidder must obtain written approval from Bastrop County before deviating from the scope of work provided in this request for Bids. Failure to promptly notify Bastrop County of any errors or concerns with the scope of work will constitute a waiver of all claims for misunderstandings or ambiguities that result from the errors, omissions, or discrepancies discovered.

X. Cost of Bid: The cost of submitting Bids shall be borne by the Bidder, and the County will not be liable for any costs incurred by a Bidder responding to this solicitation.

4. RFB Withdrawals and/or Amendments

A. RFB Withdrawal: The County reserves the right to withdraw this RFB for any reason.

B. RFB Amendments: The County reserves the right to amend any aspect of this RFB by formal written Addendum prior to the Bid submittal deadline and will endeavor to notify all potential Bidders that have registered with the County, but failure to notify shall impose no obligation or liability on the County. All modifications and addendums must be in written form prepared by the County department issuing the solicitation. Bidder is responsible for incorporating any and all modifications and addendums into their Bids.

5. Bid Submittal Requirements

A. Submittal Packet – Required Content: Bidder shall submit one (1) signed original Bid. This submittal packet shall be submitted in a sealed envelope with the completed and signed forms and documents listed in Appendix B – Bid Verification (Page 10).

B. Submittal Deadline: The deadline for submittal of Bids is 2:00PM (CST) May 15, 2025. It is the Bidder's responsibility to have the Bid correctly marked and hard copies delivered to the Bastrop County Purchasing Office. No extensions will be granted, and no late Bids will be accepted.

C. Bids Received Late: Bidders are encouraged to submit their Bids as soon as possible.
The time and date of receipt as recorded in the Bastrop County Purchasing Office shall be the official time of receipt. The County is not responsible for late delivery of mail or another carrier. Late Bids will not be considered under any circumstances.

D. Alterations or Withdrawals of Bid: Any submitted Bid may be withdrawn, or a revised Bid substituted if a written notice is submitted to the Bastrop County Purchasing Office prior to the submittal deadline. Any interlineations, alteration, erasure, or other amendment made before the submittal deadline, must be signed or initialed by the Bidder or the Bidder's authorized agent, guaranteeing authenticity. Bids cannot be altered, amended, or withdrawn by the Bidder after the submittal deadline.

E. Bid Format: All Bids must be prepared in single-space type, on standard 8-1/2" x 11" vertically oriented pages, using one side of the paper only. Pages shall be numbered at the bottom. Entries shall be typed, or legibly written in ink. All Bids shall be mailed, or hand delivered to Bastrop County. Any other format (via telephone, fax, email, etc.) shall be rejected by the County.

F. Validity Period: Once the submittal deadline has passed, any Bid shall constitute an irrevocable Bid to provide the commodities and/or services set forth in the Scope of Services at the price(s) shown in the Bid on the terms set forth in the Bid, such Bid to be irrevocable until the earlier of the expiration of ninety (90) days from the submittal deadline, or until a contract has been awarded by the County.

6. Bid Evaluation and Contract Award

A. Bid Evaluation and Contract Award Process: An award of a contract to provide the goods or services specified herein will be made using competitive sealed Bids, in accordance with Chapter 262 of the Texas Local Government Code; Chapter 2269 of the Texas Government Code and with the County's purchasing policy. All Bids should be based on a lump sum price (Cost to complete all tasks listed within Appendix A to include all necessary bonds and insurance). Bastrop County will score all eligible respondents based on their proposed price. The contract will be given to the lowest/best value/most responsive Bidder that complies with all requests for Bid items and requirements set forth by Bastrop County in this RFB, to include bonds, insurance

requirements and Bastrop County may consider: 1) price: 2) the offeror's experience and reputation: 3) the quality of the offeror's goods and/or services: 4) the impact on the ability of the Governmental entity to comply with rules relating to historically underutilized businesses: 5) the offeror's safety record: 6) the offeror's proposed personnel: 7) whether the offeror's financial capability is appropriate to the size and scope of the project. The selected Bidder must NOT be debarred from any federal and/or state agency and Bastrop County will conduct a review of the Bidder's status on SAM.Gov. The Bastrop County Commissioners' Court will make the final selection and award. **The County has the right to reject any and/or all Responses.**

B. Completeness: If the Bid is incomplete or otherwise fails to conform to the requirements of the RFB, County alone will determine whether the variance is so significant as to render the Bid non-responsive, or whether the variance may be cured by the Bidder or waived by the County, such that the Bid may be considered for award.

C. Ambiguity: Any ambiguity in the Bid as a result of omission, error, lack of clarity or non- compliance by the Bidder with specifications, instructions and all conditions shall be construed in the favor of the County. In the event of a conflict between these standard RFB requirements and details provided in Appendix A – Scope of Services or Appendix B – Bid, the Appendices shall prevail.

D. Controlling Document: In the case of a discrepancy between this solicitation and the formal contract, the formal contract will prevail and control.

E. Firm Prices: Unless otherwise stated in the specifications, Bidder's prices remain firm for 90 days from date of Bid opening and, upon award, remain in effect for the contract period specified in the solicitation. If formal award has not occurred within 90 days of Bid opening, the Contractor and the County may mutually agree to extend the firm price period.

F. Additional Information: County may request any other information necessary to determine Bidder's ability to meet the minimum standards required by this RFB.

G. Debarment: The selected Bidder must **NOT** be debarred from any federal and/or state agency and Bastrop County will conduct a review of the Bidder's status on SAM.Gov. The Bastrop County Commissioners' Court will make the final selection and award. The County has the right to reject any and/or all Responses.

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Appendix A – Scope of Services

1. **Project Title:** Bastrop County Precinct 2 Road and Bridge Facility Construction

2. **Scope of Services Contact:**

Questions about the technical nature of the Scope of Services, etc. may be directed to Bastrop County Purchasing Agent, Leon Scaife through e-mail at leon.scaife@co.bastrop.tx.us

3. **Bid Evaluation Factors:**

Bid Price	Factor
Lump Sum	Cost to complete all work within Appendix A (to include the cost of insurance and bonds)

4. **Key Events Schedule:**

Bid Release Date	April 14, 2025
Pre-Bid Meeting	10 AM April 29, 2025
Deadline for Submittal of Written Questions	5 PM, May 8, 2025
Sealed Bids Due to and Opened by County	2PM, May 15, 2025
Anticipated Award Date	May 2025

5. **Scope of Services:**

Project Overview:

Bastrop County is seeking to enter into a construction contract with a competent contractor with experience in delivering turnkey construction projects. Bastrop County has purchased a pre-engineered metal building that will replace the Road and Bridge Precinct 2 shop/office at 911 SE Martin Luther King Blvd, Smithville, TX 78957. The following tasks are required for this turnkey project:

Foundation and Concrete Flatwork:

CONTRACTOR shall excavate for grade beams, piers and other fine grading associated with the foundation and concrete flatwork. **CONTRACTOR** shall provide and install building foundation and site concrete flatwork per the civil and structural foundation design drawings. **CONTRACTOR** shall provide rebar shop drawings and placing drawings for review and approval by Bastrop County in accordance with ACI 315 specifications. Contractor to provide and install Bollards as shown in attached drawings.

BASTROP COUNTY is responsible for parking areas, site drainage and drainage facilities, (storm sewer, culverts, etc..) site grading and paving. **BASTROP COUNTY** is responsible for providing and installing compacted base material and grade building site to bottom of building slab elevation. **BASTROP COUNTY** will haul-off and remove any excess excavated material associated with the excavation of the piers, grade beams and fine grading of the site.

Prefabricated Metal Building:

CONTRACTOR shall provide all labor and equipment to erect the pre-engineered metal building (PEMB) per the PEMB Structural Construction Documents. The building has been purchased by Bastrop County and is on site, including exterior doors, gutters and downspouts and insulation for the PEMB roof and walls. **CONTRACTOR** shall provide and install all exterior windows and electric insulated overhead doors. **CONTRACTOR** shall provide and install one additional exterior man door and framing (the additional exterior door was added to the plans after the building was fabricated).

Mechanical, Electrical and Plumbing:
CONTRACTOR shall provide all labor equipment and materials required to complete all tasks listed in the Mechanical, Electrical and Plumbing Construction Documents.

Architectural/Finish-out:
CONTRACTOR shall provide all labor, equipment and materials required to complete all tasks listed in the Architectural Construction Documents.

BASTROP COUNTY will be responsible for obtaining all building permits

COMPLETE CONSTRUCTION DOCUMENTS ARE ON PAGE 35

Bastrop County will host a pre-bid meeting at the project site (911 SE Martin Luther King Blvd, Smithville, TX 78957) on April 29, 2025. This meeting will start at 10:00AM and will provide all interested contractors with the opportunity to view the site and ask any clarifying questions concerning this project. This meeting is **NOT** mandatory.

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BID SHEET

RFB 25BCP04J - Bastrop County Precinct 2 Road and Bridge Facility Construction

Having examined the bid requirements and complete project specifications of this request for bids, we, the undersigned, hereby offer to enter into a contract to perform the work for the sum of:

Total Lump Sum:_____Dollars ($)

The below total cost for tasks will be used to base milestone payments made on percentage of completion of the total project (Total Lump Sum).

Foundation and Concrete Flatwork Total Cost: $_____

Erection of Pre-Engineered Metal Building Total Cost: $_____

Mechaincal Total Cost: $_____

Electrical Total Cost: $_____

Plumbing Total Cost: $_____

Interior Finish Out (Framing, Millwork, Painting, Etc.) Total Cost: $_____

We, the undersigned, have included the required bid bond in the amount of 5% ($) of the above stated sum.

We, the undersigned, guarantee the satisfactory completion of this project within _____ calendar days, from the date that a Notice to Proceed letter is issued.

_____ _____ _____

Bidder - Print the Full Name of Your Firm: **Authorized Signing Officer Signature:** **Date:**

Appendix B – Bid Verification

Submittal Checklist: (To determine validity of Bid - all Bids received without the following items will be considered non-responsive and will be rejected. Forms from previous solicitations for goods or services will not be used in place of the required forms for this RFB)

_____Bid Bond (5% of bid price in the form of bid bond executed with a surety company authorized to do business in Texas or cashier check).

_____Appendix A – Bid Form (Pages 9-11) must be completed, signed and included in the Bid submittal.

_____Appendix B (Pages 12 through 16) must be completed, signed and included in the Bid submittal.

_____Appendix C – Conflict of Interest Form (CIQ Form) (Page 17) must be completed, signed and included in the Bid submittal.

_____Appendix E – HB 89 Verification Form (Page 22) must be completed, signed and included in the Bid submittal.

_____Appendix G - Anti-Lobbying Certification (Page 26) must be completed, signed and included in the Bid submittal.

_____Appendix H – Contractor's Certification of Recovered Material (Page 29) must be completed, signed and included in the Bid submittal.

_____Proof of Contractor's Ability to Meet the Insurance Requirements (Page 13).

_____Signed Addendum(s) (If any are issued by Owner).

All Bids submitted to Bastrop County shall include this page with the submitted Bid.		
RFB Number:	**RFB 25BCP04J**	
Project Title:	**Bastrop County Precinct 2 Road and Bridge Facility Construction**	
Pre-Bid Meeting:	**April 29, 2025, at 10:00AM (**911 SE Martin Luther King Blvd, Smithville, TX 78957**)**	
Submittal Deadline:	**2:00 P.M. (CST), May 15, 2025**	
Submit hard-copies to:	**MAIL:** Bastrop County Purchasing Department: Attn: Leon Scaife 1501 Business Park Drive Bastrop Texas, 78602	**HAND DELIVER:** Bastrop County Purchasing Department: Attn: Leon Scaife 1501 Business Park Drive Bastrop Texas, 78602

Bidder Information:			
Bidder's Legal Name:			
Address:			
City, State & Zip			
Federal Employers Identification Number #			
Bidder's Point of Contact:			
Phone Number:		**Fax Number:**	
E-Mail Address:			

Bidder Authorization

I, the undersigned, have the authority to execute this Bid in its entirety as submitted and enter into a contract on behalf of the Bidder.

Printed Name and Position of Authorized Representative: _____

Signature of Authorized Representative: _____

Signed this _____(day) of _____ (month), _____(year)

Appendix B – Bid (continued)

I. *CONTRACT AWARD INFORMATION:*

A. Term of Contract

Any contract resulting from this RFB shall be effective from the date that the Notice to Proceed is received by the contractor and shall remain in effect for the duration of time submitted by the awarded contractor on their Bid Form.

B. Federal, State and/or Local Identification Information

1) Centralized Master Bidders List registration number:_____

2) Prime contractor HUB / MWBE registration number:_____

3) Employer Identification Number (EIN)/Federal Tax Identification Number: _____

4) An individual Bidder acting as a sole proprietor must also enter the Bidder's Social Security Number:

#_____-_____-_____.

II. *CONTRACT TERMS AND CONDITIONS. EXCEPT WHERE BIDDER MAKES SPECIFIC EXCEPTION IN THE SUBMITTED BID, ANY CONTRACT RESULTING FROM THIS RFB WILL CONTAIN THE FOLLOWING TERMS AND CONDITIONS, WHICH BIDDER HEREBY ACKNOWLEDGES, AND TO WHICH BIDDER AGREES BY SUBMITTING A BID*:

1. **Standard Terms and Conditions**

A. Taxpayer Identification: Bidders must provide the County with a current W-9 before any goods or services can be procured from the Bidder.

B. Governing Law and Venue: All Bids submitted in response to this solicitation and any resulting contract shall be governed by and construed in accordance with the laws and court decisions of the State of Texas. Any legal or equitable actions arising from this request for Bids or any resulting contract shall be brought before an appropriate court located in Bastrop County.

C. Resolution of Program Non-compliance and Disallowed Costs: In the event of any dispute, claim, question, or disagreement arising from or relating to this agreement, or the breach thereof, including determination of responsibility for any costs disallowed as a result of non-compliance with federal or state program requirements, the parties hereto shall use their best efforts to settle the dispute, claim, question or disagreement. To this effect, the parties shall consult and negotiate with each other in good faith within 30 days of receipt of a written notice of the dispute or invitation to negotiate and attempt to reach a just and equitable solution satisfactory to both parties. If the matter is not resolved by negotiation within 30 days of receipt of written notice or invitation to negotiate, the parties agree first to try in good faith to settle the matter by mediation administered by the American Arbitration Association under its Commercial Mediation Procedures before resorting to arbitration, litigation, or some other dispute resolution procedure. The parties may enter into a written amendment to this Agreement and choose a mediator that is not affiliated with the American Arbitration Association. The parties shall bear the costs of such mediation equally. [This section may also provide for the qualifications of the mediator(s), the locale of meetings, time limits or any other item of concern to the parties. If the matter is not resolved through such mediation within 60 days of the initiation of that procedure, either party may proceed to file a suit.

D. Force Majeure: To the extent that either party to this Contract shall be wholly or partially prevented from the

performance within the term specified of any obligation or duty placed on such party by reason of or through strikes, stoppage of labor, riot, fire, flood, acts of war, insurrection, accident, order of any court, act of God, or specific cause reasonably beyond the party's control and not attributable to its neglect or nonfeasance, in such event, the time for the performance of such obligation or duty shall be suspended until such disability to perform is removed. Determination of force majeure shall rest solely with Bastrop County.

E. Payment Terms: Unless otherwise specified in the Scope of Services or otherwise agreed to in writing by Bastrop County, payment terms for the County are a Net 30 days upon receipt of invoice after receipt of goods or services. **A 5% retainage will be held from each invoice until the completion of the project.** Pay applications must be submitted to Bastrop County and the Bastrop County Representative for approval and processing for payment. Bastrop County will pay based on percentage of completion at the time of pay application submission pending verification from Bastrop County and the Bastrop County Representative. Final approval will be based on an inspection of the project for verification of compliance with all aspects of the scope of work listed within Appendix A of this RFB. Bastrop County will NOT pay any fees to the vendor other than the agreed upon Bid price.

F. Liquidated Damages: Should the **CONTRACTOR** fail to complete the requirements set forth in the scope of work, Bastrop County will suffer damage. The amount of damage suffered by Bastrop County is difficult, if not impossible, to determine at this time. Therefore, the CONTRACTOR shall pay Bastrop County, as liquidated damages, the following:

- The **CONTRACTOR** shall pay Bastrop County liquidated damages, $100 per day for each day past the specified completion date.
- The **CONTRACTOR** shall pay Bastrop County, liquidated damages, $1500 per incident where the **CONTRACTOR** fails to repair damages that are caused by the **CONTRACTOR** and/or sub-contractor(s). Application of liquidated damages does not release the **CONTRACTOR** from the responsibility of resolving or repairing.
- The amounts specified above are mutually agreed upon as reasonable and the proper amount of liquidated damages Bastrop County would suffer in the aforementioned examples.

G. Warranty of Products and Services: All products furnished under this contract shall be warranted to be merchantable and good quality and fit for the purposes intended as described in this Bid, to the satisfaction of County and in accordance with the specifications, terms, and conditions of the scope of work (Appendix A), and all services performed shall be warranted to be of a good and workmanlike quality, in addition to, and not in lieu of, any other express written warranties provided.

H. Bid, Payment and Performance Bonds: The CONTRACTOR IS REQUIRED to furnish a good and sufficient bid bond or a cashier's check in the amount of five percent (5%) of the total Bid price. A bid bond must be executed with a surety company authorized to do business in the State of Texas. The bid bond of the awarded contractor is subject to forfeiture in the event the successful Bidder fails to execute all requirements set forth in the contract documents within ten days after the contract has been awarded.
Payment and Performance bonds shall be required and issued for this contract should the total Bid price reach the State of Texas threshold for public works projects. The contractor agrees that within ten (10) days after written notice to proceed is sent to them by Bastrop County, a Payment Bond will be executed and delivered to Bastrop County for one hundred percent (100%) of the estimated contract total, should the contract total meet and/or exceed twenty-five thousand dollars ($25,000). A Performance bond in an amount of one hundred percent (100%) of the estimated contract price should also be executed and delivered to Bastrop County should the contract amount meet and/or exceed one hundred thousand dollars ($100,000). The Performance and Payment Bond must be maintained throughout the contract execution period. At the completion of all work, the Payment and Performance Bond shall be released. The cost of all bonds must be

included in the Bid price. Payment for services will not be made until receipt of all required bonds has been made to Bastrop County.

I. Funding: State of Texas statutes prohibit the obligation and expenditure of public funds beyond the fiscal year for which a budget has been approved. Orders or other obligations that may arise beyond the end of the current fiscal year shall be subject to approval of budget funds.

J. Taxes: The County is exempt from all federal excise taxes and all state and local sales and use taxes. If such taxes are listed on a Bidder's invoice, they will not be paid.

K. Insurance: The Bidder, consistent with its status as an independent contractor, shall carry, and shall require any of its subcontractors to carry, at least the following insurance in such form, with such companies, and in such amounts (unless otherwise specified) as County may require:

1. Worker's Compensation and Employer's Liability insurance, including All States Endorsement, to the extent required by federal law and complying with the laws of the State of Texas;
2. Commercial General Liability insurance, including Blanket Contractual Liability, Broad Form Property Damage, Personal Injury, Completed Operations/Products Liability, Premises Liability, Medical Payments, Interest of Employees as additional insureds, and Broad Form General Liability Endorsements, for at least One Million Dollars ($1,000,000) Combined Single Limit Bodily Injury and Property Damage on an occurrence basis;
3. Comprehensive Automobile Liability insurance covering all owned, non-owned or hired automobiles to be used by the Contractor, with coverage for at least One Million Dollars ($1,000,000) Combined Single Limit Bodily Injury and Property Damage.

Contractor shall submit proof to Bastrop County that said contractor has the ability to meet all insurance requirements listed above. Bastrop County shall be named as an additional insured on the awarded Contractor certificate of insurance policies submitted to Bastrop County at time of contract award.

S. Indemnification: Bidder agrees to defend, indemnify and hold harmless the County of Bastrop, all of its officers, agents, employees, appointees and volunteers from and against all claims, actions, suits, demands, proceedings, costs, damages and liabilities, including reasonable attorneys' fees, court costs, related expenses for personal injury (including death), property damage or other harm for which recovery of damages is sought, suffered by any person or persons, that may arise out of or be occasioned by Bidder's breach of any of the terms or provisions of any contract awarded as a result of this solicitation, or by any negligent or strictly liable act or omission of the Bidder, its officers, agents, employees, or subcontractors, in the performance of an awarded contract; except that the indemnity provided for in this paragraph shall not apply to any liability resulting from the sole negligence or fault of the County, its officers, agents or employees, and in the event of joint and concurrent negligence or fault of the Bidder and County, responsibility and indemnity, if any, shall be apportioned comparatively in accordance with the laws of the State of Texas, without waiving any governmental immunity available to the County under Texas law and without waiving any defenses of the parties under Texas law. The provisions of this paragraph are solely for the benefit of the parties hereto and are not intended to create or grant any rights, contractual or otherwise, to any other person or entity.

IN SUBMITTING A RESPONSE TO THIS RFB, THE RESPONDENT AGREES THAT IT WAIVES ANY CLAIMS IT HAS OR MAY HAVE AGAINST THE COUNTY, THE COUNTY'S EMPLOYEES, OFFICERS, AGENTS, REPRESENTATIVES, AND THE MEMBERS OF THE COUNTY'S GOVERNING BODY IN CONNECTION WITH OR ARISING OUT OF THIS RFB, INCLUDING, THE ADMINISTRATION OF THE RFB, THE BASIS FOR SELECTION, THE EVALUATIONS OF THE RESPONSES, THE METHOD USED FOR SELECTION, AND ANY DISCLOSURE OF INFORMATION REGARDING THE RESPONSES OR EVALUATIONS. THE SUBMISSION OF A BID CONSTITUTES THE ACCEPTANCE BY THE RESPONDENT OF THE EVALUATION TECHNIQUE DESCRIBED IN THIS RFB. THE PERSON SIGNING ON BEHALF OF BIDDER CERTIFIES THAT THE SIGNER HAS AUTHORITY TO SUBMIT THE BID ON BEHALF OF THE BIDDER AND TO BIND THE BIDDER TO ANY RESULTING CONTRACT

I ACKNOWLEDGE THAT I HAVE READ AND UNDERSTAND ALL REQUIREMENTS SETFORTH IN THIS REQUEST FOR BIDS:

_____ _____

Authorized Signatory for Contractor: Name of Company:

_____

Date:

APPENDIX C

CONFLICT OF INTEREST QUESTIONNAIRE

FORM CIQ

For vendor doing business with local governmental entity

This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.

This questionnaire is being filed in accordance with Chapter 176, Local Government Code, by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the vendor meets requirements under Section 176.006(a).

By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the vendor becomes aware of facts that require the statement to be filed. *See* Section 176.006(a-1), Local Government Code.

A vendor commits an offense if the vendor knowingly violates Section 176.006, Local Government Code. An offense under this section is a misdemeanor.

OFFICE USE ONLY

Date Received

1 **Name of vendor who has a business relationship with local governmental entity.**

2 ☐ **Check this box if you are filing an update to a previously filed questionnaire.** (The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date on which you became aware that the originally filed questionnaire was incomplete or inaccurate.)

3 **Name of local government officer about whom the information is being disclosed.**

_____

Name of Officer

4 **Describe each employment or other business relationship with the local government officer, or a family member of the officer, as described by Section 176.003(a)(2)(A). Also describe any family relationship with the local government officer. Complete subparts A and B for each employment or business relationship described. Attach additional pages to this Form CIQ as necessary.**

A. Is the local government officer or a family member of the officer receiving or likely to receive taxable income, other than investment income, from the vendor?

☐ Yes ☐ No

B. Is the vendor receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer or a family member of the officer AND the taxable income is not received from the local governmental entity?

☐ Yes ☐ No

5 **Describe each employment or business relationship that the vendor named in Section 1 maintains with a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership interest of one percent or more.**

6 ☐ Check this box if the vendor has given the local government officer or a family member of the officer one or more gifts as described in Section 176.003(a)(2)(B), excluding gifts described in Section 176.003(a-1).

7

_____ _____

Signature of vendor doing business with the governmental entity Date

CONFLICT OF INTEREST QUESTIONNAIRE
For vendor doing business with local governmental entity

A complete copy of Chapter 176 of the Local Government Code may be found at http://www.statutes.legis.state.tx.us/Docs/LG/htm/LG.176.htm. For easy reference, below are some of the sections cited on this form.

Local Government Code § 176.001(1-a): "Business relationship" means a connection between two or more parties based on commercial activity of one of the parties. The term does not include a connection based on:

(A) a transaction that is subject to rate or fee regulation by a federal, state, or local governmental entity or an agency of a federal, state, or local governmental entity;

(B) a transaction conducted at a price and subject to terms available to the public; or

(C) a purchase or lease of goods or services from a person that is chartered by a state or federal agency and that is subject to regular examination by, and reporting to, that agency.

Local Government Code § 176.003(a)(2)(A) and (B):

(a) A local government officer shall file a conflicts disclosure statement with respect to a vendor if:

***

(2) the vendor:

(A) has an employment or other business relationship with the local government officer or a family member of the officer that results in the officer or family member receiving taxable income, other than investment income, that exceeds $2,500 during the 12-month period preceding the date that the officer becomes aware that

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor;

(B) has given to the local government officer or a family member of the officer one or more gifts that have an aggregate value of more than $100 in the 12-month period preceding the date the officer becomes aware that:

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor.

Local Government Code § 176.006(a) and (a-1)

(a) A vendor shall file a completed conflict of interest questionnaire if the vendor has a business relationship with a local governmental entity and:

(1) has an employment or other business relationship with a local government officer of that local governmental entity, or a family member of the officer, described by Section 176.003(a)(2)(A);

(2) has given a local government officer of that local governmental entity, or a family member of the officer, one or more gifts with the aggregate value specified by Section 176.003(a)(2)(B), excluding any gift described by Section 176.003(a-1); or

(3) has a family relationship with a local government officer of that local governmental entity.

(a-1) The completed conflict of interest questionnaire must be filed with the appropriate records administrator not later than the seventh business day after the later of:

(1) the date that the vendor:

(A) begins discussions or negotiations to enter into a contract with the local governmental entity; or

(B) submits to the local governmental entity an application, response to a request for proposals or bids, correspondence, or another writing related to a potential contract with the local governmental entity; or

(2) the date the vendor becomes aware:

(A) of an employment or other business relationship with a local government officer, or a family member of the officer, described by Subsection (a);

(B) that the vendor has given one or more gifts described by Subsection (a); or

(C) of a family relationship with a local government officer.

APPENDIX D

Implementation of House Bill 1295

Certificate of Interested Parties (Form 1295):

In 2015, the Texas Legislature adopted House Bill 1295, which added section 2252.908 of the Government Code. The law states that a governmental entity or state agency may not enter into certain contracts with a business entity unless the business entity submits a disclosure of interested parties to the governmental entity or state agency at the time the business entity submits the signed contract to the governmental entity or state agency.

The law applies (with a few exceptions) only to a contract between a business entity and a governmental entity or state agency that either (1) requires an action or vote by the governing body of the entity or agency before the contract may be signed or (2) has a value of at least $1 million. The disclosure requirement applies to a contract entered into on or after January 1, 2016.

Changed or Amended Contracts:

Form 1295 is only required for a change made to an existing contract in certain circumstances: (1) if a Form 1295 was not filed for the existing contract, then a filing is only required if the changed contract either requires an action or vote by the governing body or the value of the changed contract is at least $1 million; or (2) if a Form 1295 was filed for the existing contract, then another filing is only required for the changed contract if there is a change to the information disclosed in the Form 1295, the changed contract requires an action or vote by the governing body, or the value of the changed contract increases by at least $1 million.

As required by law, the Commission adopted the Certificate of Interested Parties form (Form 1295) on October 5, 2015. The Commission also adopted rules (Chapter 46) to implement the law. The Commission does not have any additional authority to enforce or interpret section 2252.908 of the Government Code.

Filing Process:

A business entity must use the Form 1295 filing application the Commission created to enter the required information on Form 1295 and print a copy of the completed form. Once entered into the filing application, the completed form will include a unique certification number, called a "certification of filing."

An authorized agent of the business entity must sign the printed copy of the form affirming under the penalty of perjury that the completed form is true and correct.

The completed, printed, and signed Form 1295 bearing the unique certification of filing number must be filed with the governmental body or state agency with which the business entity is entering into the contract.

Acknowledgement by State Agency or Governmental Entity:

The governmental entity or state agency must acknowledge receipt of the filed Form 1295 with the certification of filing, using the Commission's filing application, not later than the 30th day after the date the governing body or state agency receives the Form 1295. The Commission will post the completed Form 1295 to its website within seven business days after the governmental entity or state agency acknowledges receipt of the form.

Changes to Form 1295

Changes to the law requiring certain businesses to file a Form 1295 are in effect for contracts entered into or amended on or after January 1, 2018. The changes exempt businesses from filing a Form 1295 for certain types of contracts and replace the need for a completed Form 1295 to be notarized. Instead, the person filing a 1295 needs to complete an "unsworn declaration."

What type of contracts are exempt from the Form 1295 filing requirement under the amended law?

The amended law adds to the list of types of contract exempt from the Form 1295 filing requirement. A completed Form 1295 is not required for:

- A sponsored research contract of an institution of higher education;
- An interagency contract of a state agency or an institution of higher education;

- A contract related to health and human services if: o the value of the contract cannot be determined at the time the contract is executed; and o any qualified vendor is eligible for the contract;
- A contract with a publicly traded business entity, including a wholly owned subsidiary of the business entity;*
- A contract with an electric utility, as that term is defined by Section 31.002, Utilities Code;* or
- A contract with a gas utility, as that term is defined by Section 121.001, Utilities Code.*

The newly exempt contract types are marked with an asterisk.

Why do I need to include my date of birth and address when I sign Form 1295? Was this always the case?
In 2017, the legislature amended the law to require Form 1295 to include an "unsworn declaration" which includes, among other things, the date of birth and address of the authorized representative signing the form. The change in the law applies to contracts entered into, renewed, or amended on or after January 1, 2018. The unsworn declaration, including the date of birth and address of the signatory, replaces the notary requirement that applied to contracts entered into before January 1, 2018.

Will my date of birth and address appear on the TEC's website when I file the form?
No. The TEC filing application does not capture the date of birth or street address of the signatory and it will not appear on forms that are filed using the TEC filing application. Although the TEC does not capture the date of birth and street address of the signatory, the contracting state agency or governmental agency will have a physical copy of the form that includes the date of birth and address of the signatory. The TEC cannot answer whether the contracting state agency or governmental agency may release such information. Questions regarding the Texas Public Information Act may be directed to the Office of the Attorney General. See also Paxton v. City of Dall., No. 03-13-00546-CV, 2015 Tex. App. LEXIS 5228, at *10-11 (App.—Austin May 22, 2015) (mem. op.) (pet. denied) (available here).

CERTIFICATE OF INTERESTED PARTIES

FORM 1295

Complete Nos. 1 - 4 and 6 if there are interested parties.
Complete Nos. 1, 2, 3, 5, and 6 if there are no interested parties.

OFFICE USE ONLY

1 Name of business entity filing form, and the city, state and country of the business entity's place of business.

2 Name of governmental entity or state agency that is a party to the contract for which the form is being filed.

3 Provide the identification number used by the governmental entity or state agency to track or identify the contract, and provide a description of the services, goods, or other property to be provided under the contract.

4

Name of Interested Party	City, State, Country (place of business)	Nature of Interest (check applicable)	
		Controlling	Intermediary

5 Check only if there is NO Interested Party. ☐

6 UNSWORN DECLARATION

My name is _____, and my date of birth is _____.

My address is _____, _____, _____, _____, _____.
(street) (city) (state) (zip code) (country)

I declare under penalty of perjury that the foregoing is true and correct.

Executed in _____ County, State of _____ , on the _____ day of _____, 20_____.
(month) (year)

_____
Signature of authorized agent of contracting business entity
(Declarant)

ADD ADDITIONAL PAGES AS NECESSARY

APPENDIX E

House Bill 89 VERIFICATION

I, _____, the undersigned representative of _____ (hereafter referred to as company) being an adult over the age of eighteen (18) years of age, after being duly sworn by the undersigned notary, do hereby depose and verify under oath that the company named-above, under the provisions of Subtitle F, Title 10, Government Code Chapter 2270::

1. **Does not boycott Israel currently; and**
2. **Will not boycott Israel during the term of the contract the above-named Company, business or individual with Bastrop County, Texas.**

Pursuant to Section 2270.001, Texas Government Code:

1. *"Boycott Israel" means refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations specifically with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory, but does not include an action made for ordinary business purposes; and*
2. *"Company" means a for-profit sole proprietorship, organization, association, corporation, partnership, joint venture, limited partnership, limited liability partnership, or any limited liability company, including a wholly owned subsidiaryt, majority-owned subsidiary, parent company or affiliate of those entities or business associations that exist to make a profit.*

_____ _____

DATE SIGNATURE OF COMPANY REPRESENTATIVE

ON THIS THE _____ day of _____, 20____, personally appeared _____, the above-named person, who after by me being duly sworn, did swear and confirm that the above is true and correct.

NOTARY SEAL _____

NOTARY SIGNATURE

APPENDIX F

RESOLUTION

AN AMENDMENT TO A RESOLUTION OF THE COMMISSIONERS' COURT OF THE COUNTY OF BASTROP, TEXAS DATED APRIL 22, 2013 AUTHORIZING THE COUNTY JUDGE OR HIS DESIGNEE TO IMPLEMENT A SECTION 3 PROGRAM, WHICH TO THE GREATEST EXTENT FEASIBLE, WILL PROVIDE JOB TRAINING, EMPLOYMENT, AND CONTRACTING OPPORTUNITIES FOR SECTION 3 BUSINESSES OF THE AREA IN WHICH THE TEXAS COMMUNITY DEVELOPMENT BLOCK GRANT (TXCDBG} PROGRAM/PROJECT IS BEING CARRIED OUT.

WHEREAS; Section 3 of the Housing and Urban Development Act of 1968 (12 U.S.C. 1701u), as amended, requires that Bastrop County ensure that training, employment and other economic opportunities generated by certain HUD financial assistance for housing and Community Development Programs shall, to the greatest extent feasible, be given to low- and very low- income persons, particularly those who are recipients of governmental assistance for housing, and to businesses that provide economic opportunities for these persons, and

WHEREAS; the County of Bastrop has been grant funded for various projects under the Texas Community Development Block Grant Program (CDBG), and

WHEREAS; the County of Bastrop is required to adopt a Section 3 Program as part of the requirements of the grant(s), and

WHEREAS; a Section 3 resident is defined as a public housing resident and/or a low to very-low income person who lives in an area where a CDBG assisted project is located, and

WHEREAS; a Section 3 business is defined as a business that has a Section 3 resident own at least 51 percent or more of the business or have at least 30 percent of the permanent, full-time employees of the business identified as Section 3 residents, and

WHEREAS; the County of Bastrop will strive to attain goals for compliance with Section 3 regulations;

NOW THEREFORE BE IT RESOLVED BY THE COMMISSIONERS' COURT OF BASTROP COUNTY, TEXAS:

1. The COMMISSIONERS' COURT has reviewed and hereby agrees to Implement the following steps, which, to the greatest extent feasible, will provide job training, employment and contracting opportunities for Section 3 residents and Section 3 businesses of the area in which the CDBG program/project is being carried out.

2. The COMMISSIONERS' COURT hereby agrees to strive to attain goals for compliance with Section 3 regulations by increasing opportunities for employment and contracting with Section 3 residents and businesses where feasible.

3. The COMMISSIONERS' COURT hereby agrees to assign duties related to implementation of this plan to the designated Section 504 and Equal

Opportunity/Fair Housing Officer.

4. The COMMISSIONERS COURT hereby delegates to the County Judge the authority to implement measures that comply with the Section 3 goals and to assign duties for carrying out these measures to County personnel and/or third party consultant(s).

5. The COMMISSIONERS' COURT hereby agrees that the County will Notify Section 3 residents and business concerns of potential new employment and contracting opportunities as they are triggered by CDBG grant awards through the use of: public notices; bidding advertisements and bid documents; local advertising media including public signage; and Including Section 3 clauses In all CDBG solicitations and contracts.

6. The COMMISSIONERS' COURT hereby agrees to maintain a list of those businesses that have identified themselves as Section 3 businesses for utilization in CDBG funded procurements, notify those businesses of pending contractual opportunities, and make this list available for general Grant Recipient procurement needs.

7. The COMMISSIONERS' COURT hereby agrees to maintain a list of those persons who have identified themselves as Section 3 residents and contact those persons when hiring/training opportunities are available through either the Grant Recipient or contractors.

8. The COMMISSIONERS' COURT hereby agrees to require that all Prime contractors and subcontractors on CDBG projects commit to this plan as part of their contract work; monitor the contractors' performance with respect to meeting Section 3 requirements, and require that they submit reports as may be required to the Bastrop County.

9. The COMMISSIONERS' COURT hereby agrees to submit reports as required by the CDBG program regarding contracting with Section 3 businesses and/or employment as they occur; and submit reports within 20 days of calendar year end which identify and quantify Section 3 businesses and employees.

10. The COMMISSIONERS' COURT hereby agrees to maintain records for the CDBG program, including copies of correspondence, memoranda, etc., which document all actions taken to comply with Section 3 regulations.

11. The COMMISSIONERS COURT hereby orders that the following procedures will be implemented to assure compliance with the intent of this Resolution:
    a. The County Judge will appoint one or more county employees to coordinate the Section 3 responsibilities for compliance and monitoring of all Section 3 activities for CDBG Disaster Recovery Program funded projects. The County may also engage the services of third party consultants to assist.

    b. Preference shall be awarded to Section 3 Business Concerns according to the following system:

1) Where the Section 3 Covered Contract is to be awarded to the lowest responsible bidder, then to the extent permitted by applicable law, the contract, if awarded, shall be awarded to the qualified Section 3 Business Concern with the lowest bid, if it is reasonable and no more than 10 percent higher than the lowest bid from any qualified source. If no bid by a qualified Section 3 Business Concern is within 10 percent of the lowest bid from any qualified source, then any contract award shall be made to the source with the lowest bid.

2) Where the Section 3 Covered Contract is to be awarded based on factors in addition to price, a request for proposals shall be issued by developing the particulars of the solicitation, including a rating system for the assignment of points to evaluate the merits of each response. The solicitation shall identify all factors to be considered, including price or cost. The rating system shall provide for a range of 15 to 25 percent of the total number of available rating points to be set aside for the award to respondents who have demonstrated a commitment to meet Section 3 requirements set out below in Section 11 c. If an award is made, the contract shall be awarded to the responsible firm whose proposal provides the best value to the County, considering price and all other factors specified in the rating system.

c. In responding to a solicitation (Request for Bids, Request for Proposals, etc.) for a Section 3 covered contract, all contractors and subcontractors are required to comply with the Bastrop County Section 3 Plan. The contractor and the County will review the Section 3 Plan procedures and applicable forms that the contractor will use to report progress toward Section 3 goals. The Section 3 requirements also apply to contracts with consultants for a Section 3 covered contract.

d. All general contractors and/or sub-contractors shall set a goal that 30 percent of new hires will be Section 3 residents. Contractors should provide job opportunities for skilled and unskilled workers. All Contractors and Subcontractors will be required to post all new hire opportunities with the local Workforce Solutions Center, WorkinTexas.com, and Bastrop County.

e. Bastrop County will analyze and evaluate the contractor's compliance with requirements and obligations set forth in the contract. In the event that a review reveals a contractor has not complied with Section 3 requirements, the County will undertake efforts to help the contractor achieve compliance.

f. The contractor and or sub-contractor shall submit monthly

reports regarding the status of each Section 3 participant. An annual report will also be requested from each contractor and/or subcontractor in connection to the performance of each project. This Annual Report will document the efforts and success of all Section 3 participants and subcontractors working under the general contractor, in reaching the percentage goals for employment and business opportunities established in these policies.

g. The contractor and/or subcontractor shall submit weekly-certified payroll reports to Bastrop County. This report shall be submitted weekly and clearly identify Section 3 Hires.

h. Bastrop County or its consultant will conduct periodic site visits to the worksite. The Coordinator shall visibly notice each Section 3 hire on site. The general contractor will sign a monitoring form verifying that a Section 3 worker is present.

i. Complaints regarding the County's Section 3 Program must be submitted in writing. All complaints must include the complainant's name, address, telephone number, and a brief narrative detailing the complaint, including but not limited to, the date of the alleged violation and the date the alleged violation was discovered. Complaints shall be filed within 30 calendar days after the complainant becomes aware of any alleged violation. Bastrop County will investigate every complaint. All parties involved will have the opportunity to submit testimony and/or evidence as may be available and relevant to the complaint, and a written determination will be issued within 30 days after the filing of the complaint. Filing a complaint does not terminate a contractor's Section 3 requirements. Contractors remain accountable for fulfilling the agreed upon Section 3 requirements.

As officers and representatives of the County of Bastrop, we the undersigned have read and fully agree and become a party to the full implementation of this program.

PASSED AND ADOPTED at a regular meeting of the CQMMISSIONERS' COURT of the County held on the 22nd day of June 2015.

Paul Pape, County Judge

ATTEST:
Rose Pietsch

Rose Pietsch, County Clerk

APPENDIX G

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents of all sub-awards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, United States Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Organization: _____

Street address: _____

City, State, Zip: _____

_____
CERTIFIED BY: (type or print)

_____
TITLE:

_____ _____
(signature) (date)

Approved by OMB

0348-0046

Disclosure of Lobbying Activities

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352

(See reverse for public burden disclosure)

1. Type of Federal Action: a. contract ____ b. grant c. cooperative agreement d. loan e. loan guarantee f. loan insurance	**2. Status of Federal Action:** a. bid/offer/application _____ b. initial award c. post-award	**3. Report Type:** a. initial filing _____ b. material change **For material change only:** Year _____ quarter _____ Date of last report_____

4. Name and Address of Reporting Entity: ____ Prime _____ Subawardee Tier_____, if Known: **Congressional District, if known:**	**5. If Reporting Entity in No. 4 is Subawardee,** Enter Name and Address of Prime: **Congressional District, if known:**
6. Federal Department/Agency:	**7. Federal Program Name/Description:** CFDA Number, *if applicable*: _____
8. Federal Action Number, *if known:*	**9. Award Amount**, *if known:* **$**
10. a. Name and Address of Lobbying Registrant *(if individual, last name, first name, MI):*	**b. Individuals Performing Services** *(including address if different from No. 10a)* *(last name, first name, MI):*
11. Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be reported to the Congress semi-annually and will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.	**Signature: _____** **Print Name:_____** **Title:_____** **Telephone No.: _____ Date: _____**
Federal Use Only	**Authorized for Local Reproduction** **Standard Form - LLL (Rev. 7-97)**

INSTRUCTIONS FOR COMPLETION OF SF-LLL, DISCLOSURE OF LOBBYING ACTIVITIES

This disclosure form shall be completed by the reporting entity, whether subawardee or prime Federal recipient, at the initiation or receipt of a covered Federal action, or a material change to a previous filing, pursuant to title 31 U.S.C. section 1352. The filing of a form is required for each payment or agreement to make payment to any lobbying entity for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a covered Federal action. Complete all items that apply for both the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

1. Identify the type of covered Federal action for which lobbying activity is and/or has been secured to influence the outcome of a covered Federal action.

2. Identify the status of the covered Federal action.

3. Identify the appropriate classification of this report. If this is a followup report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by this reporting entity for this covered Federal action.

4. Enter the full name, address, city, State and zip code of the reporting entity. Include Congressional District, if known. Check the appropriate classification of the reporting entity that designates if it is, or expects to be, a prime or subaward recipient. Identify the tier of the subawardee, e.g., the first subawardee of the prime is the 1st tier. Subawards include but are not limited to subcontracts, subgrants and contract awards under grants.

5. If the organization filing the report in item 4 checks "Subawardee," then enter the full name, address, city, State and zip code of the prime Federal recipient. Include Congressional District, if known.

6. Enter the name of the federal agency making the award or loan commitment. Include at least one organizational level below agency name, if known. For example, Department of Transportation, United States Coast Guard.

7. Enter the Federal program name or description for the covered Federal action (item 1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.

8. Enter the most appropriate Federal identifying number available for the Federal action identified in item 1 (e.g., Request for Proposal (RFP) number; Invitations for Bid (IFB) number; grant announcement number; the contract, grant, or loan award number; the application/proposal control number assigned by the Federal agency). Included prefixes, e.g., "RFP-DE-90-001."

9. For a covered Federal action where there has been an award or loan commitment by the Federal agency, enter the Federal amount of the award/loan commitment for the prime entity identified in item 4 or 5.

10. (a) Enter the full name, address, city, State and zip code of the lobbying registrant under the Lobbying Disclosure Act of 1995 engaged by the reporting entity identified in item 4 to influence the covered Federal action.

    (b) Enter the full names of the individual(s) performing services, and include full address if different from 10(a). Enter Last Name, First Name, and Middle Initial (MI).

11. The certifying official shall sign and date the form, print his/her name, title, and telephone number.

APPENDIX H

CONTRACTOR'S CERTIFICATION
of RECOVERED MATERIAL

ACKNOWLEDGEMENT

I, _____(Principal's Name) of _____(Company Name)_____, (hereinafter called "Contractor"), acknowledge the recovered material bidding requirements found in 2 CFR 200.322 that requires the Contractor to procure those items designated in the guidelines of the Environmental Protection Agency (EPA) at 40 CFR 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition.

I also acknowledge that this requirement shall apply to items purchased (1) where the Contractor purchases in excess of $10,000 of the item under this contract; or (2) where during the preceding fiscal year, the value of the quantity acquired was in excess of $10,000.

Finally, I acknowledge the attached list of recovered materials included in the bid documents.
(For up-to-date listing, please go to http://www3.epa.gov/epawaste/conserve/tools/cpg/directory.htm))

_____
Printed Name and Title

_____
Signature

_____
Date

USE OF RECOVERED MATERIAL

Please check one:

- ☐ Recovered materials are included in this bid:
  Materials included_____
- ☐ Recovered materials are not reasonably available in a reasonable period of time.
- ☐ Recovered materials fail to meet reasonable performance standards, which are determined on the basis of the guidelines of the National Institute of Standards and Technology, if applicable.
- ☐ Recovered materials are only available at an unreasonable price.

_____
Printed Name and Title

_____
Signature

_____
Date

COMPREHENSIVE PROCUREMENT GUIDELINE (CPG) PROGRAM - PRODUCT SUPPLIER DIRECTORY

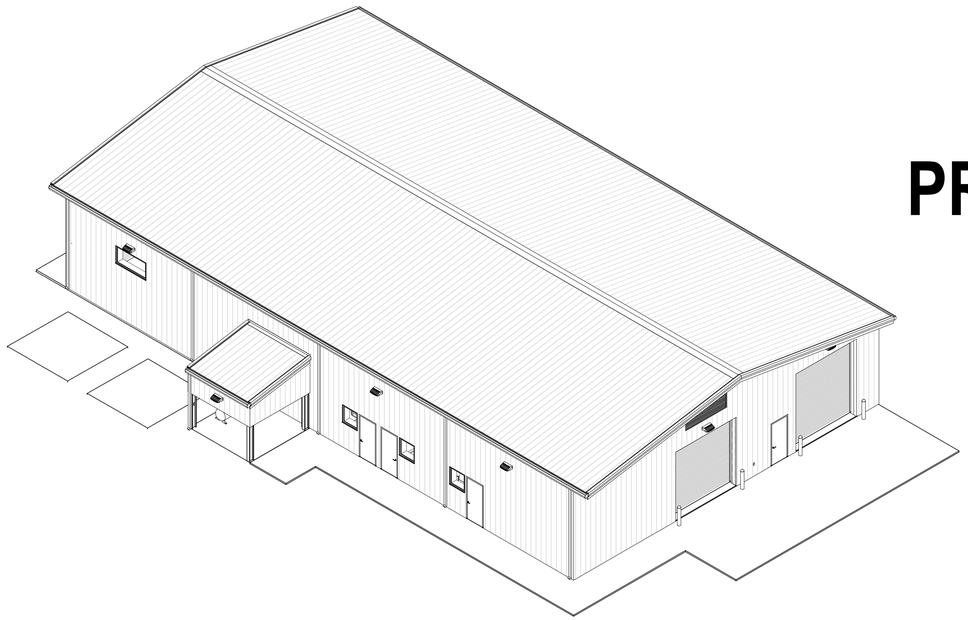
Product	Product Notes	Supplier	Address	State	Contact
Construction: Building Insulation	Material: Glass (30% Total Recovery) Product Notes: Product currently manufactured with 30 percent recovered cullet. Call 800-438-7465 to order product and call headquarters (Santa Clara) for any other information.	Owens Corning Fiberglass Corporation	3700 Interstate 35 East Waxahatchie, TX 75165	TX	Sales Department Tel: 972-937-1340
Construction: Building Insulation	Material: Paper (86% Post-consumer; 86% Total Recovery) Product Notes: Cellulose Insulation made from old newspapers for EPA Region 6.	Tascon Industries, Inc.	P.O. Box 41846 Houston, TX 77241	TX	Jim Adamoli Email: jadamoli@tasconindustries.com Tel: 713-397-0900 Fax: 713-937-1496
Construction: Building Insulation	Material: Paper (75-100% Post-consumer; 75-100% Total Recovery) Product Notes: Cellulose Insulation for EPA Region 6.	International Cellulose Corporation	12315 Robin Boulevard Houston, TX 77045-0006	TX	Joey Dickey Email: icc@spray-on.com Tel: 713-433-6701 Fax: 713-433-2029
Construction: Cement and Concrete	Material: Coal Fly Ash Company Notes: Electric Utility Producer	Lower Colorado River Authority	6549 Power Plant Road LaGrange, TX 78945	TX	Elaine Garcia Email: elaine.garcia@lcra.org Tel: 512-473-3200 Fax: 979-249-8724
Construction: Cement and Concrete	Material: Bottom Ash	CEMEX, INC.	2700 Research Forest Drive Suite 150 The Woodlands, TX 77381	TX	Martha Cienfuegos Email: martha.cienfuegos@cemex.com Tel: 713-722-6036 Fax: 281-362-1809
Construction: Cement and Concrete	Material: Coal Fly Ash Product Notes: Electric Utility Producer	Center Point Energy	P.O. Box 1700 Houston, TX 77251-1700	TX	Jeff Weber Tel: 281-343-2112 Fax: 713-238-5730
Construction: Cement and Concrete	Material: Coal Fly Ash Company Notes: Electric Utility Producer	Public Service Company of Oklahoma	P.O. Box 660164 Dallas, TX 75266-0164	TX	
Construction: Cement and Concrete	Material: Coal Fly Ash	NRG Texas LP	P.O. Box 4710 Houston, TX 77210	TX	Jeffrey Davis Email: jeff.davis@nrgenergy.c Tel: 713-795-6207
Construction: Cement	Material: Coal Fly Ash	Boral Resources	45 Northeast Loop 410	TX	Gary Shelton

and Concrete	Material: Silica Fume		Suite 700 San Antonio, TX 78216		Email: gary.shelton@boral.com Tel: 800 964-0951 Fax: 210-349-2986
Construction: Cement and Concrete	Material: Bottom Ash Material: Coal Fly Ash Product Notes: Produced at four facilities: 1. Nelson Industrial Steam Company (Louisiana) 2. Roy S. Nelson Power Station (Louisiana) 3. White Bluff Plant (Arkansas) 4. Independence Plant (Arkansas)	Entergy Services, Inc.	10055 Grogans Mill Road The Woodlands, TX 77380	TX	Stuart Bier Email: sbier@entergy.com Tel: 281-297-3308 Fax: 281-297-3251
Construction: Railroad Grade Crossing Surfaces	Material: Coal Fly Ash (15-20% Total Recovery) Product Notes: Manufactures standard full-depth, precast concrete railroad grade crossings.	Union Pacific Railroad Company	24125 Aldine-Westfield Road Spring, TX 77373	TX	
Construction: Roofing Materials	Material: Plastic Composite (100% Post-consumer; 100% Total Recovery)	U.S. Intec (Now GAF Commercial Roofing Systems)	P.14911 Quorum Dr., Suite 600, Dallas, TX 75254	TX	1 972 851 0500
Construction: Structural Fiberboard	Material: Wood (0% Post-consumer; 81% Total Recovery)	Temple-Inland Forest Products (now Georgia Pacific Building Products)	303 S. Temple Drive Diboll, TX 75941	TX	Gary Keeling Email: garykeeling@templeinland.com Tel: 800-231-6060 Fax: 888-434-0002
Landscaping: Compost	Material: Yard Trimmings	Silver Creek Materials, Inc.	P.O. Box 150665 Fort Worth, TX 76108	TX	Sales Department Email: colby@silvercreekmaterials.com Tel: 817-246-2426 Fax: 817-367-3413
Landscaping: Compost	Material: Yard Trimmings (100% Post-consumer; 100% Total Recovery)	Recom	4705 W Industrial Avenue Midland, TX 79703	TX	Email: geostability@yahoo.com Tel: 432-520-2034 Fax: 432-520-2039
Landscaping: Hydraulic Mulch	Material: Paper (100% Post-consumer; 100% Total Recovery)	Tascon Industries, Inc.	P.O. Box 41846 Houston, TX 77241	TX	Jim Adamoli Email: jadamoli@tasconindustries.com

	Product Notes: Made from old newspapers.				Tel: 713-397-0900 Fax: 713-937-1496
Miscellaneous: Blasting Grit	Material: Glass (100% Post-consumer; 100% Total Recovery)	Strategic Materials	16365 Park Ten Place Suite 200 Houston, TX 77084	TX	Tom E. Dudak, Tom Dudak Tel: 281-647-2754 Fax: 281-647-2710
Miscellaneous: Pallets	Material: Wood (100% Post-consumer; 100% Total Recovery) Product Notes: IFCO pallets are 100% reusable, recyclable, and come from a renewable resource.	IFCO SYSTEMS N.A., INC.	6829 Flintlock Road Houston, TX 77040	TX	Hillary Whyard Email: Hillary.Whyard@ifcosystems.com Tel: 813-463-4124
Miscellaneous: Sorbents	Material: Paper (90% Post-consumer; 90% Total Recovery) Product Notes: K-Sorb Hydrophobic Fiber & K-Sorb Hydrophobic Particulate. Used to contain/absorb oil-based spills. Repels water, floats indefinitely. Incinerable, pass EPA Paint Filter Test Method	Ecosorb International	12315 Robin Blvd. Houston, TX 77245	TX	Troy Shulte Email: sales@biocel.com Tel: 713-413-1173 Fax: 713-433-2900
Miscellaneous: Sorbents	Material: Paper (99% Post-consumer; 100% Total Recovery) Product Notes: Source of material is old newspapers.	Tascon Industries, Inc.	P.O. Box 41846 Houston, TX 77241	TX	Jim Adamoli Email: jadamoli@tasconindustries.com Tel: 713-397-0900 Fax: 713-937-1496
Miscellaneous: Sorbents	Material: Paper (98% Post-consumer; 98% Total Recovery) Product Notes: K-Sorb Universal Particulate contains/absorbs industrial spills. K-Sorb Universal Fiber absorbs free liquids in waste prior to disposal. Incinerable, pass EPA Paint Filter Test Method	Ecosorb International	P.O. Box 450005 Houston, TX 77245-0005	TX	Troy Shulte Email: sales@ecosorb.com Tel: 713-413-1173 Fax: 713-433-2029
Nonpaper Office: Binders (plastic covered, chipboard, pressboard)	Material: Plastic (37-60% Post-consumer; 44-56% Total Recovery)	Samsill Corporation	5740 Hartman Rd. Fort Worth, TX 76180	TX	Customer Service Email: customerservice@samsill.com Tel: 800-255-1100 Fax: 817-535-6900
Nonpaper Office: Plastic Trash Bags	Material: Plastic (10% Post-consumer; 50% Total Recovery)	Poly-America, L.P.	2000 West Marshall Drive Grand Prairie, TX 75051	TX	Trent Mallory Email: trentm@poly- Tel: 972 337-7344, 800-527- Fax: 972 337-8344
Nonpaper Office:	Material: Remanufactured	Cartridge World West	4036 Bellaire Blvd	TX	Kathy Ranjbar

Toner Cartridges	Company Notes: Certified refills and remanufacturing with disassembling and cleaning of all major cartridge brands including full-color, high-speed printer/copiers and multi-function printers.	U/Bellaire	Houston, TX 77025		Email: refill@cartridgeworldwestu.com Tel: 713-518-1484 Fax: 713-518-1543
Nonpaper Office: Toner Cartridges	Material: Remanufactured Company Notes: Certified refills and remanufacturing with disassembling and cleaning of all major cartridge brands including full-color, high-speed printer/copiers and multi-function printers.	Cartridge World of San Antonio	7959 Fredericksburg Rd., Ste 213 , TX 78229	TX	Ray Edinger Email: rayedinger@yahoo.com Tel: 210.949.0565 Fax: 210.949.0667
Nonpaper Office: Toner Cartridges	Material: Remanufactured (75-98% Total Recovery) Schedule: GSA # GS02F0076R & TXMAS-9-75020 Company Notes: Woman-owned business	Precision Imaging	PO BOX 26046 El Paso, TX 79926	TX	Maria Garcia Email: maria@precisionimagin Tel: 914-241-9190 Fax: 915-356-1885
Nonpaper Office: Toner Cartridges	Material: Remanufactured Schedule: GSA	Computer Wholesale Products of America, Inc.	P.O. Box 11309 Spring, TX 77391-1309	TX	Michelle Kalkoff Email: marketing@cwpa.com Tel: 800-421-0315 Fax: 866-499-5921
Paper and Paper Products: Printing and Writing Paper	Material: Paper (80% Post-consumer; 80% Total Recovery) Schedule: GSA (GS-14F-0050L)	Dolphin Blue, Inc.	7324 Gaston Ave. #124-416 Dallas, TX 75214-6218	TX	Tom Kemper Email: dbdesk@dolphinblue.c Tel: 800-932-7715 Fax: 214-565-7835
Paper and Paper Products: Printing and Writing Paper	Material: Paper (30% Post-consumer; 30% Total Recovery) Schedule: GSA (GS-14F-0050L)	Dolphin Blue, Inc.	7324 Gaston Ave. #124-416 Dallas, TX 75214-6218	TX	Tom Kemper Email: dbdesk@dolphinblue.c Tel: 800-932-7715 Fax: 214-565-7835
Park & Recreation: Park Benches and Picnic Tables	Material: Plastic (100% Post-consumer; 100% Total Recovery) Material: Plastic Composite (100% Post-consumer; 100% Total Recovery) Schedule: GSA	Grounds for Play, Inc.	1401 E. Dallas Street Mansfield, TX 76063	TX	Emily Smith Email: sales@groundsforplay. Tel: 800-552-7529, 817-477- Fax: 817-477-1140

	Product Notes: Manufactures picnic tables and park benches from plastic lumber made from 100 percent postconsumer HDPE and wood/plastic composite lumber.				
Park & Recreation: Playground Equipment	Material: Aluminum (100% Total Recovery) Material: Plastic Composite (100% Post-consumer; 100% Total Recovery) Material: Rubber (55-66% Total Recovery) Material: Steel (50% Total Recovery) Schedule: GSA Product Notes: Product incorporates Trex plastic lumber and recycled content steel, aluminum, and rubber	Grounds for Play, Inc.	1401 E. Dallas Street Mansfield, TX 76063	TX	Emily Smith Email: sales@groundsforplay. Tel: 800 552-7529 Fax: 817 477-1140
Vehicular: Re-Refined Lubricating Oil	Material: Remanufactured Product Notes: Engine lube. oil (quart, pail, drum, gal): 5W30, 10W30, 10W40, 15W40, 10WSAE, 20WSAE, 30WSAE, 40WSAE, 50WSAE, 20W50; Hydraulic fluid (pail, drum); Gear oil (pail, keg, drum), 80W90/GL5 also in gal. Company Notes: Manufacturer	Safety-Kleen Oil Recovery	5400 Legacy Drive Cluster II, Building 3 Plano, TX 75024	TX	Email: info@safety-kleen.com Tel: (800) 669-5740 Fax: 972-265-2990
Vehicular: Re-Refined Lubricating Oil	Material: Remanufactured Product Notes: Brand: Enviroil. Products: Engine lube. oil (10W30); Quarts, drums, bulk. Anti-wear hydraulic oil (ISO 32, 46 and 68 grades); Drums, bulk. Diesel engine lube. oil (15W40, SAE30); Company Notes: Vendor/distributor	LyondellBasell Industries	12000 Lawndale Avenue P.O. Box 2451 Houston, TX 77252-2451	TX	Rod Dougan Tel: 713-321-4310 Fax: 713-321-4700
Vehicular: Re-Refined Lubricating Oil	Material: Remanufactured Product Notes: 76 Firebird: LD Motor Oil (passenger cars); HD Motor Oil (HD trucks/mixed); Tractor Hydraulic Fluid (farm); 5005 GEO (nat. gas engines); AW (ind./mobile hydraulic sys);	76 Lubricants (ConocoPhillips)	600 North Dairy Ashford 2W9076 Houston, TX 77079	TX	Email: 76lubricants@conocophillips.com Tel: (281) 293-1000 Fax: (832)486-2886



BASTROP COUNTY
PRECINCT 2 ROAD & BRIDGE FACILITY

911 SE Martin Luther King Blvd,
Smithville, TX 78957

CONSTRUCTION DOCUMENTS

03.03.2025

CLARA BECKETT
PRECINCT 2 COUNTY COMMISSIONER

DANA TOVAR
PRECINCT 2 ASSISTANT & SPECIAL PROJECTS COORDINATOR

TYRONE WASHINGTON
PRECINCT 2 R&B FOREMAN

KENNETH TRENCH
PRECINCT 2 R&B ASSISTANT FOREMAN

DARRELL WILLIAMSON
MECHANIC

PROJECT TEAM

ARCHITECT	**CASABELLA ARCHITECTS** 3821 JUNIPER TRACE, SUITE 104 AUSTIN, TEXAS 78738 JAIME BEAMAN, AIA	tel. 512.458.5700
CIVIL	**BEFCO** 485 N. JEFFERSON ST. LAGRANGE, TEXAS 78945	979.968.6474
MEP	**TEESI** 1301 S. CAPITAL OF TEXAS HWY SUITE B-325 AUSTIN, TEXAS 78746	512.328.2533
STRUCTURAL	**MUELLER, INC.** 1913 HUTCHENS AVE. BALLINGER, TEXAS 76821	800.527.1087

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CasaBella ARCHITECTS
3821 JUNIPER TRACE | SUITE 104
AUSTIN TEXAS 78738
512.458.5700 | casabella-architects.com

REGISTERED ARCHITECT JAIME BEAMAN 8889 STATE OF TEXAS

03/03/2025

REVISIONS

NO.	DATE	DESCRIPTION	BY

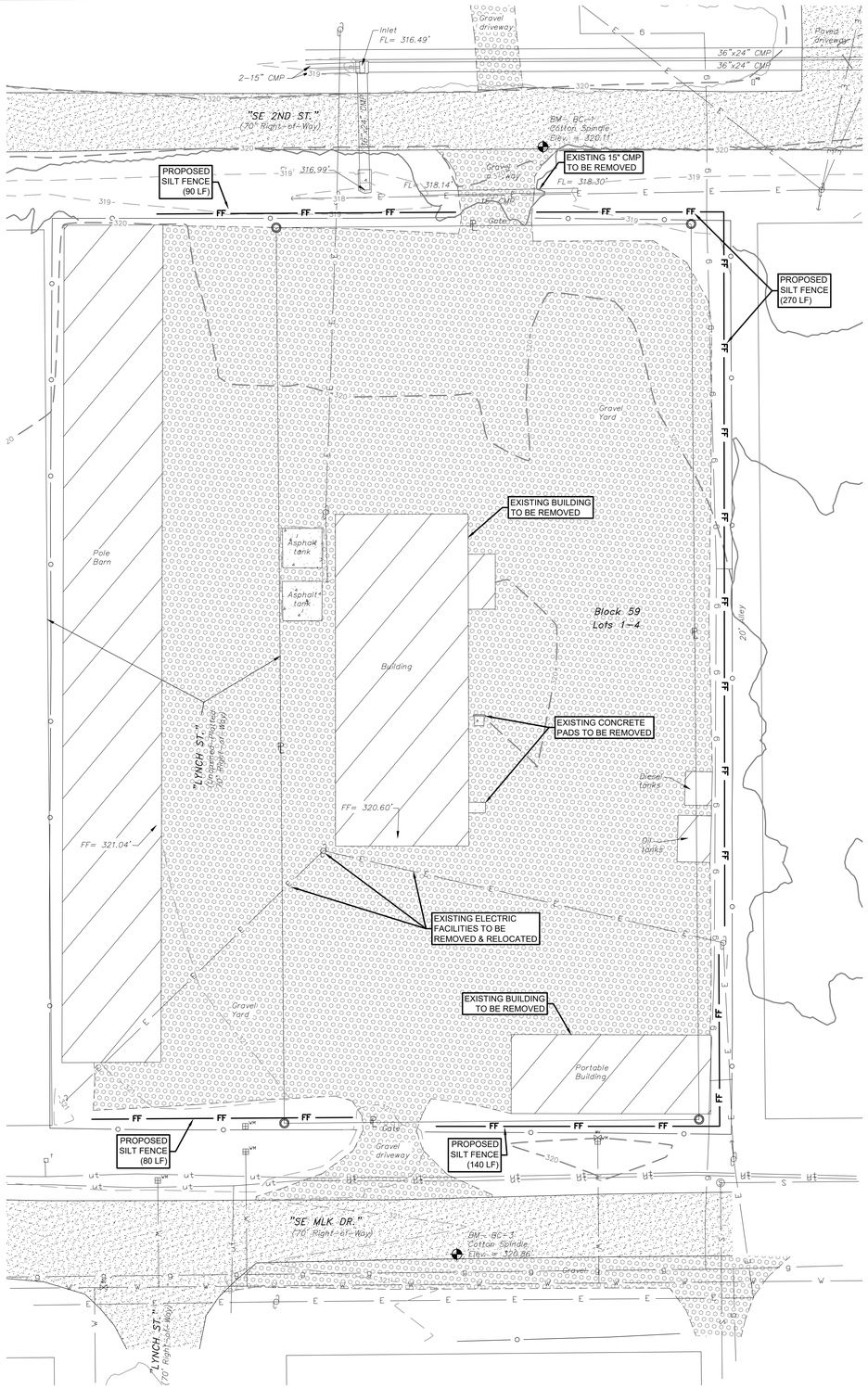
BASTROP COUNTY
PRECINCT 2 ROAD & BRIDGE FACILITY
911 SE Martin Luther King Blvd, Smithville, TX 78957

PROJECT NUMBER:	202415
PROJECT PHASE:	CONSTRUCTION DOCUMENTS
DRAWN BY:	CBA
CHECKED BY:	CBA
ISSUE DATE:	03.03.2025

COVER SHEET

SHEET
A000

PLOTTED: 4/9/2025 10:19:41 AM



EXISTING LAYOUT

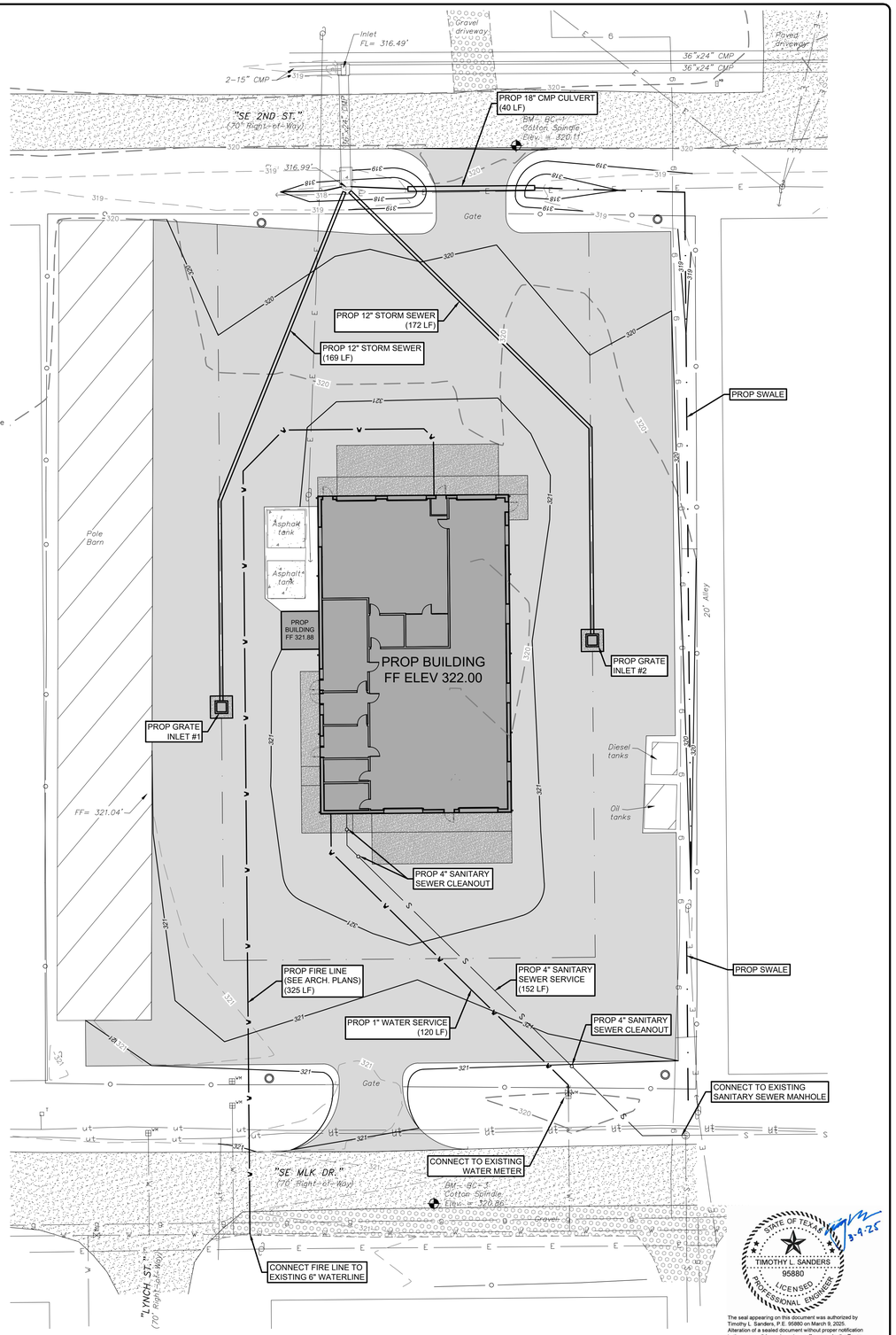
24" X 36"
GRAPHIC SCALE
0 20 40
10 30

SCALE: 1"=20'

LEGEND

- 1/2" Iron rod found (or as noted)
- 1/2" Iron rod set
- Concrete monument found
- Cotton spindle set
- Stone found
- Benchmark
- E — Overhead electric line
- ue — Underground electric line
- T — Overhead telephone cable
- ut — Underground telephone cable
- TV — Overhead television cable
- U — Overhead utility line
- S — Sewer line
- FM — Sewer force main
- W — Water line
- g — Natural gas line
- Water meter
- Water valve
- Irrigation control valve
- Sprinkler head
- Hose bib
- Sign
- Gas meter
- Propane tank
- Utility Pole
- Light pole
- Guy wire
- Transformer
- Telephone pedestal
- Television pedestal
- Storm sewer manhole
- Storm sewer inlet
- Fire hydrant
- Water well
- Sanitary sewer manhole
- Sewer clean-out
- Ground light
- Mail box
- Railroad crossing arm
- X — Wire fenceline
- Chain link fence
- Wood fence

- Proposed Building
- Proposed Asphalt Pavement
- Proposed Concrete Pavement
- Existing Gravel Pavement
- Existing Asphalt Pavement
- 320 — Proposed 1' Contour



PROPOSED LAYOUT

STATE OF TEXAS
TIMOTHY L. SANDERS
95880
LICENSED
PROFESSIONAL ENGINEER
3-9-25

The seal appearing on this document was authorized by Timothy L. Sanders, P.E. 95880 on March 9, 2025. Alteration of a sealed document without proper notification to the responsible engineer is an offense under the Texas Engineering Practice Act.

Texas Registered Engineering Firm F-2011

FIELD BOOK NO.----
S:_Projects\BASTROP COUNTY\24-9106 Smithville Precinct 2 Facility\Dwg\TLS 24-9106A SHEETS

BEFCO ENGINEERING, INC.
P. O. Box 615
LaGrange, Texas 78945
(979) 968-6474 TBPE F-2011

BASTROP COUNTY PRECINCT NO. 2
MAINTENANCE FACILITY IMPROVEMENTS
SMITHVILLE, TEXAS

REVISION:
1.
2.
3.

DRAWN BY: TLS
CHECKED BY: TLS

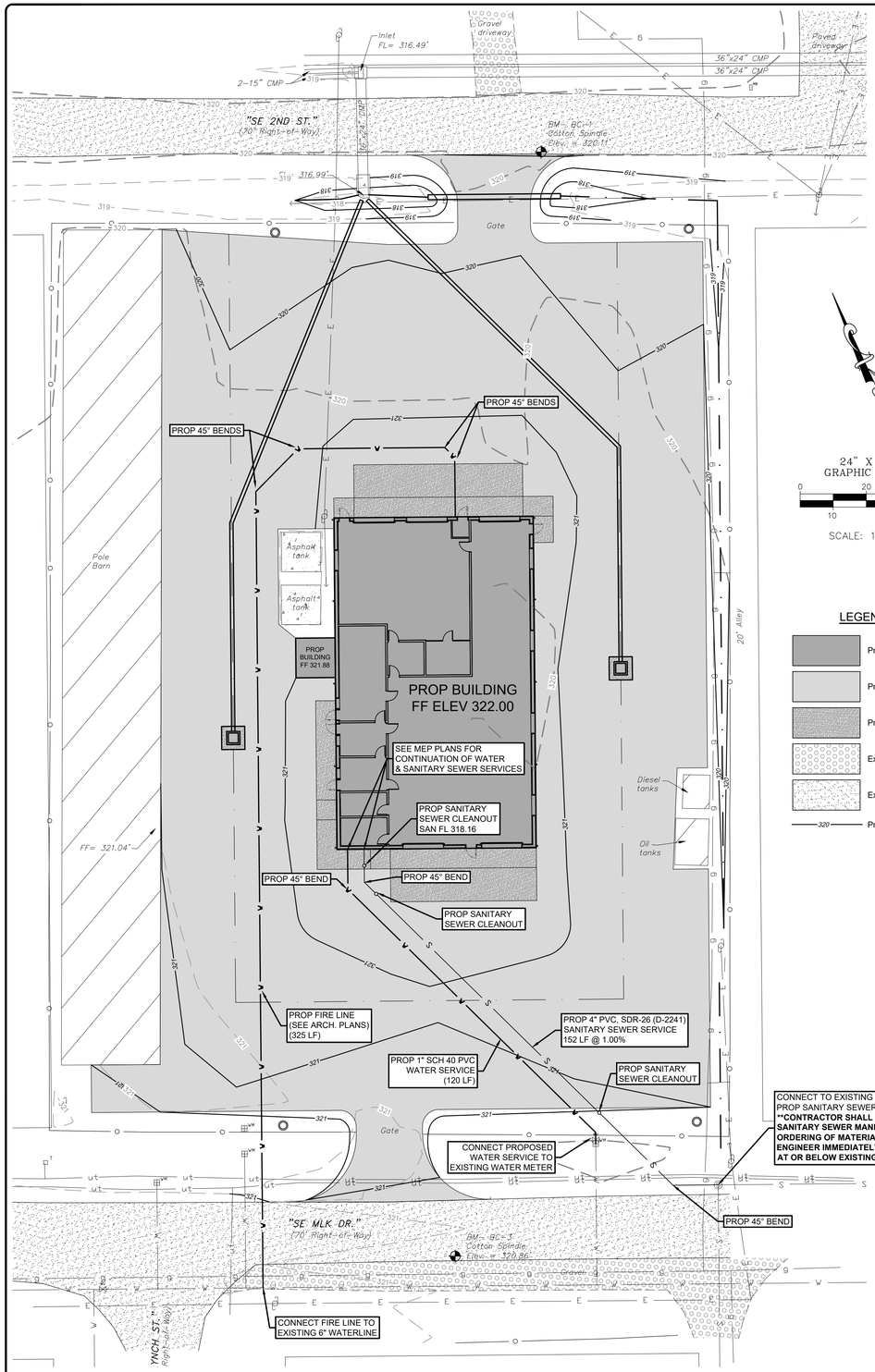
BEFCO JOB NO: 24-9106

PLOT SCALE 1" = 20'

SHEET TITLE
EXISTING & PROPOSED SITE LAYOUTS

DATE ISSUED: 03/09/25

SHEET
1
OF 8



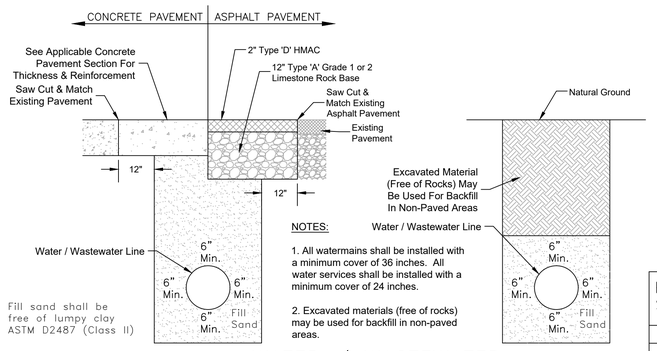
PROPOSED LAYOUT

24" X 36"
GRAPHIC SCALE
0 20 40
10 30

SCALE: 1"=20'

LEGEND

- Proposed Building
- Proposed Asphalt Pavement
- Proposed Concrete Pavement
- Existing Gravel Pavement
- Existing Asphalt Pavement
- 320 Proposed 1' Contour



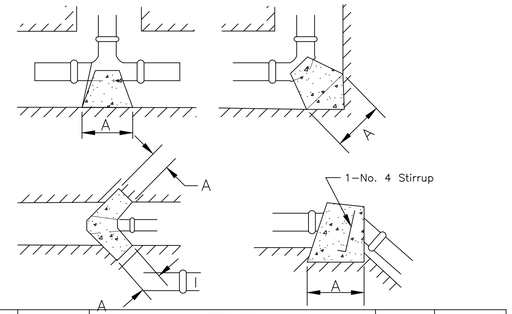
Fill sand shall be free of lumpy clay ASTM D2487 (Class II)

NOTES:

1. All watermains shall be installed with a minimum cover of 36 inches. All water services shall be installed with a minimum cover of 24 inches.

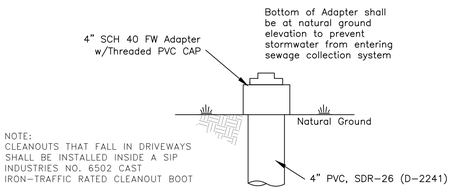
2. Excavated materials (free of rocks) may be used for backfill in non-paved areas.

WATER / WASTEWATER
BEDDING & BACKFILL DETAIL
FOR PAVED & NON-PAVED AREAS
N.T.S.



PIPE SIZE	TEES		BENDS								PIPE SIZE	REDUCER	
			90°		45°		22 1/2°		VERTICAL				
	A	B	A	B	A	B	A	B	A	B		A	B
4"	21"	12"	24"	15"	18"	12"	12"	9"	12"	18"	2"-4"	12"	12"
6"	24"	21"	30"	24"	24"	18"	18"	12"	18"	18"	4"-6"	15"	12"
8"	39"	24"	42"	30"	30"	24"	24"	15"	24"	24"	6"-8"	18"	18"
10"	48"	30"	54"	36"	45"	24"	24"	21"	30"	24"	8"-10"	24"	18"

THRUST BLOCKS



NOTE:
CLEANOUTS THAT FALL IN DRIVEWAYS SHALL BE INSTALLED INSIDE A SIP INDUSTRIES NO. 6502 CAST IRON-TRAFFIC RATED CLEANOUT BOOT

SERVICE CLEAN-OUT DETAIL
N.T.S.

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Texas Registered Engineering Firm F-2011

FIELD BOOK NO.----
S:_Projects\BASTROP COUNTY\24-9106 Smithville Precinct 2 Facility\Dwg\TLS 24-9106A SHEETS

BEFCO ENGINEERING, INC.
P. O. Box 615
LaGrange, Texas 78945
(979) 968-6474 TBPE F-2011

BASTROP COUNTY PRECINCT NO. 2
MAINTENANCE FACILITY IMPROVEMENTS
SMITHVILLE, TEXAS

REVISION:
1.
2.
3.

DRAWN BY: TLS
CHECKED BY: TLS

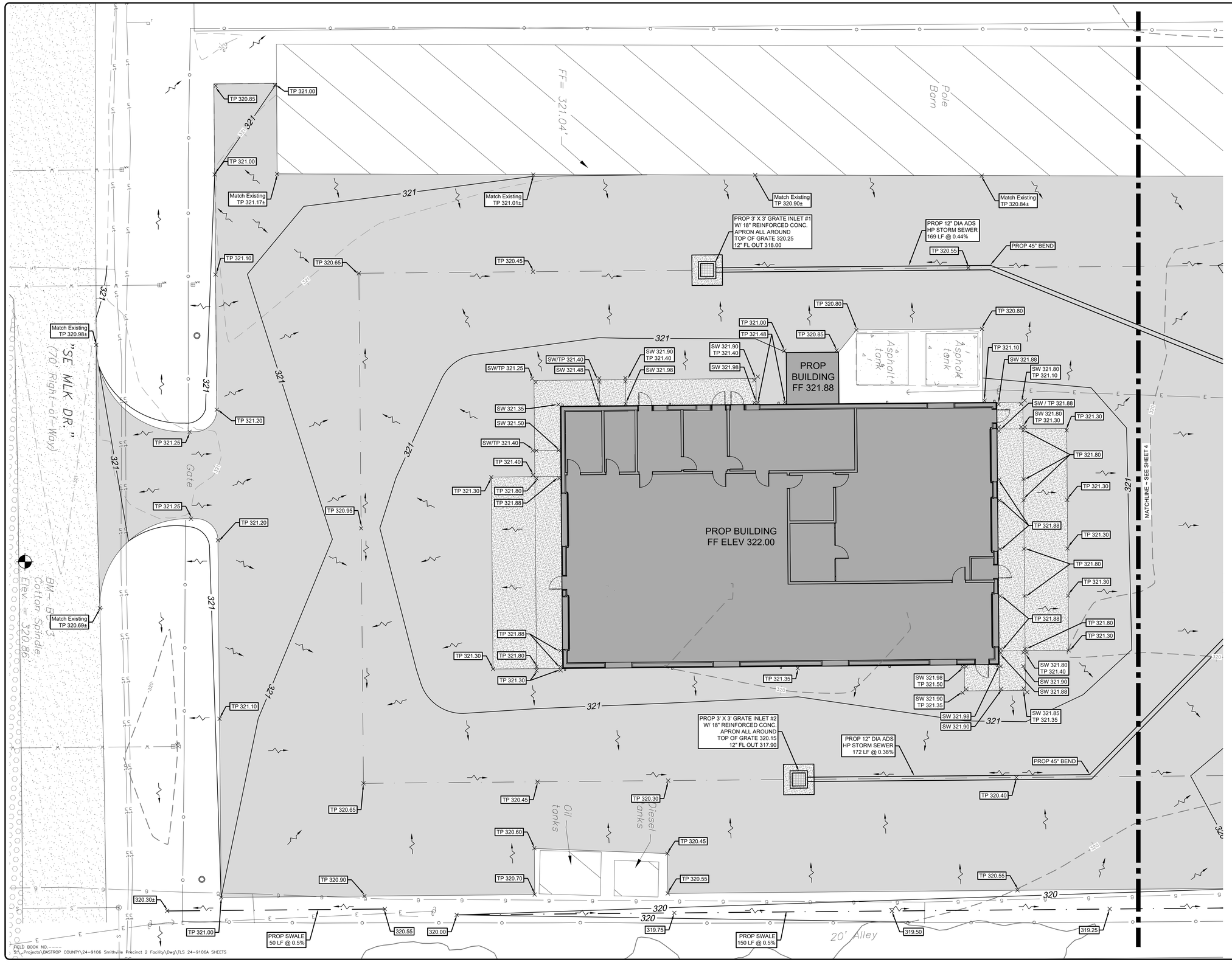
BEFCO JOB NO: 24-9106

PLOT SCALE 1" = 20'

SHEET TITLE
WATER & SANITARY SEWER LAYOUT & DETAILS

DATE ISSUED: 03/09/25

SHEET
2
OF 8



LEGEND

- Proposed Building
- Proposed Asphalt Pavement
- Proposed Concrete Pavement
- Existing Gravel Pavement
- Existing Asphalt Pavement
- 320 — Proposed 1' Contour
- Direction of Storm Water Runoff
- SW 329.10 — Proposed Top of Sidewalk
- TP 329.10 — Proposed Top of Pavement
- 329.10 — Proposed Top of Ground
- TC 329.10 — Proposed Top of Curb

24" X 36" GRAPHIC SCALE

0 5 10 15 20

SCALE: 1"=10'

FIELD BOOK NO.-----
S:_Projects\BASTROP COUNTY\24-9106 Smithville Precinct 2 Facility\Dwg\TLS 24-9106A SHEETS

BEFCO ENGINEERING, INC.
P. O. Box 615
LaGrange, Texas 78945
(979) 968-6474 TBPE F-2011

BASTROP COUNTY PRECINCT NO. 2 MAINTENANCE FACILITY IMPROVEMENTS

SMITHVILLE, TEXAS

REVISION:
1.
2.
3.

DRAWN BY: TLS
CHECKED BY: TLS

BEFCO JOB NO: 24-9106

PLOT SCALE 1" = 10'

SHEET TITLE
GRADING PLAN

DATE ISSUED: 03/09/25

SHEET
3
OF 8

STATE OF TEXAS
TIMOTHY L. SANDERS
95880
LICENSED PROFESSIONAL ENGINEER
3-9-25

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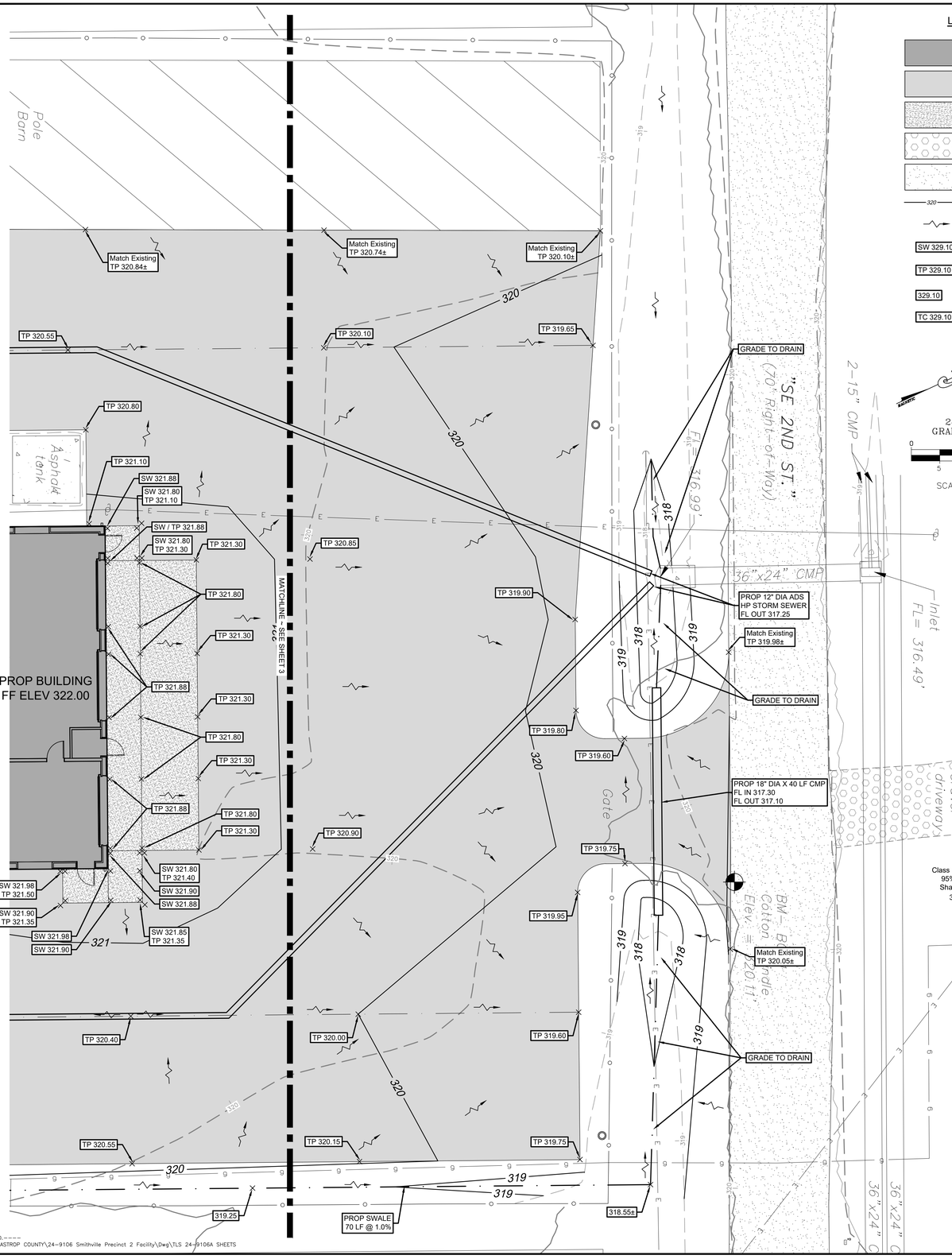
Texas Registered Engineering Firm F-2011



FIELD BOOK NO.----
S:_Projects\BASTROP COUNTY\24-9106 Smithville Precinct 2 Facility\Dwg\TLS 24-9106A SHEETS

LEGEND

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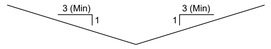
24" X 36" GRAPHIC SCALE

0 5 10 15 20

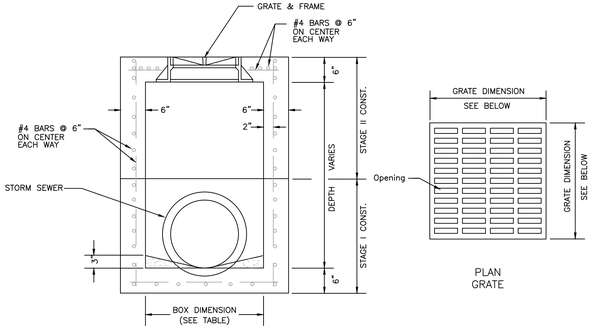
SCALE: 1"=10'

Side slopes may vary, but under no circumstances shall they be less than 3H:1V. All swales shall be lined with grass.



PROPOSED SWALE DETAIL

N.T.S.



INLET NO.	GRATE TYPE**	GRATE DIMENSION	OPENING	BOX DIMENSION
1	V5934-1	34" X 34"	7/8" X 8"	36" X 36"
2	V5934-1	34" X 34"	7/8" X 8"	36" X 36"

**ALL GRATES AND FRAMES SHALL BE EAST JORDAN IRON WORKS HEAVY DUTY SQUARE DRAINAGE GRATES OR APPROVED EQUIVALENT (TRAFFIC LOADING)

Note: All grate inlets shall have an 18" wide concrete apron all around reinforced with #4 Bars Spaced 12" O.C.E.W.

BOX INLET WITH GRATE

N.T.S.

CMP / ADS HP STORM SEWER DETAIL

UNDER PAVEMENT

N.T.S.

Notes:
1. Unless otherwise noted, storm sewer shall be installed in accordance with ASTM D2321, "Standard Practice For Underground Installation Of Thermoplastic Pipe For Sewers And Other Gravity Flow Applications." Soil classifications are per the latest version of ASTM D2321.
2. If necessary, measures should be taken to prevent migration of native fines into backfill material.
3. Contractor shall provide documentation for material specification to Owner and Engineer.
4. All backfill to be compacted in 6" lifts.

CMP / ADS HP STORM SEWER DETAIL

UNDER NATURAL GROUND

N.T.S.

STATE OF TEXAS
TIMOTHY L. SANDERS
95880
LICENSED
PROFESSIONAL ENGINEER
3-9-25

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Texas Registered Engineering Firm F-2011

BEFCO ENGINEERING, INC.
P. O. Box 615
LaGrange, Texas 78945
(979) 968-6474 TBPE F-2011

BASTROP COUNTY PRECINCT NO. 2 MAINTENANCE FACILITY IMPROVEMENTS

SMITHVILLE, TEXAS

REVISION:
1.
2.
3.

DRAWN BY: TLS
CHECKED BY: TLS

BEFCO JOB NO: 24-9106

PLOT SCALE 1" = 20'

SHEET TITLE
GRADING PLAN, PAVING & DRAINAGE DETAILS

DATE ISSUED: 03/09/25

SHEET
4
OF 8

GENERAL SITE PLAN NOTES

1. Location of underground utilities is approximate and are based on visible evidence, Texas 811 locates (if marked), and utility record drawings. Other underground service lines may exist on site, with no record of their location.

2. Contractor shall verify depth and location of water, sewer, gas, and other buried utilities by notifying proper utility entity and Texas 811 a minimum of 48 hours prior to needing locator service. The contractor agrees to be fully responsible for any and all damages which may occur as a result of his failure to exactly locate underground utilities.

3. The contractor shall be responsible for furnishing all material and labor to construct the project as shown and described in the construction documents in accordance with the appropriate approving authorities, specifications and requirements. All material and construction to conform to City of Smithville construction standards, specifications, and approved products list including private improvements unless otherwise noted.

4. Contractor shall contact all franchise utility companies to have them locate existing utilities prior to construction. The contractor shall coordinate the exact location and depth of all franchise utility services and any required relocation and/or extensions. Proposed services shown on the plans, if shown, are conceptual.

5. The Contractor shall be responsible for verifying locations, elevations, and dimensions of adjacent and/or conflicting utilities sufficiently in advance of construction in order that adjustments can be made to provide adequate clearances. The contractor shall preserve and protect public and private utilities at all times during construction. Any damage to utilities resulting from contractor's operations shall be restored at their expense. The engineer shall be notified when proposed facility grades conflict with existing utility grades.

6. The contractor shall immediately repair or replace any physical damage to private property, including, but not limited to fences, walls, pavement, grass, trees, lawn sprinkler and irrigation systems at no cost to the owner. This work shall be subsidiary to the contract (unless otherwise noted) and is not a separate pay item.

7. The contractor shall remove surplus material from the project area. This work shall be subsidiary to the contract and is not a separate pay item.

8. Any discrepancies on the drawings shall be immediately brought to the attention of the architect and engineer before commencing work. No field changes or deviations from design are to be made without prior approval of the owner and notification to the engineer. No consideration will be given to change orders for which the owner and engineer were not contacted prior to construction of the affected item.

9. All copies of compaction, concrete and other required test results are to be sent to the owner and design engineer of record directly from the testing agency. Contractor shall coordinate directly with the testing agency for testing schedule.

10. Contractor shall verify benchmarks and datum prior to commencing construction or staking of improvements.

11. The contractor is responsible for coordinating relocation and installation of franchise utilities and other site private utilities necessary for on and off site construction.

12. THE CONTRACTOR SHALL TOPSOIL, SOD AND FERTILIZE ALL AREAS DISTURBED BY CONSTRUCTION. The contractor shall provide whatever measures are needed including temporary irrigation to establish full coverage of grassing. Unless otherwise noted, private lawn areas and parkways in front of private lawn areas disturbed by construction shall be replaced with block sod of a similar grass to that existing. All sodded areas shall receive six (6) inches of topsoil. Any areas disturbed for any reason prior to final acceptance of the job shall be corrected by the contractor at no additional cost to the owner.

13. The contractor shall be responsible for the control of dust and dirt rising and scattering in the air during construction and shall provide water sprinkling or other suitable methods of control. The contractor shall comply with all governing regulations pertaining to environmental protection.

14. The contractor must provide and maintain a copy of a storm water pollution prevention plan with all conditions, attachments, exhibits, and permit modifications in good condition at the construction site. The complete SWPPP must be made readily available at the time of an on-site inspection to the executive director; a federal, state, or local agency approving sediment and erosion plans, grading plans, or stormwater management plans; local government officials; and the operator of a municipal separate storm sewer (ms4) receiving discharges from the site.

15. Any entity that meets the definition of a "primary operator" for a large construction activity (five or more acres) shall be responsible for completing and submitting a Notice Of Intent (NOI) and a Notice Of Termination (NOT) with the Texas Commission on Environmental Quality (TCEQ).

16. All contractors and subcontractors providing services related to the SWPPP shall sign a contractor certification statement acknowledging their responsibilities as specified in the SWPPP.

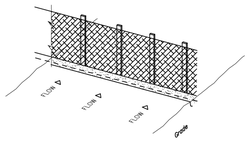
17. A copy of the SWPPP, including contractor certifications and any revisions, shall be submitted to the city, owner and engineer by the contractor and filed with the construction plans, and shall be retained on-site during construction.

18. If applicable, a Notice Of Termination (NOT) shall be submitted to TCEQ by any primary operator within 30 days after all soil disturbing activities at the site have been completed and a uniform vegetative cover of the density of 70% has been established on all unpaved areas and areas not covered by structures, a transfer of operational control has occurred, or the operator has obtained alternative authorization under a different permit. A copy of the NOT shall be provided to the operator of any MS4 receiving discharge from the site.

19. Upon completion of construction, contractor shall provide as-built plans identifying all deviations or variations of original plans. As-built plans are subsidiary to all other bid items and shall not be paid for as a separate line item.

20. Contractor shall be responsible for all construction staking. Construction staking shall be performed by a Registered Professional Land Surveyor in the State of Texas. Cad files can be made available, however, sealed hard copies prevail.

21. All paving, grading, and earthwork to be constructed according to recommendations provided in geotechnical report and all addenda and are to be incorporated into these construction drawings by reference.



FABRIC FENCE DETAIL

GRADING & DRAINAGE NOTES

1. All excavation is unclassified and shall include all materials encountered. Unless otherwise shown, unusable excavated material and all waste resulting from site clearing and grubbing shall be disposed of off site by the grading contractor at his expense.

2. The contractor shall clear and grub the site, proof roll, and place, compact, and moisture condition all fill per the project geotechnical engineer's specifications. The fill material to be used shall be approved by the geotechnical engineer prior to placement.

3. Trees shall be removed as required for construction of the project. No additional trees shall be removed or damaged without prior authorization of the owner or owner's representative. Existing trees shall be preserved whenever possible.

4. After placement of subgrade and prior to placement of pavement, contractor shall test and observe pavement areas for evidence of ponding. All areas shall adequately drain towards the intended structure to convey storm runoff. Contractor shall immediately notify owner and engineer if any discrepancies are discovered.

5. Slopes on accessible routes may not exceed 1:20 unless designed as a ramp with maximum cross slope of 2%.

6. The maximum slope of a ramp in new construction is 1:12. The maximum rise for any ramp run is 30 inches with handrails. Typical is 6 inches without handrails.

7. Ground surfaces along accessible routes shall be stable, firm, and slip resistant.

8. Contractor to match existing grade, gutter, and pavement when tying into existing roadways or pavement.

9. Contractor to coordinate final perimeter building grades with final architectural plans and owner requirements.

10. Contractor to ensure positive drainage away from the building foundation.

11. Elevations shown are finished grades including any gravel, topsoil, grass, etc.

12. All slopes within accessible parking areas shall not exceed 2.0% in all directions. All slopes along accessible routes shall not exceed 5.0% longitudinally and 2.0% in cross-slope.

13. Reference geotechnical report and all addenda for all building pad, earthwork, subgrade, and pavement recommendations.

14. Roof drainage to discharge at grade by downspout where indicated. Reference architectural plans for details.

15. Slopes shown are approximate.

16. All disturbed areas to be revegetated that are not covered by pavement, buildings, or gravel.

17. A minimum 5'x5' landing with maximum slopes of 2% in all directions to be provided at all door locations.

18. Reference structural plans and geotechnical engineering report for select fill required under the building pads.

19. Fill placed on existing slopes steeper than 6:1 shall be benched into the existing slopes in such a manner as to provide a minimum bench width of 5 feet. This should provide good contact between existing soils and new fill materials and reduce potential sliding planes.

20. The contractor shall be responsible for preparing and implementing a trench protection plan for all open trench excavation.

21. All signs, pavement markings, and other traffic control devices shall conform to the "Texas Manual on Uniform Traffic Control Devices".

22. Contractor shall coordinate with the utility companies for any required utility adjustments prior to paving. Existing private utilities requiring adjustment to be made by contractor prior to paving.

23. Contractor to install construction joints in concrete pavement at all pc's and as convenient to phasing of pours, with expansion joints a maximum of every 60 feet in both directions and sawed dummy joints a maximum of every 15 feet in both directions. Reference structural plans for joint requirements at building.

24. Contractor to submit a jointing plan to the engineer and owner prior to the beginning of any concrete paving work.

25. Traffic control devices shall be installed according to the current approved TXDOT requirements.

26. All pavement striping color to be approved by owner.

27. All dimensions are to face of curb / edge of pavement unless noted otherwise.

28. Any firelane markings required shall be coordinated with City of Smithville Fire Marshal.

29. Where new pavement and sidewalk ties to existing pavement, connection shall be doweled into existing.

EROSION CONTROL NOTES:

1. The contractor shall maintain adequate site drainage during all phases of construction. The contractor shall use silt fences (or other methods approved by the engineer and city) as required to prevent silt and construction debris from flowing onto adjacent properties. Contractor shall comply with all applicable federal, state, or local erosion, conservation, and siltation requirements. Contractor shall remove all temporary erosion control devices upon completion of permanent drainage facilities and the establishment of a stand of grass or other growth to prevent erosion. Contractor is responsible for filing an NOI and a NOT with the TCEQ, if applicable. Contractor is solely responsible for all mandated SWPPP record keeping and reporting.

2. Erosion control devices shown on the plan are recommended to be installed prior to commencing construction. Best management practices (BMP's) shown are suggestions only. Contractor is solely responsible for BMP selection, implementation, and maintenance.

3. Contractor shall provide adequate temporary erosion control devices to prevent erosion on the project site or migration of silt from the site until permanent stabilization is achieved. Install devices to minimize runoff water from circumventing the controls.

4. Contractor shall inspect erosion control devices after each rain. When silt reaches a depth of 1', remove and dispose of in such a manner as to not create a siltation problem.

5. Alternate methods of erosion control such as interceptor or diversion dikes or swales, sedimentation basins, etc.,may be allowed with prior approval of Engineer. Submit details for review.

6. When site is completely stabilized, erosion control structures shall be removed and disposed of in an approved manner.

7. Posts which support the silt fence shall be installed on a slight angle toward the anticipated runoff source.

8. The toe of the silt fence shall be trenched in with a spade or mechanical trencher, so that the downslope face of the trench is flat and perpendicular to the line of flow.

9. The trench should be a min. of 6" deep and 6" wide to allow for the silt fence to be laid in the ground and backfilled.

10. Silt fence should be securely fastened to each steel support post or to woven wire, which is in turn attached to the steel fence posts.

WATER AND SANITARY SEWER NOTES

1. Contractor shall coordinate water and sanitary sewer tie-in's with City of Smithville Water / Sewer Department. Contractor shall verify location, depth and size of existing tie-in's prior to construction.

2. The contractor shall verify all dimensions shown, coordinating the horizontal and vertical location of all utility services entering the building and/or crossing other utilities.

3. All water taps, meter setups, and wastewater taps shall be coordinated by contractor with City of Smithville Water / Sewer Department. Contractor will make all installations.

4. All main water line shall maintain a minimum cover of 36 inches. Service lines shall maintain a minimum of 24 inches of cover. Wastewater service cover will be as shown on the plans. Tracer wire, twelve (12) gauge (minimum), or approved equivalent shall be provided for both water and wastewater lines and shall be brought up in meter box and valve boxes.

5. Contractor to sequence construction as to avoid interruption of water or wastewater service to surrounding areas.

6. Contractor to replace grass and restore property to original condition in all disturbed areas.

7. Existing manhole tops, cleanouts, valve boxes, etc. are to be adjusted as required to match proposed grades.

8. Contractor shall contact necessary franchise utility companies prior to construction, in order to locate and/or disconnect services.

9. The contractor shall be responsible for preparing and implementing a trench protection plan for all open trench excavation over 5 feet.

10. All plumbing construction shall be per city building code.

11. All gravity utilities to be constructed downstream to upstream. Tie in elevations shall be verified with the plans.

12. Cleanouts for services are required at all wyes, bends, and no greater than 100 feet. Double cleanouts to be provided at building sewer connection.

13. Services to be extended to and plugged 5' from the building.

14. Reference geotechnical report for utility trench / building foundation interface.

15. Contractor to verify all line sizes and depths prior to construction and ordering materials. Sizes of existing lines have not been verified below existing grade.

16. Reference architectural plans for final coordination on utility connections.

MISCELLANEOUS NOTES:

1. Proposed improvement are located in designated Zone "X" per FEMA Flood Insurance Rate Map No.'s 48021C0395F dated May 9, 2023.

2. BEFCO Engineering, Inc. is not responsible for the means and methods employed by the contractor to implement demolition of this site. These plans indicate the known objects on the site that are to be demolished and removed from the site. BEFCO Engineering, Inc. does not warrant or represent that the plans show all improvements and utilities, that the improvements and utilities are shown accurately, or that the utilities shown can be removed. The contractor is responsible for performing his own site investigation to scope his work and to confirm with the owners of improvements and utilities the ability and process for the removal of their facilities. The plans are intended to give a general guide to the contractor. The goal of the demolition is to leave the site in a state suitable for the construction of the proposed project. Removal or preservation of improvements, utilities, etc. to accomplish this goal are the responsibility of the contractor. Contractor shall comply with all local and state regulations regarding demolition and disposal of the materials off-site and obtain required permits.

3. All existing utilities shall remain unless otherwise noted. Existing location of irrigation lines, if any, are unknown and may require relocation.

4. Contractor to verify location and elevation of existing utilities prior to demolition.

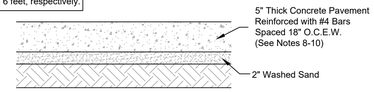
5. Contractor is responsible for damage to existing utilities, irrigation lines, pavement, etc. to remain resulting from demolition activities and repair at his own expense.

6. Contractor is responsible for obtaining all permits required for demolition and disposal.

7. Perimeter erosion control devices shall be in place prior to demolition.

8. Unless otherwise noted, Contractor shall be responsible for the disposal of all removed material.

Spacing of expansion and control joints for sidewalk shall be 30 feet and 6 feet, respectively.



SIDEWALK PAVEMENT DETAIL

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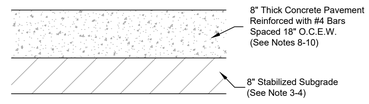

CONCRETE PAVEMENT DETAIL

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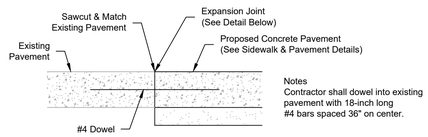

TYPICAL CONCRETE PAVEMENT

TIE-IN DETAIL

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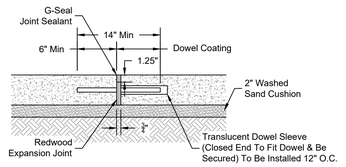


EXPANSION JOINT DETAIL

N.T.S.

PAVING NOTES:

1. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH 2014 TEXAS DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MAINTENANCE OF HIGHWAYS, STREETS, AND BRIDGES AND **DESIGN RECOMMENDATIONS IN DECEMBER 18, 2024 GEOTECHNICAL INVESTIGATION REPORT PREPARED BY TSI LABORATORIES, INC.**

2. ALL OF THE TOPSOIL (SOIL WITH HIGH ORGANIC CONTENT, E.G. >4%), TREE ROOTS, VEGETATION, WET SOILS, AND ANY SOFT OR LOOSE SOILS MUST BE REMOVED FROM THE PROPOSED PAVEMENT AREAS. EXISTING SOILS SHALL BE UNDERCUT A MINIMUM OF 6 INCHES OR AS REQUIRED. UNDERCUT SHALL EXTEND A MINIMUM OF 1 FOOT BEYOND PROPOSED EDGE OF LIMESTONE ROCK BASE. STRIPPED MATERIALS MAY EITHER BE WASTED OR STOCKPILED FOR LATER USE. ANY RE-USED EXCAVATED SOILS MUST BE FREE OF ROOTS AND DEBRIS AND MEET MATERIAL REQUIREMENTS OF THE INTENDED USE. ANY EXCESS MATERIAL SHALL BE DISPOSED OF OFFSITE.

3. PRIOR TO THE ADDITION OF FILL OR STABILIZATION OF SUBGRADE IN PARKING AREAS, EXPOSED SUBGRADE SHALL BE PROOF-ROLLED WITH EQUIPMENT CAPABLE OF PROVIDING A MINIMUM 20-TON WHEEL LOAD, TYPICALLY, A FULLY LOADED 12-YARD TANDEM AXLE DUMP TRUCK OR A FULLY LOADED 2,000 GALLON WATER TRUCK. ENTIRE AREA SHALL BE ROLLED TO CHECK SOFT AND/OR PUMPING SOILS. IF SOFT OR PUMPING AREAS ARE OBSERVED, THESE AREAS SHALL BE EXCAVATED TO FIRM SUBGRADE AND REPLACED WITH COMPACTED AND TESTED DRY SOIL. ***A GEOTECHNICAL REPRESENTATIVE SHALL BE PRESENT DURING PROOF-ROLL. IT SHALL BE IMPERATIVE TO DETERMINE THE IN-PLACE CONDITION OF THE PARKING LOT PRIOR TO SUBGRADE STABILIZATION AND PLACEMENT OF BASE MATERIALS.***

SELECT FILL, NATIVE SOILS, AND BACKFILL SHALL BE PLACED IN HORIZONTAL LOOSE LIFTS OF NOT MORE THAN 8 INCHES IN THICKNESS. RE-USE OF EXISTING MATERIAL MAY REQUIRE SOME WETTING OR DRYING TO PRODUCE THE NECESSARY MOISTURE CONTENT AT THE TIME OF COMPACTION. APPROPRIATE LABORATORY TESTS SUCH AS PROCTOR MOISTURE-DENSITY TESTS SHOULD BE PERFORMED ON SAMPLES OF FILL MATERIAL. FIELD MOISTURE-DENSITY TESTS AND VISUAL OBSERVATION OF LIFT THICKNESS AND MATERIAL TYPES SHOULD BE PERFORMED DURING COMPACTION OPERATIONS TO VERIFY THE CONSTRUCTION SATISFIES MATERIAL AND COMPACTION REQUIREMENTS AS PRESENTED IN THE GEOTECHNICAL REPORT.

FILL MATERIALS SHOULD NOT BE PLACED ON SOILS RECENTLY SUBJECTED TO PRECIPITATION OR SATURATION. ALL WET SOILS SHOULD BE REMOVED OR ALLOWED TO DRY PRIOR TO CONTINUATION OF FILL PLACEMENT OPERATIONS. IMPORTED FILL MATERIALS SHOULD NOT CONTAIN WET MATERIALS AT THE TIME OF PLACEMENT. IF ANY PROBLEMS ARE ENCOUNTERED DURING EARTHWORK OPERATIONS OR IF SITE CONDITIONS DIFFER FROM THOSE ENCOUNTERED DURING THE SUBSURFACE EXPLORATION, THE GEOTECHNICAL ENGINEER SHOULD BE NOTIFIED IMMEDIATELY TO DETERMINE THE EFFECT ON RECOMMENDATIONS EXPRESSED IN THE REPORT.

SELECT FILL AND BACKFILL IMPORTED TO THE SITE SHOULD BE CLASSIFIED ACCORDING TO THE UNIFIED SOIL CLASSIFICATION SYSTEM (USCS) AS SM, SC, GM, OR GC, AND SHOULD MEET THE FOLLOWING CRITERIA:

PERCENT PASSING THE NO. 4 SIEVE:	50% TO 80% (20% TO 50% GRAVEL)
PERCENT PASSING THE NO. 200 SIEVE:	20% TO 50%
PI OF SOIL PASSING THE NO. 40 SIEVE:	4 TO 20
MAXIMUM SIZE OF GRAVEL OR ROCK FRAGMENTS:	3 INCHES IN ANY DIMENSION

ALL GENERAL / UTILITY FILL SHALL BE COMPACTED TO A MINIMUM RELATIVE COMPACTION OF 95% BASED ON THE MAXIMUM DRY UNIT WEIGHT AS DETERMINED BY THE STANDARD PROCTOR METHOD (ASTM D 698). MOISTURE CONTENT SHALL BE MINIMUM OPTIMUM MOISTURE CONTENT AT THE TIME OF COMPACTION.

4. THE SUBGRADE SHALL BE TREATED WITH CEMENT OR FLY ASH IN ACCORDANCE WITH TXDOT 2014 STANDARD SPECIFICATIONS ITEM 265 A MINIMUM OF 18 INCHES BEYOND THE EDGE OF ASPHALT PAVEMENT. THE AMOUNT OF CEMENT OR FLYASH SHOULD BE DETERMINED FOR THE SUBGRADE SOILS BY CONDUCTING LABORARTORY TESTS ON THE SUBGRADE ONCE FINAL SUBGRADE ELEVATION HAS BEEN ESTABLISHED AT THE TIME OF CONSTRUCTION. FOR PLANNING AND ESTIMATING PURPOSES, SIX PERCENT (6%) CEMENT OR FLY ASH BY DRY WEIGHT IS RECOMMENDED. SUBGRADE SHOULD BE COMPACTED TO A MINIMUM OF 95 PERCENT OF THE MAXIMUM DRY DENSITY OF AN ASTM D-698 STANDARD PROCTOR AT A MOISTURE CONTENT WITHIN TWO PERCENT OF OPTIMUM (-2 TO +2). TRAFFIC SHOULD BE KEPT OFF THE TREATED SUBGRADE FOR ABOUT 7 DAYS TO FACILITATE CURING OF SOIL-CHEMICAL MIXTURE. IN ADDITION, THE SUBGRADE IS NOT SUITABLE FOR HEAVY CONSTRUCTION TRAFFIC PRIOR TO PAVING.

5. LIMESTONE ROCK BASE SHALL MEET THE REQUIREMENTS OF TXDOT 2014 STANDARD SPECIFICATIONS ITEM 247, TYPE A, GRADE 1-2. MAXIMUM FLEXIBLE BASE LOOSE LIFT THICKNESS SHALL BE 9 INCHES. THE BASE MATERIAL SHOULD BE COMPACTED TO A MINIMUM OF 100 PERCENT OF THE MAXIMUM DRY DENSITY AS PER THE TEX 113E PROCTOR METHOD OR 95 PERCENT OF THE MAXIMUM DRY DENSITY AS DEFINED BY AN ASTM D-1557 MODIFIED PROCTOR TO WITHIN TWO (2) PERCENTAGE POINTS OF OPTIMUM AS DEFINED BY THE SELECTED PROCTOR METHOD.

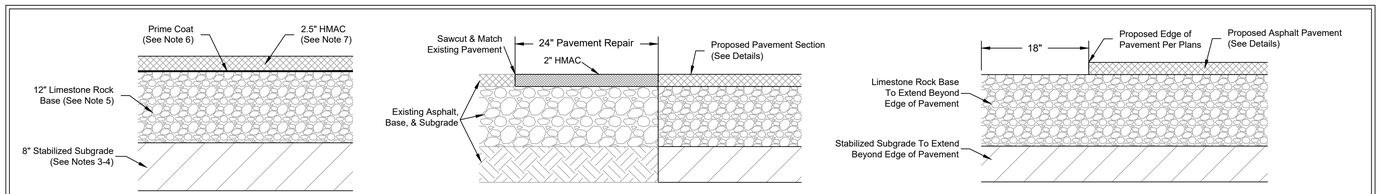
6. APPLICATION OF PRIME COAT SHALL BE IN ACCORDANCE WITH TXDOT SPECIFICATION ITEMS 310. PRIME COAT SHALL BE MC-30 WITH AN APPLICATION RATE OF 0.20 GAL / SY.

7. ASPHALTIC CONCRETE SURFACE COURSE SHALL BE PLANT MIXED, HOT LAID TYPE D (FINE GRADED SURFACE COURSE) MEETING TXDOT 2014 STANDARD SPECIFICATIONS ITEM 340. HMAC SHALL BE COMPACTED TO WITHIN AN AIR VOID RANGE OF 5 TO 9 PERCENT CALCULATED USING THE MAXIMUM THEORETICAL SPECIFIC GRAVITY MIX MEASURED BY TXDOT TEX-227-F. THE ASPHALT CEMENT CONTENT BY PERCENT OF TOTAL MIXTURE WEIGHT SHALL BE WITHIN ± 0.5 PERCENT ASPHALT CEMENT FROM THE JOB MIX DESIGN.

8. PORTLAND CEMENT CONCRETE MIX SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 4,000 PSI FOR ALL APPLICATIONS. THE MATERIALS AND PROPERTIES OF REINFORCED CONCRETE PAVEMENT SHALL MEET APPLICABLE REQUIREMENTS IN THE ACI MANUAL OF CONCRETE PRACTICE.

9. REINFORCING STEEL SHALL CONSIST OF #4 BARS SPACED 18 INCHES ON CENTER EACH WAY AND LOCATED IN TOP HALF OF CONCRETE SECTION WITH A MINIMUM OF 2 INCHES OF COVER. AT CONSTRUCTION JOINTS, 14-INCH LONG DOWELS SHALL BE SPACED AT 12 INCHES ON CENTER.

10. IF SAW CUT, CONTROL JOINTS SHOULD BE CUT WITHIN 6-12 HOURS OF CONCRETE PLACEMENT. SAW CUT JOINTS SHOULD BE AT LEAST 1/4 OF SLAB THICKNESS. CONTROL JOINTS SHOULD BE SPACED AT ABOUT THIRTY (30) TIMES THE THICKNESS OF THE CONCRETE PAVEMENT. FURTHER, ACI RECOMMENDS A MAXIMUM CONTROL JOINT SPACING OF 12.5-FOOT FOR 5-INCH THINK PAVEMENTS AND MAXIMUM CONTROL JOINT SPACING OF 15-FOOT FOR 6-INCH OR THICKER PAVEMENTS. DOWELS AT EXPANSION JOINTS SHALL BE 3/4" SMOOTH BARS, 14 INCHES IN LENGTH WITH 6-INCH EMBEDMENT, WITH ONE END TREATED TO SLIP, AND SPACED 12" O.C.



ASPHALT PAVEMENT DETAIL

N.T.S.

ASPHALT PAVEMENT TIE-IN DETAIL

N.T.S.

ASPHALT EDGE OF PAVEMENT DETAIL

N.T.S.

ASPHALT PAVEMENT WORK SHALL BE PERFORMED BY OTHERS.

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Texas Registered Engineering Firm F-2011

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(979) 968-6474 TBPE F-2011

BASTROP COUNTY PRECINCT NO. 2 MAINTENANCE FACILITY IMPROVEMENTS

SMITHVILLE, TEXAS

REVISION:
1.
2.
3.

DRAWN BY: TLS
CHECKED BY: TLS

BEFCO JOB NO: 24-9106

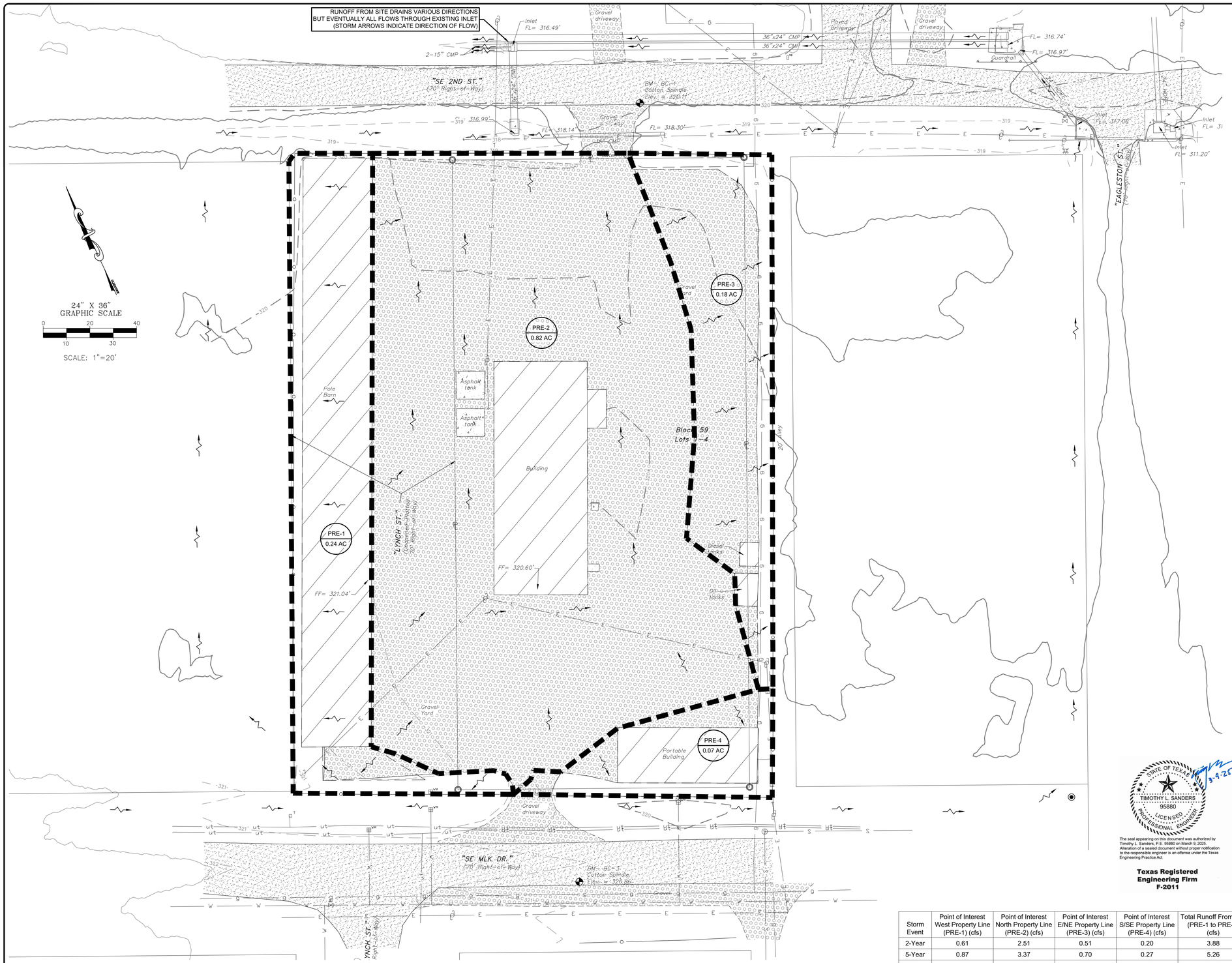
PLOT SCALE 1" = 20'

SHEET TITLE
GENERAL CONSTRUCTION NOTES & MISCELLANEOUS DETAILS

DATE ISSUED: 03/09/25

SHEET
5
OF 8

FIELD BOOK NO.----
S:_Projects\BASTROP COUNTY\24-9106 Smithville Precinct 2 Facility\Dwg\TLS 24-9106A SHEETS



EXISTING LAYOUT

FIELD BOOK NO.----
S:_Projects\BASTROP COUNTY\24-9106 Smithville Precinct 2 Facility\Dwg\TLS 24-9106A SHEETS

Bastrop County Precinct No. 2 Maintenance Facility Improvements
Pre-Development Drainage Calculations

1 = Sheet Flow
2 = Unpaved Shallow Concentrated Flow
3 = Paved Shallow Concentrated Flow
4 = Channel Flow

County: Bastrop 2 Yr - 24 Hr Rainfall: 4.23 in
Assume a Manning's Roughness Coefficient of 0.24 for overland sheet fow.

Determine the time of concentration and weighted curve number for the onsite area draining west from the site. Per NRCS Web Soil Survey, soil is primarily from Hydrologic Soil Group 'A'. Based on aerial photography and personal observation, existing land is mostly covered with an open shed and a compacted gravel base parking lot.

Drainage Area	Type of Flow	Flow Length (ft)	Land Slope (ft/ft)	Manning's Coefficient	Hydraulic Radius (ft)	Flow Velocity (ft/s)	Travel Time (min)
PRE-1	Assume a minimum time of concentration of 10 minutes.						

Drainage Area: 0.24 acres Time of Concentration: 10.0

Drainage Area	Hydrologic Soil Group	Existing Land Use	Curve Number	Drainage Area
PRE-1	A	Shed Roof	98	0.17
	A	Gravel Base	96	0.02
	A	Grass	49	0.05

Total Drainage Area = 0.24 acres
Cumulative Curve Number = 88

$I_a = 0.2 \times S$

$S = \frac{1000 - 10}{CN}$

I_a = Initial Abstraction Including Surface Storage, Interception, and Infiltration Prior To Runoff (in)
S = Potential Maximum Retention (in)
CN = Curve Number

S = 1.41
I_a = 0.28

Determine the time of concentration and weighted curve number for the onsite area draining north from the site. Per NRCS Web Soil Survey, soil is primarily from Hydrologic Soil Group 'C'. Based on aerial photography and personal observation, existing land is covered with an existing building and a compacted gravel base parking lot.

Drainage Area	Type of Flow	Flow Length (ft)	Land Slope (ft/ft)	Manning's Coefficient	Hydraulic Radius (ft)	Flow Velocity (ft/s)	Travel Time (min)
PRE-2	Assume a minimum time of concentration of 10 minutes.						

Drainage Area: 0.82 acres Time of Concentration: 10.0

Drainage Area	Hydrologic Soil Group	Existing Land Use	Curve Number	Drainage Area
PRE-2	C	Building	98	0.10
	C	Gravel Base	96	0.72

Total Drainage Area = 0.82 acres
Cumulative Curve Number = 96

S = 0.39
I_a = 0.08

Determine the time of concentration and weighted curve number for the onsite area draining east / northeast from the site. Per NRCS Web Soil Survey, soil is primarily from Hydrologic Soil Group 'C'. Based on aerial photography and personal observation, existing land is mostly covered with a compacted gravel base parking lot, two small sheds and grass.

Drainage Area	Type of Flow	Flow Length (ft)	Land Slope (ft/ft)	Manning's Coefficient	Hydraulic Radius (ft)	Flow Velocity (ft/s)	Travel Time (min)
PRE-3	Assume a minimum time of concentration of 10 minutes.						

Drainage Area: 0.18 acres Time of Concentration: 10.0

Drainage Area	Hydrologic Soil Group	Existing Land Use	Curve Number	Drainage Area
PRE-3	C	Sheds	98	0.01
	C	Gravel Base	96	0.13
	C	Grass	79	0.04

Total Drainage Area = 0.18 acres
Cumulative Curve Number = 92

S = 0.83
I_a = 0.17

Determine the time of concentration and weighted curve number for the onsite area draining south / southeast from the site. Per NRCS Web Soil Survey, soil is primarily from Hydrologic Soil Group 'C'. Based on aerial photography and personal observation, existing land is covered with a portable building, a compacted gravel base parking lot, and grass.

Drainage Area	Type of Flow	Flow Length (ft)	Land Slope (ft/ft)	Manning's Coefficient	Hydraulic Radius (ft)	Flow Velocity (ft/s)	Travel Time (min)
PRE-4	Assume a minimum time of concentration of 10 minutes.						

Drainage Area: 0.07 acres Time of Concentration: 10.0

Drainage Area	Hydrologic Soil Group	Existing Land Use	Curve Number	Drainage Area
PRE-4	C	Building	98	0.03
	C	Gravel Base	96	0.02
	C	Grass	79	0.02

Total Drainage Area = 0.07 acres
Cumulative Curve Number = 92

S = 0.87
I_a = 0.17

Determine the time of concentration and weighted curve number for the entire site. Per NRCS Web Soil Survey, soil is primarily from Hydrologic Soil Groups 'A' and 'C'. Based on aerial photography and personal observation, existing land is covered with various buildings / sheds, a compacted gravel base parking lot, and grass.

Drainage Area	Type of Flow	Flow Length (ft)	Land Slope (ft/ft)	Manning's Coefficient	Hydraulic Radius (ft)	Flow Velocity (ft/s)	Travel Time (min)
PRE-1 TO PRE-4	Assume a minimum time of concentration of 10 minutes.						

Drainage Area: 1.31 acres Time of Concentration: 10.0

Drainage Area	Hydrologic Soil Group	Existing Land Use	Curve Number	Drainage Area
PRE-1 TO PRE-4	A	Shed Roof	98	0.17
	A	Gravel Base	96	0.02
	A	Grass	49	0.05
	C	Building	98	0.14
	C	Gravel Base	96	0.87
	C	Grass	79	0.06

Total Drainage Area = 1.31 acres
Cumulative Curve Number = 94

S = 0.65
I_a = 0.13

HEC-HMS PEAK FLOW SUMMARY

Storm Event:	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Atlas 14, 24-Hour Rainfall Depth (in):	4.23	5.59	6.92	8.95	10.70	12.80
PRE-1 Peak Flow (cfs):	0.61	0.87	1.12	1.50	1.83	2.22
PRE-2 Peak Flow (cfs):	2.51	3.37	4.19	5.45	6.53	7.83
PRE-3 Peak Flow (cfs):	0.51	0.70	0.89	1.17	1.41	1.70
PRE-4 Peak Flow (cfs):	0.20	0.27	0.34	0.45	0.55	0.66
Overall Peak Flow (cfs):	3.88	5.26	6.59	8.62	10.36	12.44

STATE OF TEXAS
TIMOTHY L. SANDERS
95880
LICENSED
PROFESSIONAL ENGINEER
9-9-25

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Storm Event	Point of Interest West Property Line (PRE-1) (cfs)	Point of Interest North Property Line (PRE-2) (cfs)	Point of Interest E/NE Property Line (PRE-3) (cfs)	Point of Interest S/SE Property Line (PRE-4) (cfs)	Total Runoff From Site (PRE-1 to PRE-4) (cfs)
2-Year	0.61	2.51	0.51	0.20	3.88
5-Year	0.87	3.37	0.70	0.27	5.26
10-Year	1.12	4.19	0.89	0.34	6.59
25-Year	1.50	5.45	1.17	0.45	8.62
50-Year	1.83	6.53	1.41	0.55	10.36
100-Year	2.22	7.83	1.70	0.66	12.44

PRE-DEVELOPMENT PEAK FLOWS

BEFCO ENGINEERING, INC.
P. O. Box 615
LaGrange, Texas 78945
(979) 968-6474 TBPE F-2011

BASTROP COUNTY PRECINCT NO. 2
MAINTENANCE FACILITY IMPROVEMENTS
SMITHVILLE, TEXAS

REVISION:
1.
2.
3.

DRAWN BY: TLS
CHECKED BY: TLS

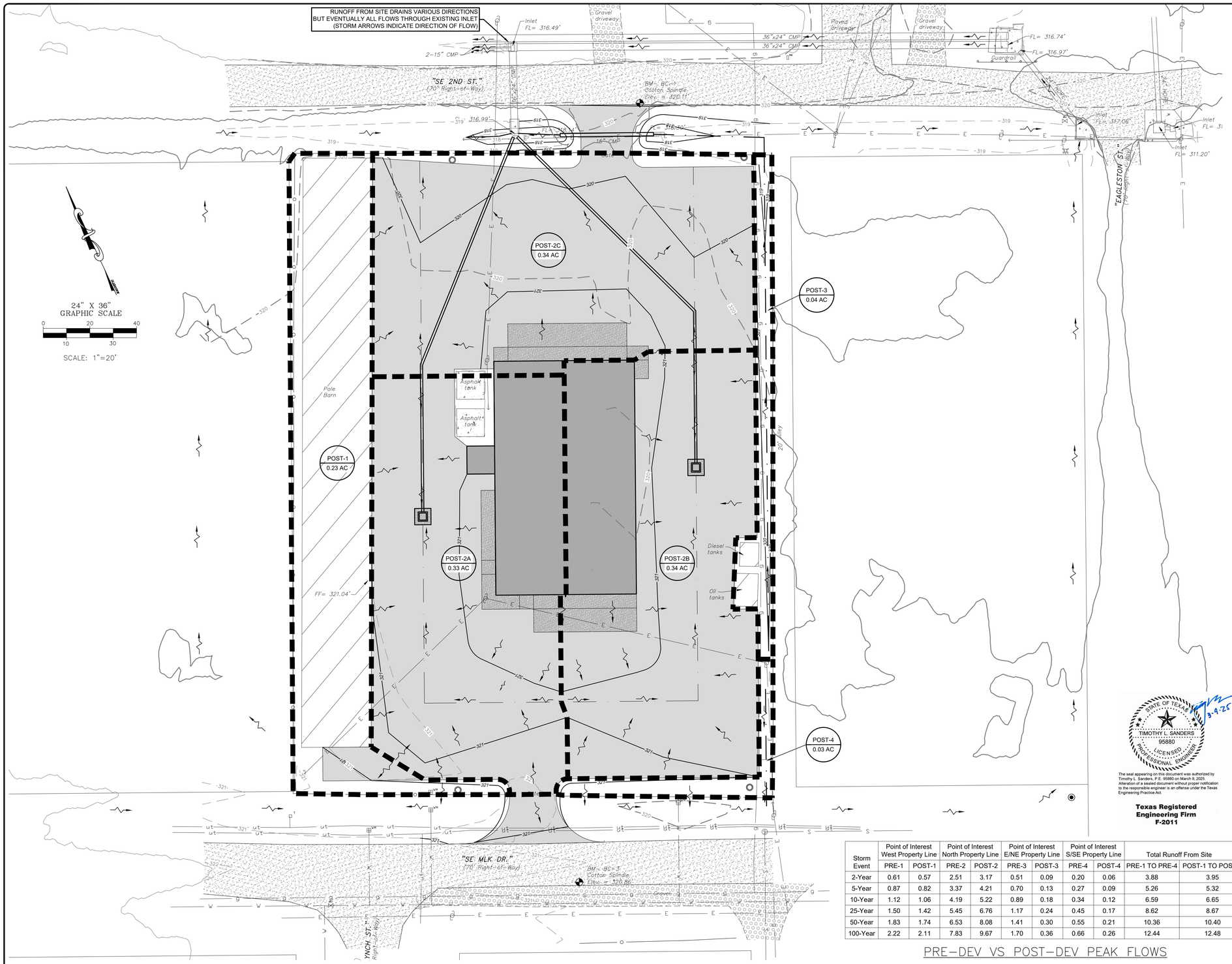
BEFCO JOB NO: 24-9106

PLOT SCALE 1" = 20'

SHEET TITLE
PRE-DEV DRAINAGE MAP & CALCULATIONS

DATE ISSUED: 03/09/25

SHEET
6
OF 8



Storm Event	Point of Interest West Property Line		Point of Interest North Property Line		Point of Interest E/NE Property Line		Point of Interest S/SE Property Line		Total Runoff From Site	
	PRE-1	POST-1	PRE-2	POST-2	PRE-3	POST-3	PRE-4	POST-4	PRE-1 TO PRE-4	POST-1 TO POST-4
2-Year	0.61	0.57	2.51	3.17	0.51	0.09	0.20	0.06	3.88	3.95
5-Year	0.87	0.82	3.37	4.21	0.70	0.13	0.27	0.09	5.26	5.32
10-Year	1.12	1.06	4.19	5.22	0.89	0.18	0.34	0.12	6.59	6.65
25-Year	1.50	1.42	5.45	6.76	1.17	0.24	0.45	0.17	8.62	8.67
50-Year	1.83	1.74	6.53	8.08	1.41	0.30	0.55	0.21	10.36	10.40
100-Year	2.22	2.11	7.83	9.67	1.70	0.36	0.66	0.26	12.44	12.48

PRE-DEV VS POST-DEV PEAK FLOWS

SUMMARY
Stormwater from the site flows in various directions; however, all runoff eventually drains through the existing inlet and storm pipes located on the north side of SE 2nd Street directly across from our site. The total peak flow from the site under post-development conditions is slightly higher than that under pre-development conditons; however, the difference is negligible (0.04 cfs or less) and should have no adverse impact on the surrounding properties.

STATE OF TEXAS
TIMOTHY L. SANDERS
95880
LICENSED PROFESSIONAL ENGINEER
3-9-25

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Texas Registered Engineering Firm F-2011

Bastrop County Precinct No. 2 Maintenance Facility Improvements
Post-Development Drainage Calculations

1 = Sheet Flow
2 = Unpaved Shallow Concentrated Flow
3 = Paved Shallow Concentrated Flow
4 = Channel Flow

County: Bastrop 2 Yr - 24 Hr Rainfall: 4.23 in
Assume a Manning's Roughness Coefficient of 0.24 for overland sheet fow.

Determine the time of concentration and weighted curve number for the onsite area draining west from the site. Per NRCS Web Soil Survey, soil is primarily from Hydrologic Soil Group 'A'. Proposed land use is primarily an existing open shed, grass, and an asphalt parking lot.

Drainage Area	Type of Flow	Flow Length (ft)	Land Slope (ft/ft)	Manning's Coefficient	Hydraulic Radius (ft)	Flow Velocity (ft/s)	Travel Time (min)
POST-1	Assume a minimum time of concentration of 10 minutes.						
Drainage Area:	0.23 acres					Time of Concentration:	10.0

Drainage Area	Hydrologic Soil Group	Existing Land Use	Curve Number	Drainage Area
POST-1	A	Shed Roof	98	0.17
	A	Asph Pvmt	98	0.01
	A	Grass	49	0.05

Total Drainage Area = 0.23 acres
Cumulative Curve Number = 87

$I_a = 0.2 \times S$

$S = \frac{1000}{CN} - 10$

I_a = Initial Abstraction Including Surface Storage, Interception, and Infiltration Prior To Runoff (in)
S = Potential Maximum Retention (in)
CN = Curve Number

S = 1.45
I_a = 0.29

Determine the time of concentration and weighted curve number for the onsite area draining north from the site. Per NRCS Web Soil Survey, soil is primarily from Hydrologic Soil Group 'C'. Proposed land use is primarily a new building and a new asphalt parking lot.

Drainage Area	Type of Flow	Flow Length (ft)	Land Slope (ft/ft)	Manning's Coefficient	Hydraulic Radius (ft)	Flow Velocity (ft/s)	Travel Time (min)
POST-2	Assume a minimum time of concentration of 10 minutes.						
Drainage Area:	1.01 acres					Time of Concentration:	10.0

Drainage Area	Hydrologic Soil Group	Existing Land Use	Curve Number	Drainage Area
POST-2	C	Bldg/Pvmt	98	0.99
	C	Grass	79	0.02

Total Drainage Area = 1.01 acres
Cumulative Curve Number = 98

S = 0.24
I_a = 0.05

Determine the time of concentration and weighted curve number for the onsite area draining northeast from the site. Per NRCS Web Soil Survey, soil is primarily from Hydrologic Soil Group 'C'. Proposed land use is primarily grass and two small sheds.

Drainage Area	Type of Flow	Flow Length (ft)	Land Slope (ft/ft)	Manning's Coefficient	Hydraulic Radius (ft)	Flow Velocity (ft/s)	Travel Time (min)
POST-3	Assume a minimum time of concentration of 10 minutes.						
Drainage Area:	0.04 acres					Time of Concentration:	10.0

Drainage Area	Hydrologic Soil Group	Existing Land Use	Curve Number	Drainage Area
POST-3	C	Sheds	98	0.01
	C	Grass	79	0.03

Total Drainage Area = 0.04 acres
Cumulative Curve Number = 84

S = 1.94
I_a = 0.39

Determine the time of concentration and weighted curve number for the onsite area draining south / southeast from the site. Per NRCS Web Soil Survey, soil is primarily from Hydrologic Soil Group 'C'. Proposed land use is primarily grass.

Drainage Area	Type of Flow	Flow Length (ft)	Land Slope (ft/ft)	Manning's Coefficient	Hydraulic Radius (ft)	Flow Velocity (ft/s)	Travel Time (min)
POST-4	Assume a minimum time of concentration of 10 minutes.						
Drainage Area:	0.03 acres					Time of Concentration:	10.0

Drainage Area	Hydrologic Soil Group	Existing Land Use	Curve Number	Drainage Area
POST-4	C	Grass	79	0.03

Total Drainage Area = 0.03 acres
Cumulative Curve Number = 79

S = 2.66
I_a = 0.53

Determine the time of concentration and weighted curve number for the entire site. Per NRCS Web Soil Survey, soil is primarily from Hydrologic Soil Groups 'A' and 'C'. Proposed land use is a combination of various buildings / shed, asphalt pavement, and grass.

Drainage Area	Type of Flow	Flow Length (ft)	Land Slope (ft/ft)	Manning's Coefficient	Hydraulic Radius (ft)	Flow Velocity (ft/s)	Travel Time (min)
POST-1 TO POST-4	Assume a minimum time of concentration of 10 minutes.						
Drainage Area:	1.31 acres					Time of Concentration:	10.0

Drainage Area	Hydrologic Soil Group	Existing Land Use	Curve Number	Drainage Area
POST-1	A	Shed Roof	98	0.17
TO POST-4	A	Asph Pvmt	98	0.01
	A	Grass	49	0.05
	C	Bldg/Pvmt	98	1.00
	C	Grass	79	0.08

Total Drainage Area = 1.31 acres
Cumulative Curve Number = 95

S = 0.53
I_a = 0.11

HEC-HMS PEAK FLOW SUMMARY

Storm Event:	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Atlas 14, 24-Hour Rainfall Depth (in):	4.23	5.59	6.92	8.95	10.70	12.80
POST-1 Peak Flow (cfs):	0.57	0.82	1.06	1.42	1.74	2.11
POST-2 Peak Flow (cfs):	3.17	4.21	5.22	6.76	8.08	9.67
POST-3 Peak Flow (cfs):	0.09	0.13	0.18	0.24	0.30	0.36
POST-4 Peak Flow (cfs):	0.06	0.09	0.12	0.17	0.21	0.26
Overall Peak Flow (cfs):	3.95	5.32	6.65	8.67	10.40	12.48

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BASTROP COUNTY PRECINCT NO. 2
MAINTENANCE FACILITY IMPROVEMENTS
SMITHVILLE, TEXAS

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DRAWN BY: TLS
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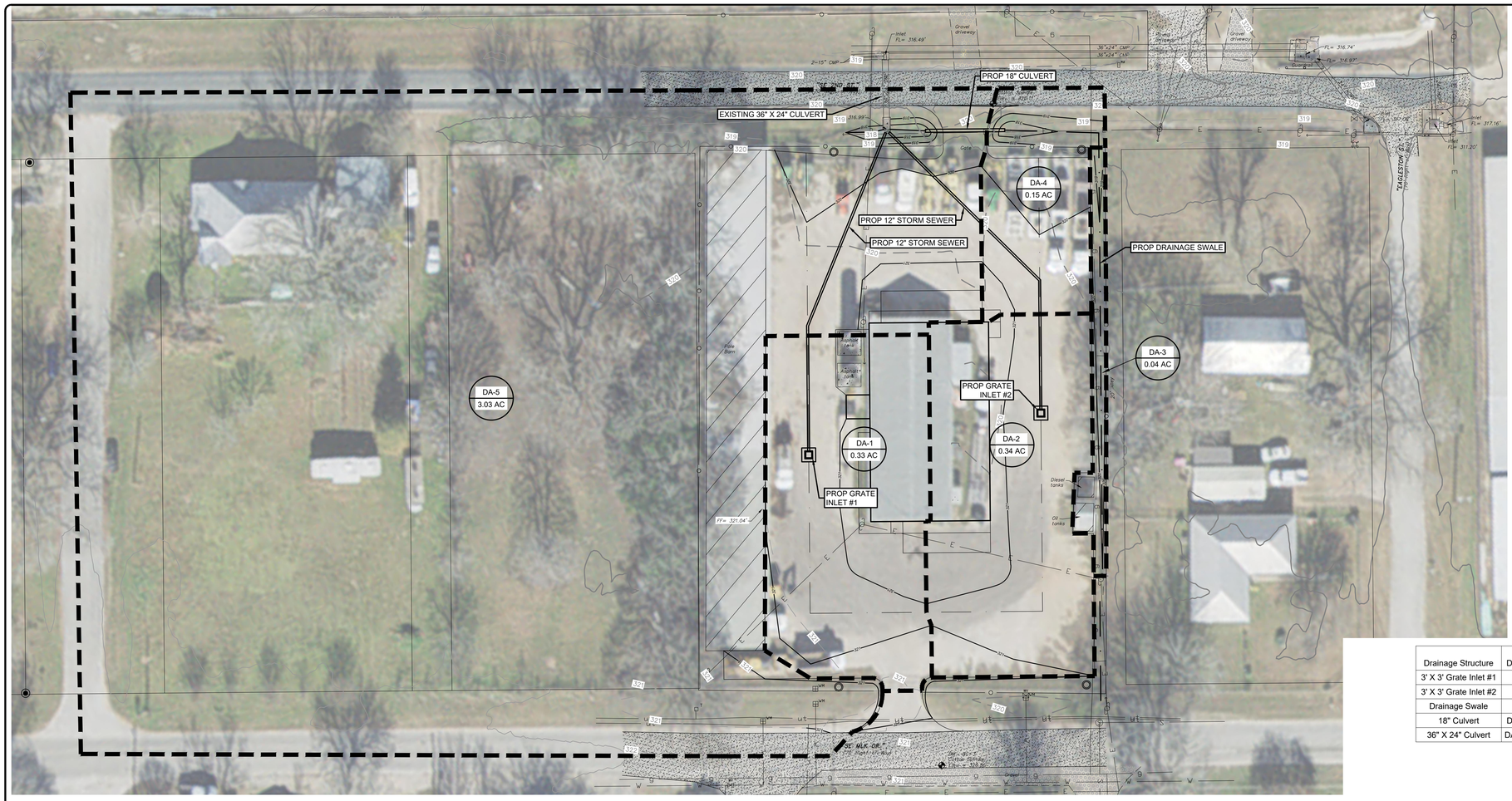
BEFCO JOB NO: 24-9106
PLOT SCALE 1" = 20'

SHEET TITLE
POST-DEV DRAINAGE MAP & CALCULATIONS

DATE ISSUED: 03/09/25

SHEET
7
OF 8

FIELD BOOK NO.-----
S:_Projects\BASTROP COUNTY\24-9106 Smithville Precinct 2 Facility\Dwg\TLS 24-9106A SHEETS



24" X 36"
GRAPHIC SCALE
0 30 60
15 45
SCALE: 1"=30'

Drainage Structure	Contributing Drainage Area (ac)		Runoff Coefficient	Time of Conc (min)	25-Yr Rainfall Intensity	25-Yr Peak Flow (cfs)	100-Yr Rainfall Intensity	100-Yr Peak Flow (cfs)
3' X 3' Grate Inlet #1	DA-1	0.33	0.95	10.0	8.79	2.76	10.96	3.44
3' X 3' Grate Inlet #2	DA-2	0.34	0.95	10.0	8.79	2.84	10.96	3.54
Drainage Swale	DA-3	0.04	0.40	10.0	8.79	0.14	10.96	0.18
18" Culvert	DA-3 & DA-4	0.19	0.70	10.0	8.79	1.17	10.96	1.46
36" X 24" Culvert	DA-1 To DA-5	3.89	0.75	10.0	8.79	25.64	10.96	31.98

RATIONAL METHOD CALCULATIONS FOR DRAINAGE STRUCTURES

OUTPUT FOR DESIGN FREQUENCY of: 25 Years

Runoff Computation for Design Frequency.

ID	C Value	Area (acre)	Tc (min)	Tc Used (min)	Intensity (in/hr)	Supply Q (cfs)	Total Q (cfs)
DA-1	0.95	0.33	10.00	10.00	8.79	0.000	2.756

Sag Inlets Configuration Data.

Inlet ID	Inlet Type	Length/ Perim (ft)	Grate Area (sf)	Left-Slope Longi (%)	Left-Slope Transv (%)	Right-Slope Longi (%)	Right-Slope Transv (%)	n	Gutter DeprW (ft)	Gutter Width (ft)	Head Allowed (ft)
DA-1	Grate	12.00	3.42	0.50	2.00	0.50	2.00	0.014	n/a		1.50

Sag Inlets Computation Data.

Inlet ID	Inlet Type	Length Perim (ft)	Grate Area (ft)	Grate Area (sf)	Total Q (cfs)	Inlet Capacity (cfs)	Actual Head (ft)	Ponded Left (ft)	Ponded Right (ft)	Width (ft)
DA-1	Grate	n/a	12.00	3.42	2.756	22.512	0.177	8.80	8.80	

Cumulative Junction Discharge Computations

Node I.D.	Node Type	Weighted C-Value	Cumulat. Dr.Area (acres)	Cumulat. Tc (min)	Intens. (in/hr)	User Supply Q (cfs)	Additional Q in Node (cfs)	Total Disch. (cfs)
DA-1	Grate	0.950	0.33	10.00	8.79		0.00	2.756
OUT	Outlt	0.950	0.33	10.00	8.79		0.00	2.756

Conveyance Configuration Data

Run #	Node US	I.D. DS	FlowLine Elev. US (ft)	DS (ft)	Shape #	Span (ft)	Rise (ft)	Length (ft)	Slope (%)	n_value
1	DA-1	OUT	318.00	317.25	Cir 1	0.00	1.00	169.0	0.444	0.012

Conveyance Hydraulic Computations. Tailwater = 318.990 (ft)

Run #	Hyd. Gr.line US (ft)	DS (ft)	Crit.Elev US (ft)	DS (ft)	Depth Fr.Slope (%)	Unif. (ft)	Actual (ft)	Velocity Unif. (f/s)	Actual (f/s)	Q (cfs)	Cap (cfs)	Junc Loss (ft)
1	319.84	318.99	320.25	0.505	0.91	1.00	3.66	3.51	2.8	2.6	0.000	

OUTPUT FOR DESIGN FREQUENCY of: 100 Years

Runoff Computation for Design Frequency.

ID	C Value	Area (acre)	Tc (min)	Tc Used (min)	Intensity (in/hr)	Supply Q (cfs)	Total Q (cfs)
DA-1	0.95	0.33	10.00	10.00	10.96	0.000	3.436

Sag Inlets Configuration Data.

Inlet ID	Inlet Type	Length/ Perim (ft)	Grate Area (sf)	Left-Slope Longi (%)	Left-Slope Transv (%)	Right-Slope Longi (%)	Right-Slope Transv (%)	n	Gutter DeprW (ft)	Gutter Width (ft)	Head Allowed (ft)
DA-1	Grate	12.00	3.42	0.50	2.00	0.50	2.00	0.014	n/a		1.50

Sag Inlets Computation Data.

Inlet ID	Inlet Type	Length Perim (ft)	Grate Area (ft)	Grate Area (sf)	Total Q (cfs)	Inlet Capacity (cfs)	Actual Head (ft)	Ponded Left (ft)	Ponded Right (ft)	Width (ft)
DA-1	Grate	n/a	12.00	3.42	3.436	22.512	0.205	9.55	9.55	

Cumulative Junction Discharge Computations

Node I.D.	Node Type	Weighted C-Value	Cumulat. Dr.Area (acres)	Cumulat. Tc (min)	Intens. (in/hr)	User Supply Q (cfs)	Additional Q in Node (cfs)	Total Disch. (cfs)
DA-1	Grate	0.950	0.33	10.00	10.96		0.00	3.436
OUT	Outlt	0.950	0.33	10.00	10.96		0.00	3.436

Conveyance Configuration Data

Run #	Node US	I.D. DS	FlowLine Elev. US (ft)	DS (ft)	Shape #	Span (ft)	Rise (ft)	Length (ft)	Slope (%)	n_value
1	DA-1	OUT	318.00	317.25	Cir 1	0.00	1.00	169.0	0.444	0.012

Conveyance Hydraulic Computations. Tailwater = 318.990 (ft)

Run #	Hyd. Gr.line US (ft)	DS (ft)	Crit.Elev US (ft)	DS (ft)	Depth Fr.Slope (%)	Unif. (ft)	Actual (ft)	Velocity Unif. (f/s)	Actual (f/s)	Q (cfs)	Cap (cfs)	Junc Loss (ft)
1	320.32	318.99	320.25	0.786	1.00	1.00	4.37	4.37	3.4	2.6	0.000	

OUTPUT FOR DESIGN FREQUENCY of: 25 Years

Runoff Computation for Design Frequency.

ID	C Value	Area (acre)	Tc (min)	Tc Used (min)	Intensity (in/hr)	Supply Q (cfs)	Total Q (cfs)
DA-2	0.95	0.34	10.00	10.00	8.79	0.000	2.839

Sag Inlets Configuration Data.

Inlet ID	Inlet Type	Length/ Perim (ft)	Grate Area (sf)	Left-Slope Longi (%)	Left-Slope Transv (%)	Right-Slope Longi (%)	Right-Slope Transv (%)	n	Gutter DeprW (ft)	Gutter Width (ft)	Head Allowed (ft)
DA-2	Grate	12.00	3.42	0.50	2.00	0.50	2.00	0.014	n/a		1.50

Sag Inlets Computation Data.

Inlet ID	Inlet Type	Length Perim (ft)	Grate Area (ft)	Grate Area (sf)	Total Q (cfs)	Inlet Capacity (cfs)	Actual Head (ft)	Ponded Left (ft)	Ponded Right (ft)	Width (ft)
DA-2	Grate	n/a	12.00	3.42	2.839	22.512	0.180	8.90	8.90	

Cumulative Junction Discharge Computations

Node I.D.	Node Type	Weighted C-Value	Cumulat. Dr.Area (acres)	Cumulat. Tc (min)	Intens. (in/hr)	User Supply Q (cfs)	Additional Q in Node (cfs)	Total Disch. (cfs)
DA-2	Grate	0.950	0.34	10.00	8.79		0.00	2.839
OUT	Outlt	0.950	0.34	10.00	8.79		0.00	2.839

Conveyance Configuration Data

Run #	Node US	I.D. DS	FlowLine Elev. US (ft)	DS (ft)	Shape #	Span (ft)	Rise (ft)	Length (ft)	Slope (%)	n_value
1	DA-2	OUT	317.90	317.25	Cir 1	0.00	1.00	172.0	0.378	0.012

Conveyance Hydraulic Computations. Tailwater = 318.990 (ft)

Run #	Hyd. Gr.line US (ft)	DS (ft)	Crit.Elev US (ft)	DS (ft)	Depth Fr.Slope (%)	Unif. (ft)	Actual (ft)	Velocity Unif. (f/s)	Actual (f/s)	Q (cfs)	Cap (cfs)	Junc Loss (ft)
1	319.91	318.99	320.15	0.537	1.00	1.00	3.61	3.61	2.8	2.4	0.000	

OUTPUT FOR DESIGN FREQUENCY of: 100 Years

Runoff Computation for Design Frequency.

ID	C Value	Area (acre)	Tc (min)	Tc Used (min)	Intensity (in/hr)	Supply Q (cfs)	Total Q (cfs)
DA-2	0.95	0.34	10.00	10.00	10.96	0.000	3.540

Sag Inlets Configuration Data.

Inlet ID	Inlet Type	Length/ Perim (ft)	Grate Area (sf)	Left-Slope Longi (%)	Left-Slope Transv (%)	Right-Slope Longi (%)	Right-Slope Transv (%)	n	Gutter DeprW (ft)	Gutter Width (ft)	Head Allowed (ft)
DA-2	Grate	12.00	3.42	0.50	2.00	0.50	2.00	0.014	n/a		1.50

Sag Inlets Computation Data.

Inlet ID	Inlet Type	Length Perim (ft)	Grate Area (ft)	Grate Area (sf)	Total Q (cfs)	Inlet Capacity (cfs)	Actual Head (ft)	Ponded Left (ft)	Ponded Right (ft)	Width (ft)
DA-2	Grate	n/a	12.00	3.42	3.540	22.512	0.209	9.65	9.65	

Cumulative Junction Discharge Computations

Node I.D.	Node Type	Weighted C-Value	Cumulat. Dr.Area (acres)	Cumulat. Tc (min)	Intens. (in/hr)	User Supply Q (cfs)	Additional Q in Node (cfs)	Total Disch. (cfs)
DA-2	Grate	0.950	0.34	10.00	10.96		0.00	3.540
OUT	Outlt	0.950	0.34	10.00	10.96		0.00	3.540

Conveyance Configuration Data

Run #	Node US	I.D. DS	FlowLine Elev. US (ft)	DS (ft)	Shape #	Span (ft)	Rise (ft)	Length (ft)	Slope (%)	n_value
1	DA-2	OUT	317.90	317.25	Cir 1	0.00	1.00	172.0	0.378	0.012

Conveyance Hydraulic Computations. Tailwater = 318.990 (ft)

Run #	Hyd. Gr.line US (ft)	DS (ft)	Crit.Elev US (ft)	DS (ft)	Depth Fr.Slope (%)	Unif. (ft)	Actual (ft)	Velocity Unif. (f/s)	Actual (f/s)	Q (cfs)	Cap (cfs)	Junc Loss (ft)
1	320.42	318.99	320.15	0.834	1.00	1.00	4.51	4.51	3.5	2.4	0.000	

Culvert Summary Table - 18in Culvert

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.50	0.50	317.73	0.38	0.43	3-M2t	0.36	0.26	0.27	0.27	2.33	0.93
0.65	0.65	317.79	0.44	0.49	3-M2t	0.41	0.30	0.32	0.32	2.37	1.02
0.80	0.80	317.84	0.49	0.54	3-M2t	0.45	0.33	0.37	0.37	2.39	1.09
0.95	0.95	317.90	0.53	0.60	3-M2t	0.50	0.36	0.41	0.41	2.42	1.15
1.17	1.17	317.97	0.60	0.67	3-M2t	0.55	0.40	0.47	0.47	2.44	1.23
1.25	1.25	317.99	0.62	0.69	3-M2t	0.57	0.42	0.50	0.50	2.45	1.26
1.40	1.40	318.03	0.66	0.73	3-M2t	0.61	0.44	0.54	0.54	2.46	1.30
1.55	1.55	318.08	0.69	0.78	3-M2t	0.65	0.47	0.58	0.58	2.48	1.34
1.70	1.70	318.12	0.73	0.82	3-M2t	0.68	0.49	0.62	0.62	2.49	1.38
1.85	1.85	318.16	0.76	0.86	3-M2t	0.71	0.51	0.65	0.65	2.50	1.42
2.00	2.00	318.19	0.80	0.89	3-M2t	0.75	0.53	0.69	0.69	2.51	1.45

Culvert Summary Table - 36x24 Culvert

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
20.00	20.00	319.41	2.19	2.42	4-FFf	1.36	1.22	2.00	2.00	4.30	0.00
21.50	21.50	319.55	2.34	2.56	4-FFf	1.46	1.27	2.00	2.00	4.62	0.00
23.00	23.00	319.70	2.49	2.71	4-FFf	1.57	1.32	2.00	2.00	4.95	0.00
24.50	24.50	319.86	2.66	2.87	4-FFf	1.72	1.37	2.00	2.00	5.27	0.00
25.64	25.64	320.00	2.80	3.01	4-FFf	2.00	1.40	2.00	2.00	5.51	0.00
27.50	27.50	320.22	3.03	3.23	4-FFf	2.00	1.46	2.00	2.00	5.91	0.00
29.00	28.30	320.32	3.14	3.33	4-FFf	2.00	1.48	2.00	2.00	6.09	0.00
30.50	28.46	320.35	3.16	3.36	4-FFf	2.00	1.48	2.00	2.00	6.12	0.00
32.00	28.58	320.36	3.18	3.37	4-FFf	2.00	1.49	2.00	2.00	6.15	0.00
33.50	28.68	320.37	3.19	3.38	4-FFf	2.00	1.49	2.00	2.00	6.17	0.00
35.00	28.77	320.39	3.21	3.40	4-FFf	2.00	1.49	2.00	2.00	6.19	0.00

STATE OF TEXAS
TIMOTHY L. SANDERS
95880
LICENSED
PROFESSIONAL ENGINEER
3-9-25

The seal appearing on this document was authorized by Timothy L. Sanders, P.E. 95880 on March 9, 2025. Alteration of a sealed document without proper notification to the responsible engineer is an offense under the Texas Engineering Practice Act.

Texas Registered Engineering Firm F-2011

FIELD BOOK NO.-----
S:_Projects\BASTROP COUNTY\24-9106 Smithville Precinct 2 Facility\Dwg\TLS 24-9106A SHEETS

BEFCO ENGINEERING, INC.
P. O. Box 615
LaGrange, Texas 78945
(979) 968-6474 TBPE F-2011

BASTROP COUNTY PRECINCT NO. 2 MAINTENANCE FACILITY IMPROVEMENTS

SMITHVILLE, TEXAS

REVISION:
1.
2.
3.

DRAWN BY: TLS
CHECKED BY: TLS

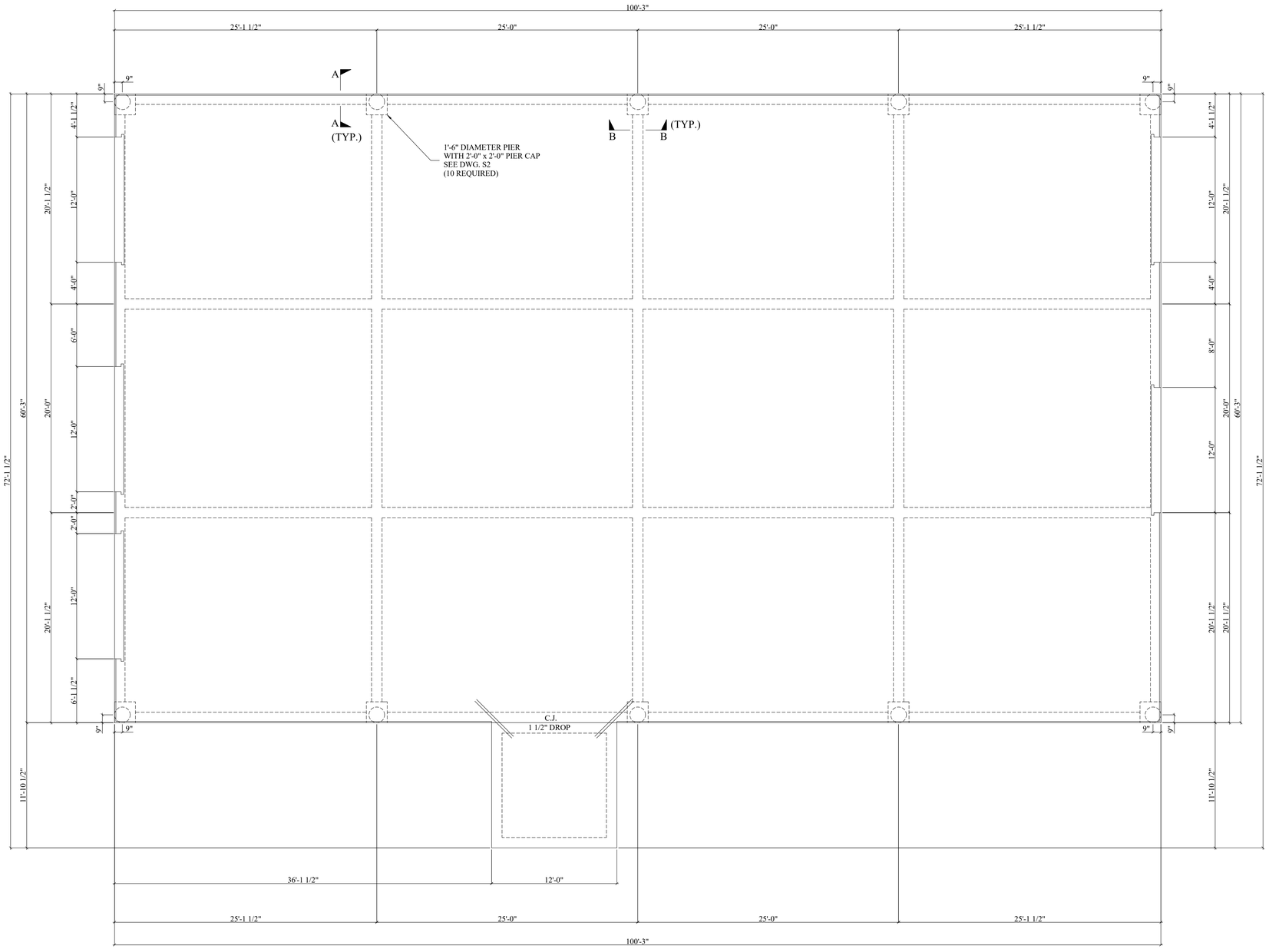
BEFCO JOB NO: 24-9106

PLOT SCALE 1" = 30'

SHEET TITLE
MISCELLANEOUS DRAINAGE CALCULATIONS

DATE ISSUED: 03/09/25

SHEET
8
OF 8



FOUNDATION PLAN

NOT TO SCALE

NOTE: ALL GRADE BEAMS ARE 1'-0" WIDE UNLESS OTHERWISE NOTED.
VERIFY ALL DIMENSIONS WITH ARCHITECTURAL PLANS AND
METAL BUILDING DRAWINGS. IF A DISCREPANCY IS FOUND,
NOTIFY ENGINEER IMMEDIATELY.

GEOTECHNICAL NOTES:

1. GEOTECHNICAL STUDY PREPARED BY TSI LABORATORIES, INC, (G-241435), DATED DECEMBER 18, 2024, SHALL BE USED FOR SITE PREPARATION, PLACEMENT OF FILL, AND FOUNDATION CONSTRUCTION.
2. BUILDING PAD PREPARATION: MIMIMUM OF 1 FOOT OF SELECT STRUCTURAL FILL COMPACTED TO 95% OF STANDARD PROCTOR IN ACCORDANCE WITH D698. A MINIMUM OF 5 FEET BEYOND THE EDGE OF THE SLAB AREA. COMPACTION TESTING IS REQUIRED.
3. CONSTRUCTION AREAS SHALL BE STRIPPED OF VEGETATION AND ROOT STRUCTURES, AND THE EXPOSED SUBGRADE SHALL BE PROOF ROLLED WITH APPROPRIATE CONSTRUCTION EQUIPMENT WEIGHING AT LEAST 20 TONS. IF WEAK OR SOFT AREAS ARE OBSERVED DURING PROOF ROLLING OPERATIONS, THE SOIL IN THE SUBJECT AREA SHALL BE REMOVED TO EXPOSE COMPETENT SUBGRADE SOILS IN BOTH HORIZONTAL AND VERTICAL LIMITS. SUBGRADE AREAS SHALL BE MOISTURE ADJUSTED TO WITHIN 2% OF THE OPTIMUM MOISTURE CONTENT. THE MOISTURE CONDITIONED SUBGRADE SHALL THEN BE COMPACTED TO AT LEAST 95% OF MAXIMUM DRY DENSITY DETERMINED IN ACCORDANCE WITH ASTM D698.
4. SELECT FILL SHALL CONSIST OF LEAN CLAY OR SANDY LEAN CLAY, FREE OF ROOTS, ORGANICS, AND DELETERIOUS MATERIALS. SELECT FILL SHALL HAVE AT LEAST 50% PASSING THE NO. 200 SIEVE AND HAVE A PI BETWEEN 8 AND 15. REPRESENTATIVE SAMPLES OF THE FILL MATERIALS SHALL BE TESTED TO CONFIRM THEIR MATERIAL CHARACTERISTICS PRIOR TO FILLING OPERATIONS.
5. STRUCTURAL FILL SHOULD BE PLACED ON PREPARED SURFACES IN LIFTS NOT TO EXCEED 8 INCHES LOOSE MEASURE, WITH COMPACTED THICKNESS NOT TO EXCEED 6 INCHES. ALL STRUCTURAL FILL SHOULD BE MOISTURE CONDITIONED TO BETWEEN 1% AND 3% OF OPTIMUM MOISTURE CONTENT, AND THEN COMPACTED TO AT LEAST 95% OF MAXIMUM DRY DENSITY DETERMINED IN ACCORDANCE WITH ASTM D698.
6. ELEVATION OF GROUND SURFACE ADJACENT TO THE FOUNDATION SHOULD BE A MINIMUM OF AT LEAST 6 INCHES BELOW FINISHED FLOOR.
7. COMPACTION TESTING IS REQUIRED.
8. THE SLOPE OF THE GROUND SURFACE AWAY FROM THE STRUCTURE SHOULD BE A MINIMUM OF 5% FOR A DISTANCE OF 10 FEET.
9. A GEOTECHNICAL FIRM SHALL BE RETAINED IN ACCORDANCE WITH THE GEOTECHNICAL REPORT TO PROVIDE SOIL TESTING DURING GRADING AND CONSTRUCTION ACTIVITIES. THIS IS TO OBSERVE COMPLIANCE WITH THE PLAN SPECIFICATIONS, GEOTECHNICAL RECOMMENDATIONS, AND TO ALLOW DESIGN CHANGES IF SUBSURFACE CONDITIONS DIFFER FROM THOSE ANTICIPATED BEFORE CONSTRUCTION.

CONCRETE NOTES:

1. ALL CONCRETE CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE ACI STANDARD "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE", LATEST EDITION.
2. A 10 MIL VAPOR BARRIER IS REQUIRED UNDER THE FOUNDATION IN ACCORDANCE WITH ACI SPECIFICATIONS.
3. REBAR CLEARANCE SHALL BE 3" CLEAR UNLESS OTHERWISE NOTED.
4. 5. ALL CONCRETE SHALL HAVE A 4000 PSI COMPRESSIVE STRENGTH IN 28 DAYS.
6. ALL REINFORCING STEEL SHALL BE LAPPED 50 BAR DIAMETERS UNLESS OTHERWISE NOTED.
7. ALL REINFORCING BARS SHALL BE ASTM A-615, GRADE 60.
8. ALL BENDING OF REINFORCING STEEL SHALL BE COLD BENT.
9. ALL EXPOSED EXTERIOR CONCRETE EDGES SHALL BE CHAMFERED 3/4 INCHES BY 45 DEGREES.
10. ALL EMBEDMENTS SHALL BE IN PLACE PRIOR TO PLACEMENT OF CONCRETE.
11. ALL STEEL CONCRETE EMBEDMENTS SHALL BE HOT DIP GALVANIZED AFTER FABRICATION.
12. CONCRETE SHALL BE CURED FOR A MINIMUM OF 7 DAYS IN ACCORDANCE WITH ACI 302.
13. ALL REINFORCING BARS SHALL BE SECURELY HELD IN PLACE WHILE PLACING CONCRETE. IF REQUIRED, ADDITIONAL BARS, CHAIRS, OR STIRRUPS SHALL BE PROVIDED TO SUPPORT ALL BARS.
14. ALL BENDS AND HOOKS SHALL BE AS DETAILED IN THE MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE, LATEST EDITION.
15. CONCRETE SHALL BE TESTED IN ACCORDANCE WITH ACI SPECIFICATIONS.
16. CONTRACTION JOINTS ARE RECOMMENDED TO REDUCE CRACKING IN ACCORDANCE WITH ACI SPECIFICATIONS.
17. PIPES THAT PENETRATE THE GRADE BEAMS SHALL BE LOCATED AT THE CENTER OF THE GRADE BEAM VERTICALLY AND SHALL BE SLEEVED.
18. CONTRACTOR SHALL VERIFY ALL DIMENSIONS WITH THE BUILDING DRAWINGS . IF ANY DESCREPANCIES EXIST, CONTACT OWNER.
19. CONTRACTOR SHALL VERIFY ALL PLACEMENT, DIMENSIONS, AND LOCATION OF ALL EMBEDDED ITEMS AS REQUIRED BY ALL TRADES BEFORE CONCRETE IS PLACED.
20. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS BY MEASUREMENTS AT THE JOB SITE AND SHALL TAKE ANY AND ALL MEASUREMENTS NECESSARY TO VERIFY THE DRAWINGS AND TO PERFORM HIS/HER WORK PROPERLY.
21. THE CONTRACTOR SHALL BEAR THE TOTAL RESPONSIBILITY FOR THE SAFETY OF THE EXISTING ADJOINING STRUCTURES AND FOR ANY METHODS REQUIRED TO ENSURE THAT SAFETY.

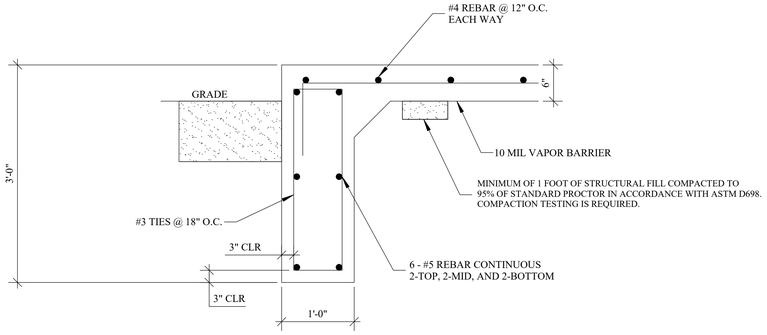
STATE OF TEXAS
CHRISTOPHER J. KORINEK
104683
REGISTERED
PROFESSIONAL ENGINEER

January 10, 2025

Structural Engineer:
T.S.I. Laboratories, Inc.
TBPE Firm Registration: F-9236
1801 N. Laurent
Victoria, TX 77901

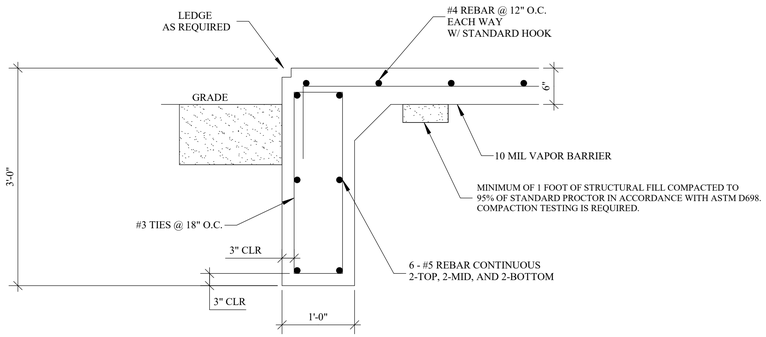
Bastrop County
Smithville Annex
911 SE Martin Luther King Dr.
Smithville, Texas
Foundation Plan

S1



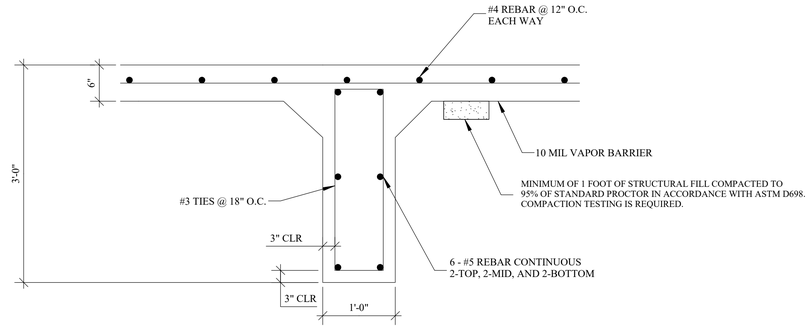
1'-0" WIDE EXTERIOR GRADE BEAM W/OUT LEDGE

NOT TO SCALE



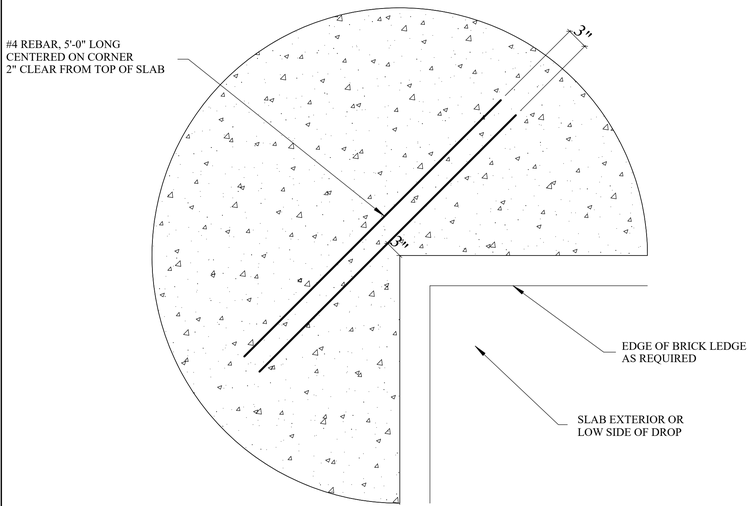
1'-0" WIDE EXTERIOR GRADE BEAM WITH LEDGE

NOT TO SCALE



1'-0" WIDE INTERIOR GRADE BEAM

NOT TO SCALE

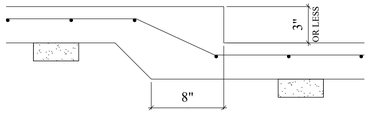


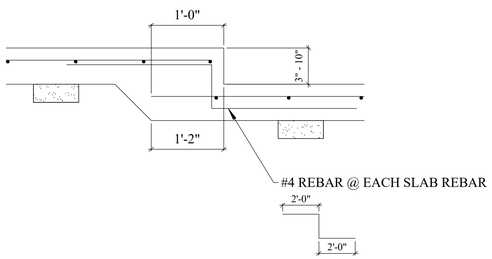
NOTE: RE-ENTRANT STEEL REQUIRED AT ALL DROP AND EDGE CORNERS (NOT SHOWN ON PLAN)

NOTE: PROVIDE REBAR AT ALL RE-ENTRANT SLAB EDGES AND DEPRESSION CORNERS

RE-ENTRANT CORNER REBAR

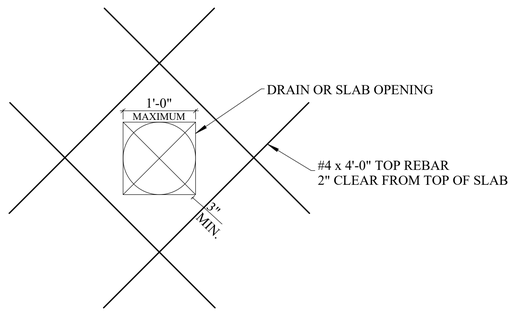
NOT TO SCALE





FLOOR DEPRESSION DETAILS

NOT TO SCALE



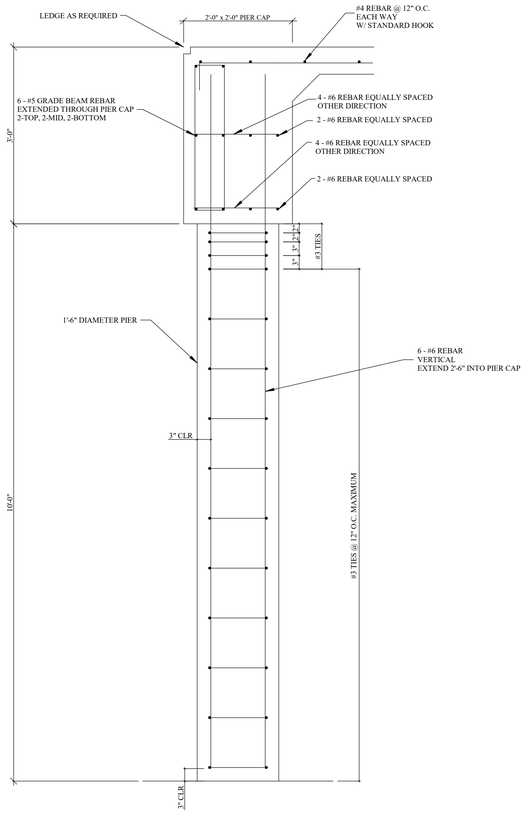
SLAB OPENING REINFORCEMENT DETAILS

NOT TO SCALE

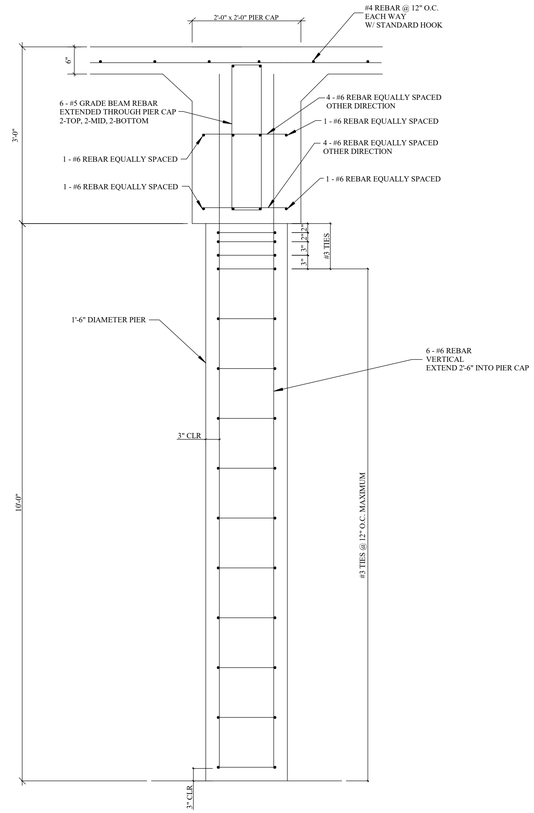
STATE OF TEXAS
CHRISTOPHER J. KORINEK
104683
REGISTERED
PROFESSIONAL ENGINEER

January 10, 2025

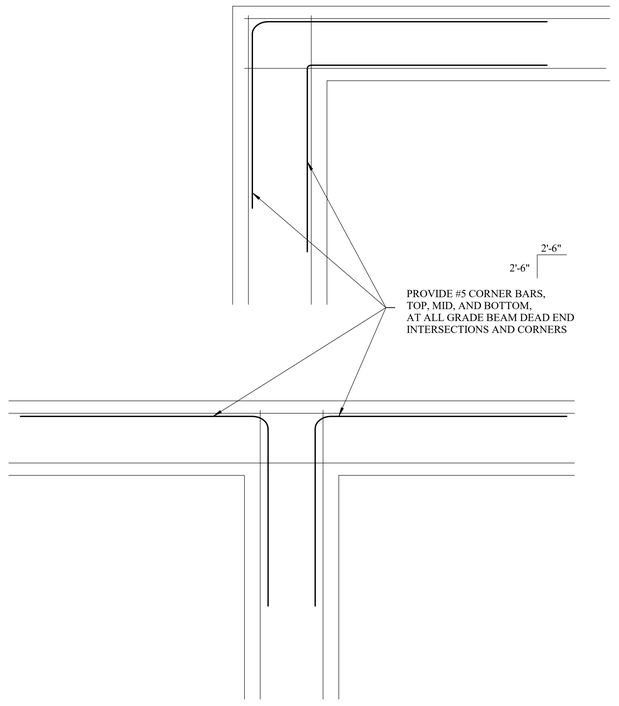
Structural Engineer: T.S.I. Laboratories, Inc. TBPE Firm Registration: F-9236 1801 N. Laurent Victoria, TX 77901	Bastrop County Smithville Annex 911 SE Martin Luther King Dr. Smithville, Texas Foundation Details 1



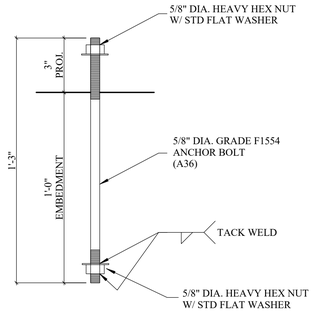
SECTION A-A
DRILLED PIER DETAIL
NOT TO SCALE



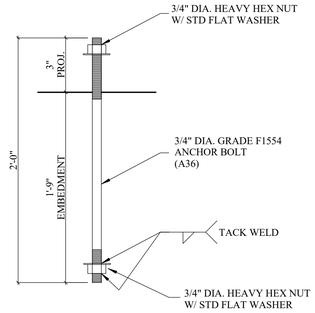
SECTION B-B
DRILLED PIER DETAIL
NOT TO SCALE



CORNER BAR DETAIL
NOT TO SCALE



5/8" DIA. ANCHOR BOLT DETAIL
NOT TO SCALE



3/4" DIA. ANCHOR BOLT DETAIL
NOT TO SCALE

January 10, 2025

Structural Engineer:
T.S.I. Laboratories, Inc.
TBPE Firm Registration: F-9236
1801 N. Laurent
Victoria, TX 77901

Bastrop County
Smithville Annex
911 SE Martin Luther King Dr.
Smithville, Texas
Foundation Details 2

S3

WARNING

Mueller strongly advises against attempting to assemble structure during high winds or other inclement weather. The building system will not support its engineered design loads until fully and properly assembled and sheeted. Until fully assembled, temporary bracing should always be used and all flange bracing should be installed as each individual frame is erected. Attempted assembly during unfavorable weather conditions may lead to damaged material, injury, or even the collapse of the partially assembled structure.

GENERAL NOTES

THE STRUCTURE UNDER THIS CONTRACT HAS BEEN DESIGNED AND DETAILED FOR THE LOADS AND CONDITIONS STIPULATED IN THE CONTRACT AND SHOWN ON THESE DRAWINGS. ANY ALTERATIONS TO THE STRUCTURAL SYSTEM, REMOVAL OF ANY COMPONENT PARTS, OR THE ADDITION OF OTHER CONSTRUCTION MATERIALS OR LOADS MUST BE DONE UNDER THE ADVICE AND DIRECTION OF A REGISTERED ARCHITECT, CIVIL OR STRUCTURAL ENGINEER. THE BUILDING MANUFACTURER WILL ASSUME NO RESPONSIBILITY FOR ANY LOADS NOT INDICATED.

THIS METAL BUILDING IS DESIGNED WITH THE BUILDING MANUFACTURER'S STANDARD PRACTICES WHICH ARE BASED ON PERTINENT PROCEDURES AND RECOMMENDATIONS OF THE FOLLOWING ORGANIZATIONS AND CODES AS APPLICABLE.

1. AMERICAN INSTITUTE OF STEEL CONSTRUCTION, SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS
2. AMERICAN IRON AND STEEL INSTITUTE, SPECIFICATION FOR THE DESIGN OF COLD FORMED STEEL STRUCTURAL MEMBERS.
3. AMERICAN WELDING SOCIETY, STRUCTURAL WELDING CODE' AWS D1.1
4. METAL BUILDING MANUFACTURER'S ASSOCIATION , LOW RISE BUILDING SYSTEMS MANUAL
5. INTERNATIONAL CODE COUNCIL: INTERNATIONAL BUILDING CODE

ALL WELDING ELECTRODES SHALL BE A233 CLASS E-70 SERIES. MINIMUM WELDS ON PRIMARY STRUCTURAL MEMBERS SHALL BE 3/16 FILLET WELDS UNLESS SHOWN OTHERWISE ON SHOP FABRICATION DRAWINGS.

ALL STRUCTURAL STEEL SHALL BE SHOP FABRICATED UNLESS NOTED.

MATERIAL PROPERTIES OF STEEL PLATE AND SHEET USED IN THE FABRICATION OF PRIMARY RIGID FRAMES AND ALL PRIMARY STRUCTURAL FRAMING MEMBERS (OTHER THAN COLD-FORMED SECTIONS) CONFORM TO THE CHEMISTRY REQUIREMENTS OF ASTM-A36 WITH MINIMUM YIELD POINT OF 50,000 P.S.I. OR 36,000 P.S.I. AS REQUIRED BY DESIGN.

MATERIAL PROPERTIES OF COLD FORMED LIGHT GAGE STEEL MEMBERS CONFORM TO THE REQUIREMENTS OF A.S.T.M. A-570, GRADE 55, WITH A MINIMUM YIELD POINT OF 57,000 P.S.I.

ALL PIPE SHALL BE MINIMUM SCHEDULE 40 AND 36,000 P.S.I. UNLESS OTHERWISE NOTED.

CABLE BRACING TO BE "BRACE GRIP" SYSTEM AS MANUFACTURED BY FLORIDA WIRE AND CABLE COMPANY, EHS CABLE OR EQUAL. BRACING IN FLUSH GIRT SIDEWALL / ENDWALL BAYS MAY REQUIRE THE FIELD CUTTING OF SLOTS SO THAT CABLE IS INSTALLED WITHIN GIRTS.

STRUCTURAL JOINTS WITH A.S.T.M. A-325 HIGH STRENGTH BOLTS, WHERE INDICATED ON THE DRAWINGS, SHALL BE ASSEMBLED AND THE FASTENERS TIGHTENED IN ACCORDANCE WITH 'SNUG-TIGHT' METHOD AS DESCRIBED IN THE SPECIFICATION FOR STRUCTURAL JOINTS USING ASTM F-3125 GRADE A325 OR GRADE A490 BOLTS (2020 EDITION), UNLESS OTHERWISE NOTED. ALL JOINTS WILL BE ASSEMBLED WITHOUT WASHERS UNLESS OTHERWISE NOTED.

ALL STEEL MEMBERS EXCEPT BOLTS AND FASTENERS SHALL RECEIVE ONE SHOP COAT OF IRON OXIDE CORROSION INHIBITIVE PRIMER.

SHOP AND FIELD INSPECTIONS AND ASSOCIATED FEES ARE THE RESPONSIBILITY OF THE CONTRACTOR.

UNLESS OTHERWISE NOTED, ALL SCREWED-DOWN ROOF AND WALL PANELS ARE TO BE INSTALLED USING A MINIMUM OF ONE SCREW PER FOOT AT EACH PURLIN / GIRT AND ONE STITCH SCREW EVERY 20 INCHES ALONG THE PANEL LAPS AND ENDS AS DESCRIBED IN THE INSTALLATION MANUAL. SINCE BEARING FRAME ENDWALLS DEPEND ON DIAPHRAGM STRENGTH TO PROVIDE LATERAL SUPPORT, THE NUMBER AND SIZE OF FIELD INSTALLED OPENINGS IN THESE WALLS MAY BE LIMITED. SEE THE APPLICABLE WALL DRAWING OR CONTACT YOUR SALES REPRESENTATIVE FOR MORE INFORMATION.

APPROVAL NOTES

THE FOLLOWING CONDITIONS APPLY IN THE EVENT THAT THESE DRAWINGS ARE USED AS APPROVAL DRAWINGS:

A) IT IS IMPERATIVE THAT ANY CHANGES TO THESE DRAWINGS:
   1) BE MADE IN CONTRASTING INK.
   2) BE LEGIBLE AND UNAMBIGUOUS.
   3) HAVE ALL INSTANCES OF CHANGE CLEARLY INDICATED.

B) DATED SIGNATURE IS REQUIRED ON ALL PAGES.

C) MANUFACTURER RESERVES THE RIGHT TO RESUBMIT DRAWINGS WITH EXTENSIVE OR COMPLEX CHANGES REQUIRED TO AVOID MISFABRICATION, THIS MAY IMPACT THE DELIVERY SCHEDULE. APPROVAL OF THESE DRAWINGS INDICATES CONCLUSIVELY THAT THE MANUFACTURER HAS CORRECTLY INTERPRETED THE CONTRACT REQUIREMENTS, AND FURTHER CONSTITUTES AGREEMENT THAT THE BUILDING AS DRAWN, OR AS DRAWN WITH INDICATED CHANGES REPRESENTS THE TOTALITY OF THE MATERIALS TO BE SUPPLIED BY MANUFACTURER.

D) ANY CHANGES NOTED ON THE DRAWINGS NOT IN CONFORMANCE WITH THE TERMS AND REQUIREMENTS OF THE CONTRACT BETWEEN MANUFACTURER AND ITS CUSTOMER ARE NOT BINDING ON MANUFACTURER UNLESS SUBSEQUENTLY SPECIFICALLY ACKNOWLEDGED AND AGREED TO IN WRITING BY CHANGE ORDER OR SEPARATE DOCUMENTATION. MANUFACTURER RECOGNIZES THAT RUBBER STAMPS ARE ROUTINELY USED FOR INDICATING APPROVAL, DISAPPROVAL, REJECTION, OR MERE REVIEW OF THE DRAWINGS SUBMITTED, HOWEVER, MANUFACTURER DOES NOT ACCEPT CHANGES OR ADDITIONS TO CONTRACTUAL TERMS AND CONDITIONS THAT MAY APPEAR WITH USE OF A STAMP OR SIMILAR INDICATION OF APPROVAL, DISAPPROVAL, ETC. SUCH LANGUAGE APPLIED TO MANUFACTURER'S DRAWINGS BY THE CUSTOMER, ARCHITECT, ENGINEER, OR ANY OTHER PARTY WILL BE CONSIDERED AS UNACCEPTABLE ALTERATIONS TO THESE DRAWING NOTES, AND WILL NOT ALTER THE CONTRACTUAL RIGHTS AND OBLIGATIONS EXISTING BETWEEN MANUFACTURER AND ITS CUSTOMER.

E) ONLY DRAWINGS SPECIFICALLY MARKED "FOR CONSTRUCTION" ARE APPROVED FOR CONSTRUCTION. USING ANCHOR BOLT PLANS WITHOUT THIS NOTATION IS DONE AT THE CUSTOMER'S RISK.

WARRANTY NOTE

ENGINEERING CALCULATIONS AND DESIGN ARE BASED ON PRE-FABRICATED METAL BUILDING(S) AS SHOWN IN THESE DRAWINGS AND SUPPLIED BY MUELLER, INC. AND ANY FIELD FABRICATION AND/OR MODIFICATION OF SAID BUILDING(S) IS THE SOLE RESPONSIBILITY OF THE CUSTOMER AND MAY VOID ALL ENGINEERING AND WARRANTY.

NOTE:
THIS BUILDING IS DESIGNED AS AN ENCLOSED STRUCTURE. ANY ACCESSORIES USED WITH THIS BUILDING (DOORS, WINDOWS, VENTS, ETC.) MUST BE RATED TO MEET THE SAME WIND CRITERIA AS THIS BUILDING.

PRODUCT CERTIFICATIONS

THIS IS TO CERTIFY THE ABOVE REFERENCED BUILDING HAS BEEN DESIGNED IN ACCORDANCE WITH A.I.S.C. AND A.I.S.I. DESIGN PROCEDURES AND GOOD ENGINEERING PRACTICE AND FOR THE FOLLOWING LOADS. ALL WELDING IS PER THE A.W.S. D1.1 & D1.3 CODES. LOADS ARE APPLIED IN ACCORDANCE WITH THE M.B.M.A. LOW RISE BUILDING SYSTEMS MANUAL, AND THE DESIGN SATISFIES THE REQUIREMENTS OF IBC'21

DEAD LOAD: METAL BLDG STRUCTURE ONLY AS FURNISHED BY MUELLER, INC.

LIVE LOAD (ROOF): 20.0 (psf)

LIVE LOAD REDUCED PER CODE? YES

WIND EXPOSURE: C

RISK CATEGORY: II - Normal

GROUND SNOW LOAD: P_g = 5.0 (psf)

ROOF SNOW LOAD (Flat): P_f = 5.0 (psf)

C_e = 1.0 I_s = 1.0

WIND LOAD: V_{ULT} = 112.0 MPH

V_{ASD} = 86.8 MPH

SEISMIC LOADS

I_e = 1.0

S_s = 0.059 S_{DS} = 0.062

S_1 = 0.034 S_{D1} = 0.053

SEISMIC DESIGN CATEGORY: B

SITE CLASS: D

ANALYSIS PROCEDURE: Equivalent Lateral Force Method

BUILDING-SPECIFIC LOADING INFORMATION

BLDG	Collateral Load (psf)	C_t	SNOW C_s	Roof (Sloped) P_s (psf)	WIND Enclosure	GC_{Pi}	R	SEISMIC C_s	V(kips)
1	2.0	1.0	1.0	5.00	PartiallyEnclosed	± 0.55	3.00	0.021	0.97
2	2.0	1.0	1.0	5.00	PartiallyEnclosed	± 0.55	3.00	0.021	0.03

THIS LETTER OF CERTIFICATION APPLIES SOLELY TO THIS BUILDING AND ITS COMPONENT PARTS AS FURNISHED AND/OR FABRICATED BY MUELLER, INC. AND SPECIFICALLY EXCLUDES FOUNDATION, MASONRY OR GENERAL CONTRACT WORK INCLUDING ERECTION CERTIFICATION. THE DESIGN AND CERTIFICATION FOR THIS PROJECT IS IN ACCORDANCE WITH THE PROVISIONS AND LOADS SPECIFIED ON THE CONTRACT DOCUMENTS. THE CUSTOMER IS TO INSURE ALL LOADS ARE IN COMPLIANCE WITH LOCAL REGULATORY AUTHORITIES. ALL COMPONENTS AND PARTS MUST WITHSTAND THE WIND LOAD AND DESIGN SPECIFICATIONS MENTIONED ABOVE.

PANEL ACCESSORY INFORMATION

	PANEL TYPE	PANEL COLOR	TRIM COLOR
WALL SHEETS	126_PBR	LGR Lt Gray	DCH Dark Charcoal
ROOF SHEETS	MLK	SIL Silver	DCH Dark Charcoal

WARNING: IN NO CASE SHOULD GALVALUME STEEL PANELS BE USED IN CONJUNCTION WITH LEAD OR COPPER. BOTH LEAD AND COPPER HAVE HARMFUL CORROSION EFFECTS ON THE ALUMINUM ZINC ALLOY COATING WHEN THEY ARE USED IN CONTACT WITH GALVALUME STEEL PANELS. EVEN RUN-OFF FROM COPPER FLASHING, WIRING, OR TUBING ONTO GALVALUME SHOULD BE AVOIDED.

BUILDING DESCRIPTION

BLDG	WIDTH		LENGTH		HEIGHT BACK	HEIGHT FRONT	ROOF PITCH BACK	ROOF PITCH FRONT
1	60'-0"	X	100'-0"	X	16'-0"	16'-0"	2.00:12	2.00:12
2	12'-0"	X	12'-0"	X	10'-0"	12'-0"	2.00:12	

NOTE: SECONDARY ONLY TO BE GALVANIZED

DEFLECTION LIMIT TABLE	
EW Column	L / 110
EW Rafter (Live)	L / 180
EW Rafter (Wind)	L / 180
Wall Girt	L / 90
Roof Purlin (Live)	L / 150
Roof Purlin (Wind)	L / 150
Rigid Frame (Horiz)	H / 60
Rigid Frame (Vert)	L / 180
Wind Framing	H / 60

APPROVAL DRAWINGS FOR REVIEW

Please mark one selection, sign, date and return.

(✓) Approved with NO Changes:
Proceed with Fabrication

( ) Approved with Changes Noted:
Revise and Proceed with Fabrication

( ) Revise and Resubmit:
Revise and Send New Approval Drawings
** Delivery Date WILL BE DELAYED **

Drawings must be received by Mueller within 10 da
or this building will be placed on fabrication hold.

These drawings are NOT FOR CONSTRUCTION.
Construction drawings will be available after the building is released for fabrication.

DRAWING INDEX

PAGE	DESCRIPTION
C1	COVERSHEET
AB1	ANCHOR BOLT PLAN
AB2	ANCHOR BOLT DETAILS
AB3	ANCHOR BOLT DETAILS
AB4	ANCHOR BOLT DETAILS
AB5	REACTIONS
AB6	REACTIONS
E1	ROOF PLAN
E2	WALL ELEVATION AT GRID A
E3	WALL ELEVATION AT GRID K
E4	WALL ELEVATION AT GRID K, L
E5	WALL ELEVATION AT GRID 1
E6	WALL ELEVATION AT GRID 2.5, 2.6
E7	WALL ELEVATION AT GRID 5
E8	FRAME ELEVATION ON GRID 1
E9	FRAME ELEVATION ON GRID 2
E10	FRAME ELEVATION ON GRID 2.5, 2.6
E11	FRAME ELEVATION ON GRID 3
E12	FRAME ELEVATION ON GRID 4
E13	FRAME ELEVATION ON GRID 5
E101	ERECTION DETAILS
E102	ERECTION DETAILS
E103	ERECTION DETAILS
S101	SHEETING DETAILS
S102	SHEETING DETAILS
T101	TRIM DETAILS
T102	TRIM DETAILS

3D Building Model

To access 3D model of your metal building, scan QR Code above.

Legend

PART MARK = Part001

NOTE: THE ENGINEER LISTED ON THESE DRAWINGS IS NOT THE "REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE" NOR "ENGINEER OF RECORD" FOR THE OVERALL PROJECT.

F-2689

STATE OF TEXAS
MATTHEW S. MALLEY
121601
REGISTERED
PROFESSIONAL ENGINEER

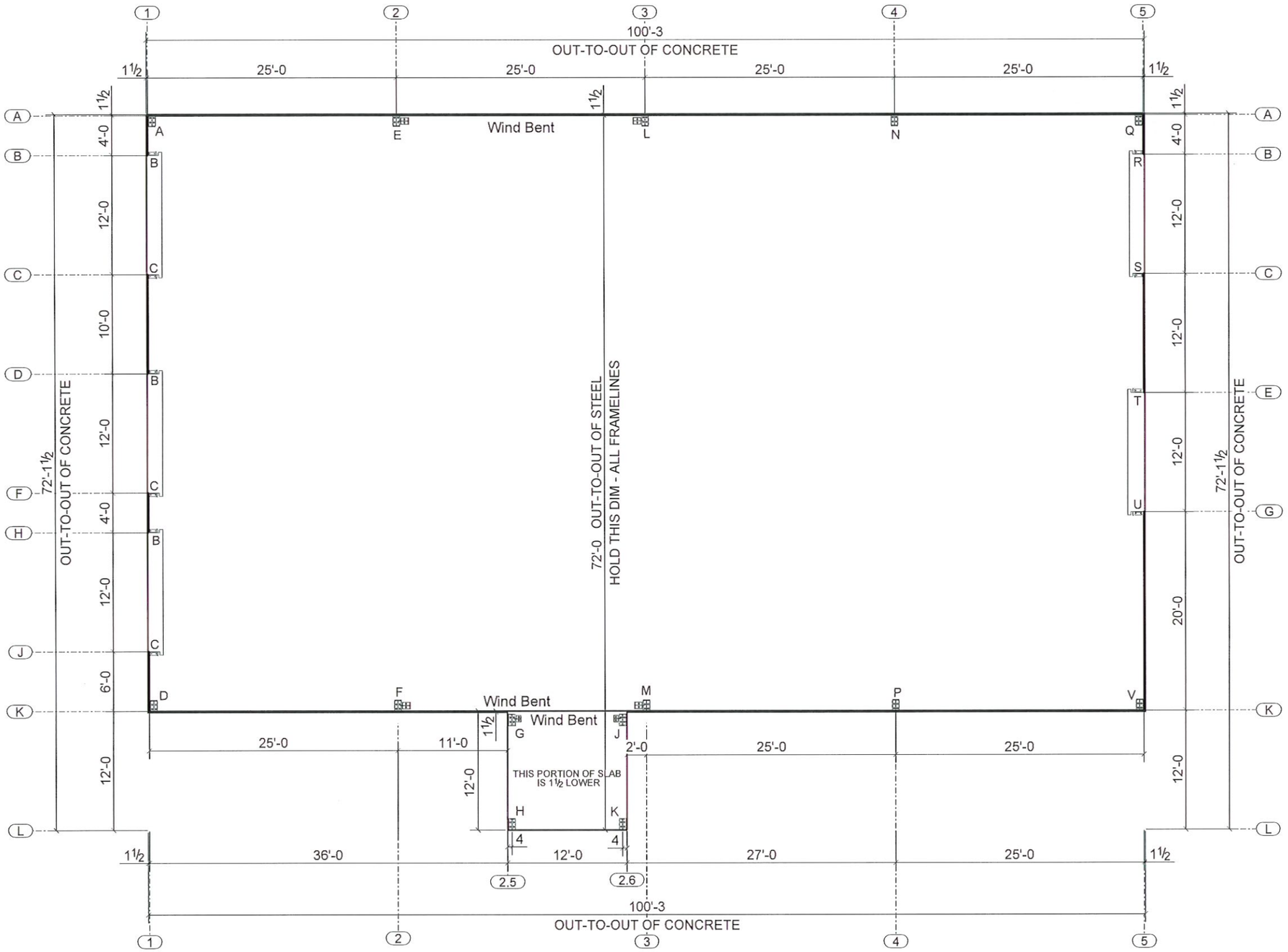
10/21/2024

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: COVERSHEET
CUSTOMER NAME: FUN ABOUNDS INC
END USER: BASTROP C0 PCT 2
SCALE: NON
SALESMAN: WESKEY CARTER
JOBSITE ADDRESS: 911 E. MLK BLVD SMITHVILLE, TX 78957
DETAILER: TRG
CHECKER:
DATE: 10/21/2024
JOB #: 6971245
DWG #: C1
REV: 0

Tekla Structures



ANCHOR BOLT PLAN
NOTE: Base Plates @ 100'-0"(U.N.)

ANCHOR BOLT SUMMARY			
	QTY	LOCATION	DIA
○	20	JAMB w/ MC5 Clip	5/8"
●	4	WIND COLUMN	3/4"
●	56	MAINFRAME	3/4"
●	8	WIND COLUMN	3/4"

For Visual Purposes, Base Plate Views may be Exaggerated Beyond Dwg Scale

FOR APPROVAL ONLY
NOT FOR CONSTRUCTION

If customer pours off this plan, customer is responsible for any possible changes

APPROVAL DRAWINGS FOR REVIEW

Please mark one selection, sign, date and return.

(✓) Approved with NO Changes:
Proceed with Fabrication

( ) Approved with Changes Noted:
Revise and Proceed with Fabrication

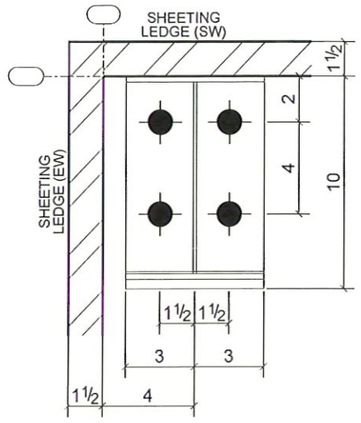
( ) Revise and Resubmit:
Revise and Send New Approval Drawings
** Delivery Date WILL BE DELAYED **

F-2689
STATE OF TEXAS
MATTHEW S. MALLEY
121601
LICENSED PROFESSIONAL ENGINEER
10/21/2024

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: ANCHOR BOLT PLAN
CUSTOMER NAME: FUN ABOUNDS INC
END USER: BASTROP C0 PCT 2
SCALE: 1:60
SALESMAN: WESKEY CARTER
JOBSITE ADDRESS: 911 E. MLK BLVD SMITHVILLE, TX 78957
DETAILER: TRG
CHECKER:
DATE: 10/21/2024
JOB #: 6971245
DWG #: AB1
REV: 0



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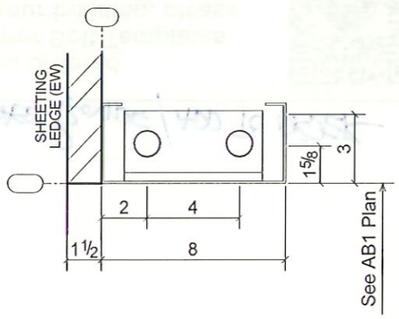

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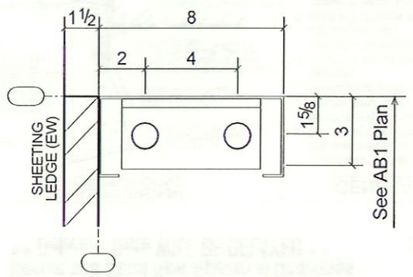

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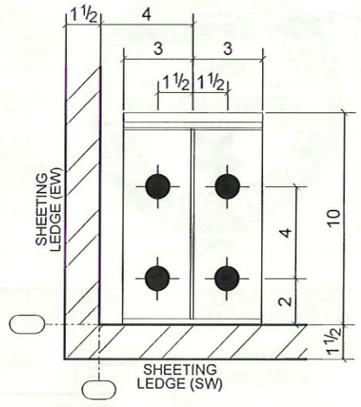

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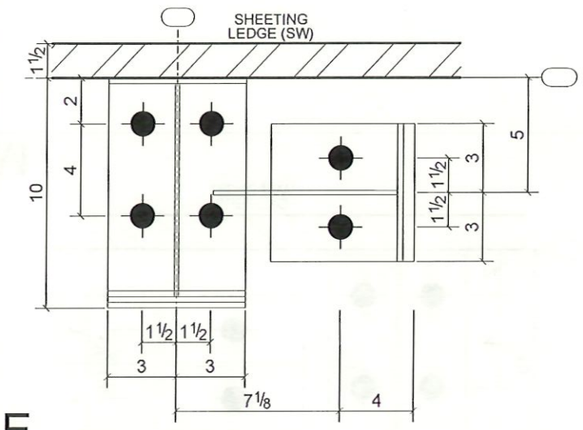

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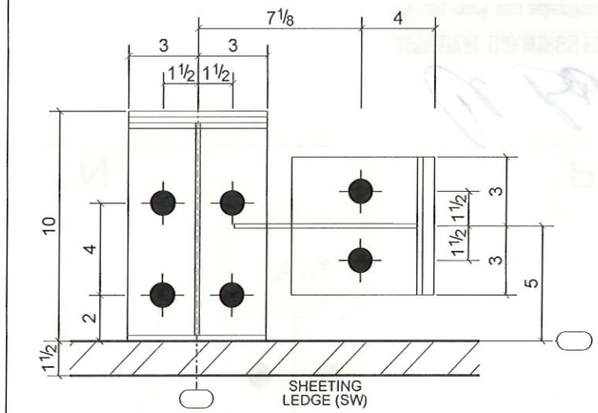

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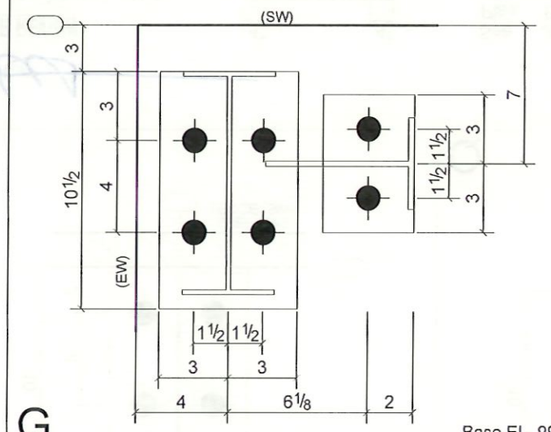


G

Base EL. 99'-10 ½"

SEE NOTE BELOW

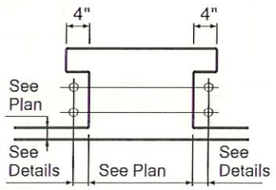
APPROVAL DRAWINGS FOR REVIEW

Please mark one selection, sign, date and return.

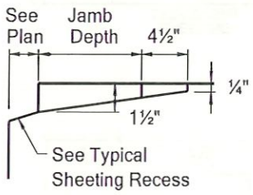
(✓) Approved with NO Changes:
Proceed with Fabrication

(✓) Approved with Changes Noted:
Revise and Proceed with Fabrication

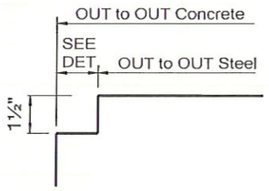
( ) Revise and Resubmit:
Revise and Send New Approval Drawings
** Delivery Date WILL BE DELAYED **



TYP. OVERHEAD DOOR BOLT LAYOUT

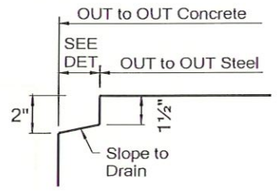


TYP. OVERHEAD DOOR RECESS



TYP. SHEETING RECESS WITH BASE DRIP EDGE TRIM

BASE DRIP EDGE TRIM MUST BE USED TO PREVENT EDGE CREEP.



TYP. SHEETING RECESS W/O BASE DRIP EDGE TRIM

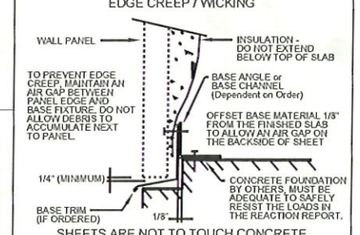
BASE DRIP EDGE TRIM NOT REQUIRED TO BE USED TO PREVENT EDGE CREEP.

○ DIA = 5/8"
✦ DIA = 3/4"

PLEASE PROVIDE/ADD TO ORDER

If you ordered Anchor Bolt Templates on your building, please visit our website:

www.muellerinc.com/downloads/videos/anchor-bolt-template-videos



SHEETS ARE NOT TO TOUCH CONCRETE

TYPICAL SECTION THRU WALL PANEL & CONCRETE FOUNDATION

GENERAL NOTES

1. Foundation design and construction are not the responsibility of MUELLER, INC.
2. The building reaction data reports the loads which this building places on the foundation.
3. Anchor Bolts shall be accurately set to a tolerance of ± 1/8" in both elevation and location.
4. Column base plates are designed not to exceed a bearing pressure of 1125 pounds per square inch.
5. Anchor Bolt sizes are based on the concrete design strength being a minimum of 3000 psi. Anchorage of the anchor bolts and adequacy of any foundation anchorage (including anchor bolts, drive pins, or any other foundation anchorage provided by MUELLER, INC.) is solely the responsibility of the foundation designer and / or customer.

F-2689

STATE OF TEXAS
MATTHEW S. MALLEY
121601
REGISTERED PROFESSIONAL ENGINEER

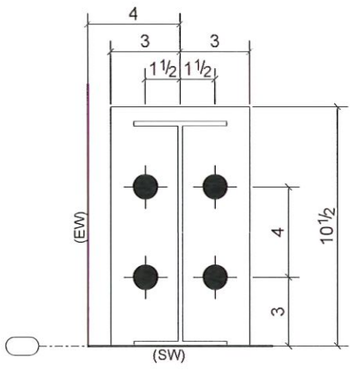
10/21/2024

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

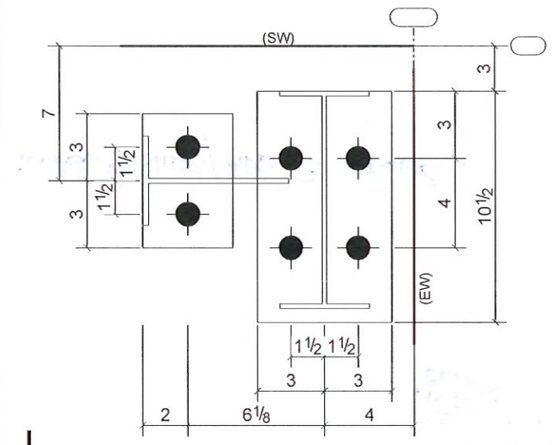
DRAWING DESCRIPTION: ANCHOR BOLT DETAILS

CUSTOMER NAME	END USER	SCALE
FUN ABOUNDS INC	BASTROP CO PCT 2	NONE
SALESMAN: WESKEY CARTER	JOBSITE ADDRESS: 911 E. MLK BLVD SMITHVILLE, TX 78957	
DETAILER: TRG / CHECKER:	DATE: 10/21/2024	JOB #: 6971245 / DWG #: AB2 / REV.: 0



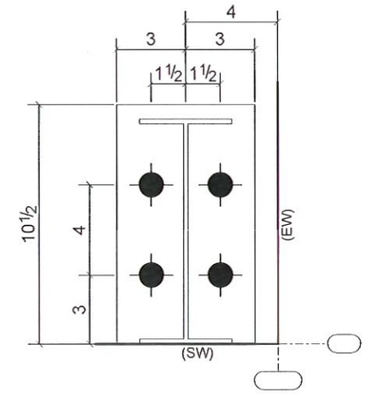
H

Base EL. 99'-10 ½"



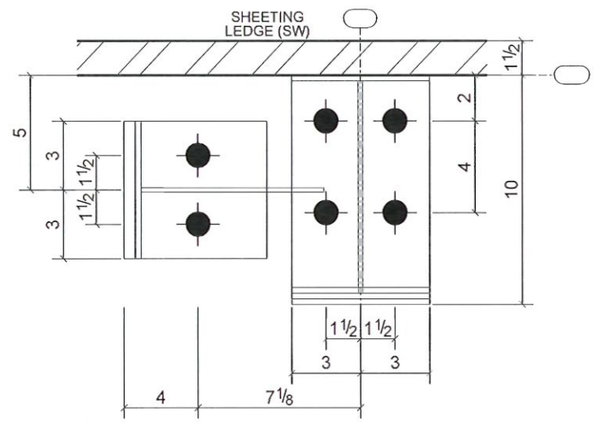
J

Base EL. 99'-10 ½"



K

Base EL. 99'-10 ½"



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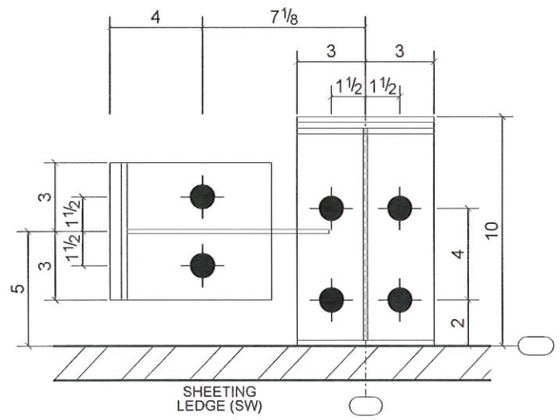

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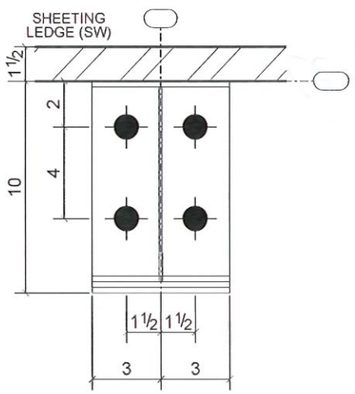

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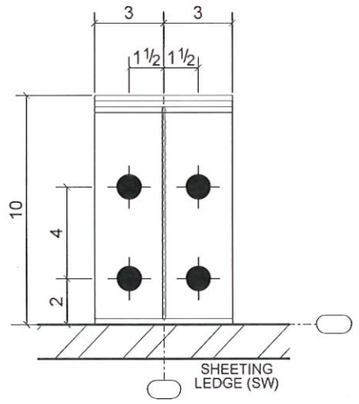

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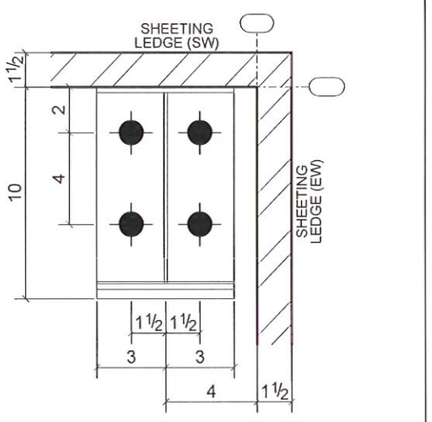


Q

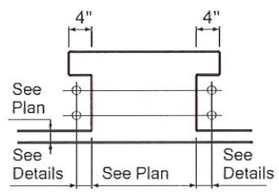
APPROVAL DRAWINGS FOR REVIEW

Please mark one selection, sign, date and return.

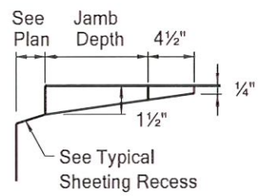
( ) Approved with NO Changes:
Proceed with Fabrication

(✓) Approved with Changes Noted:
Revise and Proceed with Fabrication

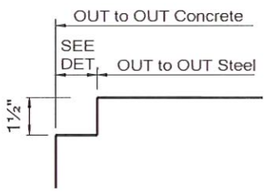
( ) Revise and Resubmit:
Revise and Send New Approval Drawings
** Delivery Date WILL BE DELAYED **



TYP. OVERHEAD
DOOR BOLT LAYOUT

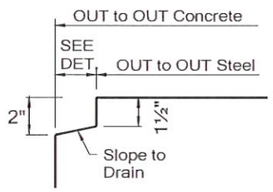


TYP. OVERHEAD
DOOR RECESS



TYP. SHEETING RECESS
WITH BASE DRIP EDGE TRIM

BASE DRIP EDGE TRIM MUST BE
USED TO PREVENT EDGE CREEP.



TYP. SHEETING RECESS
W/O BASE DRIP EDGE TRIM

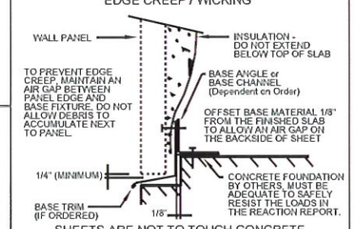
BASE DRIP EDGE TRIM NOT REQUIRED
TO BE USED TO PREVENT EDGE CREEP.

PLEASE PROVIDE / ADD TO ORDER

If you ordered
Anchor Bolt Templates
on your building, please
visit our website:

www.muellerinc.com/downloads/videos/anchor-bolt-template-videos

DIA = 3/4"



SHEETS ARE NOT TO TOUCH CONCRETE

TYPICAL SECTION THRU WALL
PANEL & CONCRETE FOUNDATION

GENERAL NOTES

1. Foundation design and construction are not the responsibility of MUELLER, INC.
2. The building reaction data reports the loads which this building places on the foundation.
3. Anchor Bolts shall be accurately set to a tolerance of ± 1/8" in both elevation and location.
4. Column base plates are designed not to exceed a bearing pressure of 1125 pounds per square inch.
5. Anchor Bolt sizes are based on the concrete design strength being a minimum of 3000 psi. Anchorage of the anchor bolts and adequacy of any foundation anchorage (including anchor bolts, drive pins, or any other foundation anchorage provided by MUELLER, INC.) is solely the responsibility of the foundation designer and / or customer.

F-2689

STATE OF TEXAS
MATTHEW S. MALLEY
121601
LICENSED
PROFESSIONAL ENGINEER

10/21/2024

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

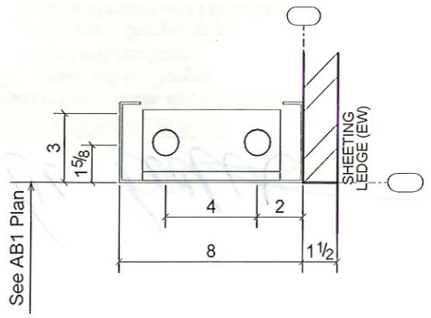
DRAWING DESCRIPTION: ANCHOR BOLT DETAILS

CUSTOMER NAME	END USER	SCALE
FUN ABOUNDS INC	BASTROP C0 PCT 2	NONE

SALESMAN	JOBSITE ADDRESS
WESKEY CARTER	911 E. MLK BLVD SMITHVILLE, TX 78957

DETAILER	CHECKER	DATE	JOB #	DWG #	REV.
TRG		10/21/2024	6971245	AB3	0

Tekla Structures



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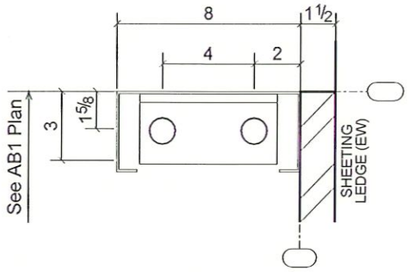

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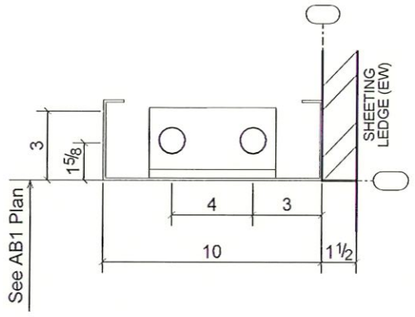

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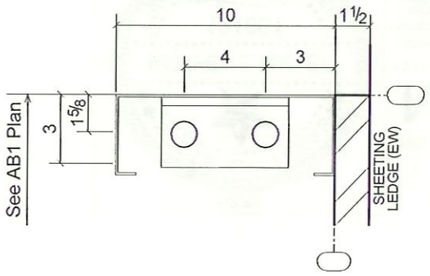

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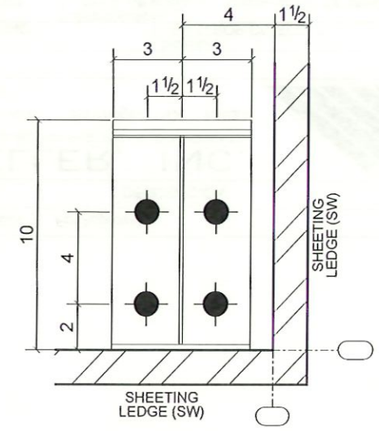

V

○ DIA = 5/8"

✦ DIA = 3/4"

Please Provide/Add to Order

If you ordered Anchor Bolt Templates on your building, please visit our website:

www.muellerinc.com/downloads/videos/anchor-bolt-template-videos

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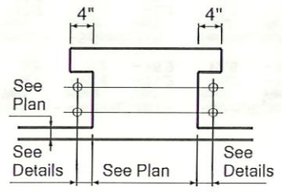
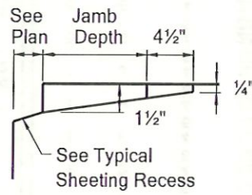
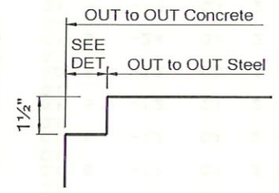


TYP. OVERHEAD DOOR BOLT LAYOUT

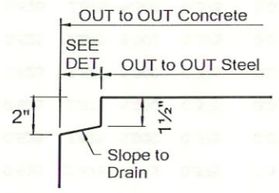


TYP. OVERHEAD DOOR RECESS



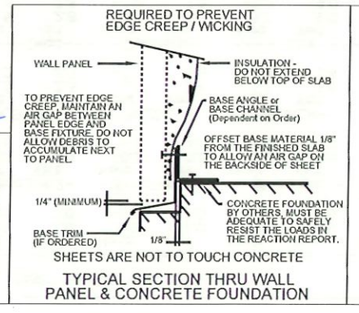
TYP. SHEETING RECESS WITH BASE DRIP EDGE TRIM

BASE DRIP EDGE TRIM MUST BE USED TO PREVENT EDGE CREEP.



TYP. SHEETING RECESS W/O BASE DRIP EDGE TRIM

BASE DRIP EDGE TRIM NOT REQUIRED TO BE USED TO PREVENT EDGE CREEP.



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F-2689

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MATTHEW S. MALLEY
121601
REGISTERED PROFESSIONAL ENGINEER

10/21/2024

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

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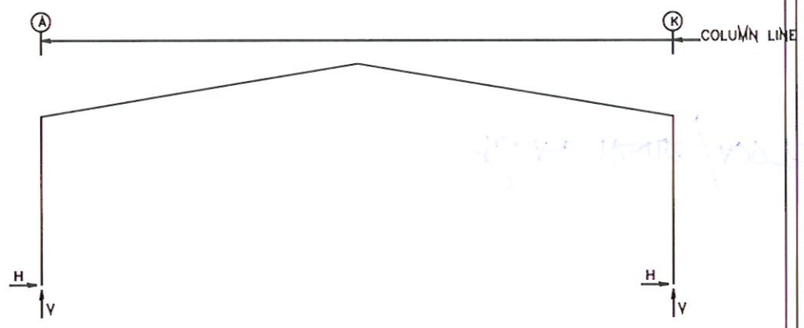
FUN ABOUNDS INC	BASTROP CO PCT 2	NONE

SALESMAN	JOBSITE ADDRESS
WESKEY CARTER	911 E. MLK BLVD SMITHVILLE, TX 78957

DETAILER	CHECKER	DATE	JOB #	DWG #	REV.
TRG		10/21/2024	6971245	AB4	0

FRAME LINES: 1 2 3 4 5



RIGID FRAME: MAXIMUM REACTIONS, ANCHOR BOLTS, & BASE PLATES

Frm Line	Col Line	Column_Reactions(k) Load Id	Hmax H	V Vmax	Load Id	Hmin H	V Vmin	Bolt(in) Qty	Bolt(in) Dia	Base_Plate(in) Width	Base_Plate(in) Length	Base_Plate(in) Thick	Grout (in)
1	A	1	4.2	8.6	2	-4.5	-8.5	4	0.750	6.000	10.00	0.500	0.0
1	K	3	4.5	-8.5	1	-4.2	8.6	4	0.750	6.000	10.00	0.500	0.0
		1	-4.2	8.6	3	4.5	-8.5						

RIGID FRAME: MAXIMUM REACTIONS, ANCHOR BOLTS, & BASE PLATES

Frm Line	Col Line	Column_Reactions(k) Load Id	Hmax H	V Vmax	Load Id	Hmin H	V Vmin	Bolt(in) Qty	Bolt(in) Dia	Base_Plate(in) Width	Base_Plate(in) Length	Base_Plate(in) Thick	Grout (in)
2*	A	1	8.3	13.3	2	-6.7	-11.0	4	0.750	6.000	10.00	0.500	0.0
2*	K	3	6.7	-11.0	1	-8.3	13.3	4	0.750	6.000	10.00	0.500	0.0
		1	-8.3	13.3	3	6.7	-11.0						

2* Frame lines: 2 3

RIGID FRAME: MAXIMUM REACTIONS, ANCHOR BOLTS, & BASE PLATES

Frm Line	Col Line	Column_Reactions(k) Load Id	Hmax H	V Vmax	Load Id	Hmin H	V Vmin	Bolt(in) Qty	Bolt(in) Dia	Base_Plate(in) Width	Base_Plate(in) Length	Base_Plate(in) Thick	Grout (in)
4	A	1	8.2	13.2	2	-6.6	-11.1	4	0.750	6.000	10.00	0.500	0.0
4	K	3	6.6	-11.1	1	-8.2	13.2	4	0.750	6.000	10.00	0.500	0.0
		1	-8.2	13.2	3	6.6	-11.1						

RIGID FRAME: MAXIMUM REACTIONS, ANCHOR BOLTS, & BASE PLATES

Frm Line	Col Line	Column_Reactions(k) Load Id	Hmax H	V Vmax	Load Id	Hmin H	V Vmin	Bolt(in) Qty	Bolt(in) Dia	Base_Plate(in) Width	Base_Plate(in) Length	Base_Plate(in) Thick	Grout (in)
5	A	1	4.2	8.6	2	-4.5	-8.5	4	0.750	6.000	10.00	0.500	0.0
5	K	3	4.5	-8.5	1	-4.2	8.6	4	0.750	6.000	10.00	0.500	0.0
		1	-4.2	8.6	3	4.5	-8.5						

RIGID FRAME: BASIC COLUMN REACTIONS (k)

Frame Line	Column Line	Dead Horiz	Dead Vert	Collateral Horiz	Collateral Vert	Live Horiz	Live Vert	Snow Horiz	Snow Vert	Wind_Left1 Horiz	Wind_Left1 Vert	Wind_Right1 Horiz	Wind_Right1 Vert
1	A	0.9	2.0	0.5	1.0	2.8	5.6	1.2	2.4	-8.3	-16.1	-3.0	-12.5
1	K	-0.9	2.0	-0.5	1.0	-2.8	5.6	-1.2	2.4	3.0	-12.5	8.3	-16.1

Frame Line	Column Line	Wind_Left2 Horiz	Wind_Left2 Vert	Wind_Right2 Horiz	Wind_Right2 Vert	Wind_Long1 Horiz	Wind_Long1 Vert	Wind_Long2 Horiz	Wind_Long2 Vert	Seismic_Left Horiz	Seismic_Left Vert	Seismic_Right Horiz	Seismic_Right Vert
1	A	-5.6	-4.1	-0.3	-0.5	-2.6	-12.5	-3.2	-11.1	-0.1	0.0	0.1	0.0
1	K	0.3	-0.5	5.6	-4.1	3.2	-11.1	2.6	-12.5	-0.1	0.0	0.1	0.0

Frame Line	Column Line	MIN_SNOW Horiz	MIN_SNOW Vert	F1UNB_SL_L Horiz	F1UNB_SL_L Vert	F1UNB_SL_R Horiz	F1UNB_SL_R Vert
1	A	1.2	2.3	1.1	2.4	1.1	1.5
1	K	-1.2	2.3	-1.1	1.5	-1.1	2.4

Frame Line	Column Line	Dead Horiz	Dead Vert	Collateral Horiz	Collateral Vert	Live Horiz	Live Vert	Snow Horiz	Snow Vert	Wind_Left1 Horiz	Wind_Left1 Vert	Wind_Right1 Horiz	Wind_Right1 Vert
2*	A	1.6	2.8	1.0	1.5	5.7	9.0	2.4	3.7	-12.7	-21.2	-5.3	-16.9
2*	K	-1.6	2.8	-1.0	1.5	-5.7	9.0	-2.4	3.8	5.3	-16.9	12.7	-21.2

Frame Line	Column Line	Wind_Left2 Horiz	Wind_Left2 Vert	Wind_Right2 Horiz	Wind_Right2 Vert	Wind_Long1 Horiz	Wind_Long1 Vert	Wind_Long2 Horiz	Wind_Long2 Vert	Seismic_Left Horiz	Seismic_Left Vert	Seismic_Right Horiz	Seismic_Right Vert
2*	A	-7.1	-2.0	0.3	2.3	-6.3	-19.9	-7.2	-17.7	-0.1	-0.1	0.1	0.1
2*	K	-0.3	2.3	7.1	-2.0	7.2	-17.7	6.3	-19.9	-0.1	0.1	0.1	-0.1

Frame Line	Column Line	MIN_SNOW Horiz	MIN_SNOW Vert	F2UNB_SL_L Horiz	F2UNB_SL_L Vert	F2UNB_SL_R Horiz	F2UNB_SL_R Vert
2*	A	2.4	3.8	2.2	3.8	2.2	2.3
2*	K	-2.4	3.8	-2.2	2.3	-2.2	3.8

Frame Line	Column Line	Dead Horiz	Dead Vert	Collateral Horiz	Collateral Vert	Live Horiz	Live Vert	Snow Horiz	Snow Vert	Wind_Left1 Horiz	Wind_Left1 Vert	Wind_Right1 Horiz	Wind_Right1 Vert
4	A	1.6	2.7	1.0	1.5	5.7	9.0	2.4	3.7	-12.6	-21.2	-5.2	-16.9
4	K	-1.6	2.7	-1.0	1.5	-5.7	9.0	-2.4	3.8	5.2	-16.9	12.6	-21.2

Frame Line	Column Line	Wind_Left2 Horiz	Wind_Left2 Vert	Wind_Right2 Horiz	Wind_Right2 Vert	Wind_Long1 Horiz	Wind_Long1 Vert	Wind_Long2 Horiz	Wind_Long2 Vert	Seismic_Left Horiz	Seismic_Left Vert	Seismic_Right Horiz	Seismic_Right Vert
4	A	-7.1	-2.0	0.3	2.3	-6.2	-19.9	-7.1	-17.7	-0.1	-0.1	0.1	0.1
4	K	-0.3	2.3	7.1	-2.0	7.1	-17.7	6.2	-19.9	-0.1	0.1	0.1	-0.1

Frame Line	Column Line	MIN_SNOW Horiz	MIN_SNOW Vert	F3UNB_SL_L Horiz	F3UNB_SL_L Vert	F3UNB_SL_R Horiz	F3UNB_SL_R Vert
4	A	2.4	3.8	2.2	3.8	2.2	2.3
4	K	-2.4	3.8	-2.2	2.3	-2.2	3.8

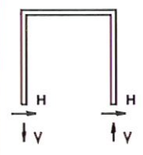
Frame Line	Column Line	Dead Horiz	Dead Vert	Collateral Horiz	Collateral Vert	Live Horiz	Live Vert	Snow Horiz	Snow Vert	Wind_Left1 Horiz	Wind_Left1 Vert	Wind_Right1 Horiz	Wind_Right1 Vert
5	A	0.9	2.0	0.5	1.0	2.8	5.6	1.2	2.4	-8.3	-16.1	-3.0	-12.5
5	K	-0.9	2.0	-0.5	1.0	-2.8	5.6	-1.2	2.4	3.0	-12.5	8.3	-16.1

Frame Line	Column Line	Wind_Left2 Horiz	Wind_Left2 Vert	Wind_Right2 Horiz	Wind_Right2 Vert	Wind_Long1 Horiz	Wind_Long1 Vert	Wind_Long2 Horiz	Wind_Long2 Vert	Seismic_Left Horiz	Seismic_Left Vert	Seismic_Right Horiz	Seismic_Right Vert
5	A	-5.6	-4.1	-0.3	-0.5	-2.6	-12.5	-3.2	-11.1	-0.1	0.0	0.1	0.0
5	K	0.3	-0.5	5.6	-4.1	3.2	-11.1	2.6	-12.5	-0.1	0.0	0.1	0.0

Frame Line	Column Line	MIN_SNOW Horiz	MIN_SNOW Vert	F4UNB_SL_L Horiz	F4UNB_SL_L Vert	F4UNB_SL_R Horiz	F4UNB_SL_R Vert
5	A	1.2	2.3	1.1	2.4	1.1	1.5
5	K	-1.2	2.3	-1.1	1.5	-1.1	2.4

2* Frame lines: 2 3

WIND BENT REACTIONS



Wall Loc	Wall Line	Col Line	± Reactions Wind(k) Horz	Wind(k) Vert	Seismic(k) Horz	Seismic(k) Vert	Bolt(in) Qty	Bolt(in) Dia	Base_Plate(in) Width	Base_Plate(in) Length	Base_Plate(in) Thick
F_SW	K	2	2.4	2.8	0.2	0.3	2	0.750	6.000	10.500	0.500
F_SW	K	3	2.4	2.8	0.2	0.3	2	0.750	6.000	10.500	0.500
B_SW	A	3	2.4	2.8	0.2	0.3	2	0.750	6.000	10.500	0.500
B_SW	A	2	2.4	2.8	0.2	0.3	2	0.750	6.000	10.500	0.500

ENDWALL COLUMN: BASIC COLUMN REACTIONS (k)

Frm Line	Col Line	Dead Vert	Wind Press Horz	Wind Suct Horz	Seis Long Vert
1	B	0.1	-1.7	1.8	0.0
1	C	0.1	-2.6	2.8	0.0
1	D	0.1	-2.9	3.1	0.0
1	F	0.1	-2.0	2.2	0.0
1	H	0.1	-1.9	2.1	0.0
1	J	0.1	-1.9	2.1	0.0
5	G	0.1	-4.0	4.2	0.0
5	E	0.1	-3.2	3.4	0.0
5	C	0.1	-2.8	3.1	0.0
5	B	0.1	-1.7	1.8	0.0

ENDWALL COLUMN: MAXIMUM REACTIONS, ANCHOR BOLTS, & BASE PLATES

Frm Line	Col Line	Column_Reactions(k) Load Id	Hmax H	V Vmax	Load Id	Hmin H	V Vmin	Bolt(in) Qty	Bolt(in) Dia	Base_Plate(in) Width	Base_Plate(in) Length	Base_Plate(in) Thick	Grout (in)
1	B	4	1.1	0.0	5	-1.0	0.0	2	0.625	2.875	6.000	0.375	0.0
		6	1.1	0.1									
1	C	4	1.7	0.1	5	-1.6	0.1	2	0.625	2.875	6.000	0.375	0.0
		6	1.7	0.1									
1	D	4	1.8	0.1	5	-1.7	0.1	2	0.625	2.875	6.000	0.375	0.0
		6	1.8	0.1									
1	F	4	1.3	0.1	5	-1.2	0.1	2	0.625	2.875	6.000	0.375	0.0
		6	1.3	0.1									
1	H	4	1.2	0.1	5	-1.2	0.1	2	0.625	2.875	6.000	0.375	0.0
		6	1.2	0.1									
1	J	4	1.3	0.0	5	-1.2	0.0	2	0.625	2.875	6.000	0.375	0.0
		6	1.3	0.1									
5	G	4	2.5	0.1	5	-2.4	0.1	2	0.625	2.875	6.000	0.375	0.0
		6	2.5	0.1									
5	E	4	2.1	0.1	5	-1.9	0.1	2	0.625	2.875	6.000	0.375	0.0
		6	2.1	0.1									
5	C	4	1.8	0.1	5	-1.7	0.1	2	0.625	2.875	6.000	0.375	0.0
		6	1.8	0.1									
5	B	4	1.1	0.0	5	-1.0	0.0	2	0.625	2.875	6.000	0.375	0.0
		6	1.1	0.1									

BUILDING BRACING REACTIONS

Wall Loc	Wall Line	Col Line	± Reactions(k) Wind Horz	Wind Vert	Seismic Horz	Seismic Vert	Panel_Shear (lb/ft) Wind	Panel_Shear (lb/ft) Seis	Note
L_EW	1								(h)
F_SW	K	2,3							(a)
R_EW	5								(h)
B_SW	A	2,3							(a)

(a) Wind bent in bay
(h) Rigid frame at endwall

Reactions for seismic represent shear force, E

LOAD COMBINATIONS

ID	Description
1	Dead+Collateral+Live
2	0.6Dead+0.6Wind_Left1
3	0.6Dead+0.6Wind_Right1
4	0.6Dead+0.6Wind_Right2+0.6Wind_Suction
5	0.6Dead+0.6Wind_Pressure+0.6Wind_Long2L
6	Dead+0.6Wind_Right2+0.6Wind_Suction

APPROVAL DRAWINGS FOR REVIEW

Please mark one selection, sign, date and return.

(✓) Approved with NO Changes:
Proceed with Fabrication

( ) Approved with Changes Noted:
Revise and Proceed with Fabrication

( ) Revise and Resubmit:
Revise and Send New Approval Drawings
** Delivery Date WILL BE DELAYED **

F-2689

STATE OF TEXAS
MATTHEW S. MALLEY
121601
PROFESSIONAL ENGINEER
10/21/2024

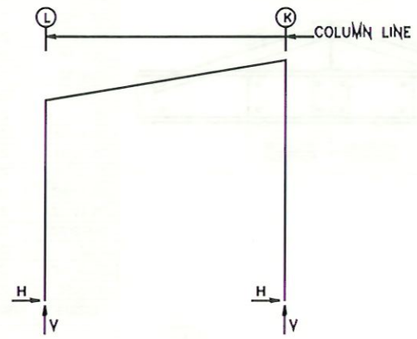
REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: REACTIONS
CUSTOMER NAME: FUN ABOUNDS INC
END USER: BASTROP C0 PCT 2
SCALE: NON
SALESMAN: WESKEY CARTER
JOBSITE ADDRESS: 911 E. MLK BLVD SMITHVILLE, TX 78957
DETAILER: TRG
CHECKER:
DATE: 10/21/2024
JOB #: 6971245
DWG #: AB5
REV.: 0

Tekla Structures

FRAME LINES: 2.6 2.5



RIGID FRAME: MAXIMUM REACTIONS, ANCHOR BOLTS, & BASE PLATES

Frm Line	Col Line	Column_Reactions(k) Load Id	Hmax H	V Vmax	Load Id	Hmin H	V Vmin	Bolt(in) Qty	Bolt(in) Dia	Base_Plate(in) Width	Base_Plate(in) Length	Base_Plate(in) Thick	Grout (in)
2.6*	L	3	0.7	0.3	7	-0.7	-0.4	4	0.750	6.000	10.50	0.500	-1.5
		4	0.3	1.3	5	-0.3	-0.9						
2.6*	K	8	0.7	-0.4	2	-0.5	-0.2	4	0.750	6.000	10.50	0.500	-1.5
		1	-0.1	1.1	6	0.4	-1.0						

2.6* Frome lines: 2.6 2.5

RIGID FRAME: BASIC COLUMN REACTIONS (k)

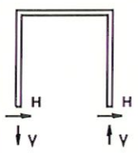
Frome Line	Column Line	Dead Horiz	Dead Vert	Collateral Horiz	Collateral Vert	Live Horiz	Live Vert	Snow Horiz	Snow Vert	Snow_Drift Horiz	Snow_Drift Vert	Slide_Snow Horiz	Slide_Snow Vert
2.6*	L	0.0	0.3	0.0	0.1	0.1	0.7	0.0	0.2	0.0	0.0	0.0	0.2
2.6*	K	0.0	0.3	0.0	0.1	-0.1	0.8	0.0	0.2	0.0	0.2	0.0	0.2

Frome Line	Column Line	Wind_Left1 Horiz	Wind_Left1 Vert	Wind_Right1 Horiz	Wind_Right1 Vert	Wind_Left2 Horiz	Wind_Left2 Vert	Wind_Right2 Horiz	Wind_Right2 Vert	Wind_Long1 Horiz	Wind_Long1 Vert	Wind_Long2 Horiz	Wind_Long2 Vert
2.6*	L	-0.5	-1.8	1.2	0.1	-1.1	-0.9	0.6	1.0	0.6	-0.9	0.5	-0.8
2.6*	K	-0.8	-0.7	0.6	-1.9	-0.2	0.2	1.2	-1.0	-0.5	-1.1	-0.6	-0.8

Frome Line	Column Line	MIN_SNOW Horiz	MIN_SNOW Vert
2.6*	L	0.0	0.2
2.6*	K	0.0	0.2

2.6* Frome lines: 2.6 2.5

WIND BENT REACTIONS



Loc	Wall Line	Col Line	± Reactions Wind(k) Horz	Wind(k) Vert	Seismic(k) Horz	Seismic(k) Vert	Bolt(in) Qty	Bolt(in) Dia	Base_Plate(in) Width	Base_Plate(in) Length	Base_Plate(in) Thick
F_SW	K	2.6	0.3	0.6	0.0	0.0	2	0.750	6.000	8.000	0.500
F_SW	K	2.5	0.3	0.6	0.0	0.0	2	0.750	6.000	8.000	0.500

BUILDING BRACING REACTIONS

Loc	Wall Line	Col Line	± Reactions(k) Wind Horz	Wind Vert	Seismic Horz	Seismic Vert	Panel_Shear (lb/ft) Wind	Panel_Shear (lb/ft) Seis	Note
L_EW	2.6								(h)
F_SW	K	2.6,2.5							(a)
R_EW	2.5								(h)
B_SW	L						1250	357	

(a)Wind bent in bay
(h)Rigid frame at endwall

Reactions for seismic represent shear force, E

LOAD COMBINATIONS

ID Description

1 Dead+Collateral+Live
2 Dead+0.6Wind_Left1
3 Dead+0.6Wind_Right1
4 Dead+Collateral+0.75Live+0.45Wind_Right2
5 0.6Dead+0.6Wind_Left1
6 0.6Dead+0.6Wind_Right1
7 0.6Dead+0.6Wind_Left2
8 0.6Dead+0.6Wind_Right2

APPROVAL DRAWINGS FOR REVIEW

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(✓) Approved with NO Changes:
Proceed with Fabrication

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Revise and Proceed with Fabrication

( ) Revise and Resubmit:
Revise and Send New Approval Drawings
** Delivery Date WILL BE DELAYED **

F-2689

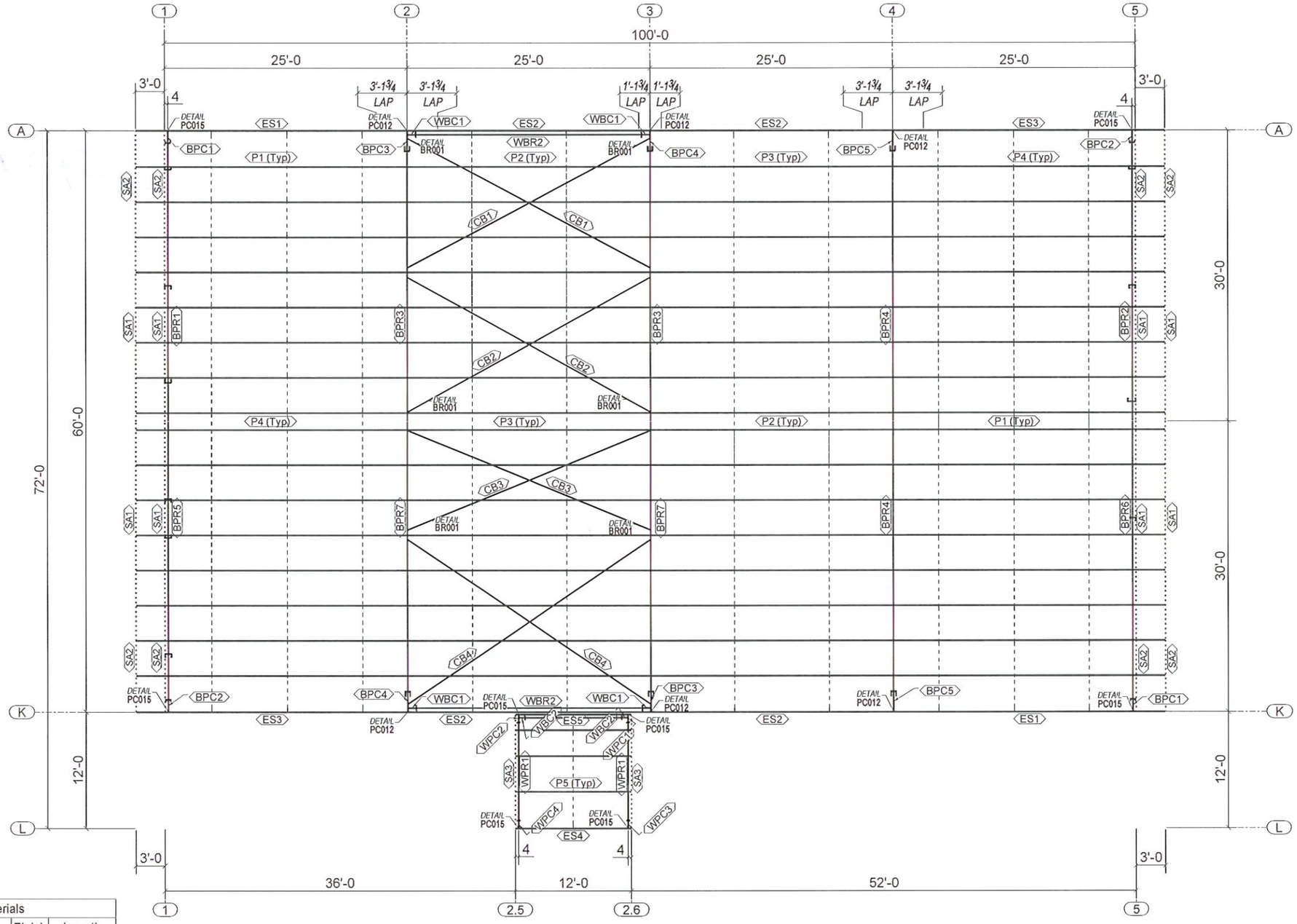
STATE OF TEXAS
MATTHEW S. MALLEY
121601
REGISTERED PROFESSIONAL ENGINEER
10/21/2024

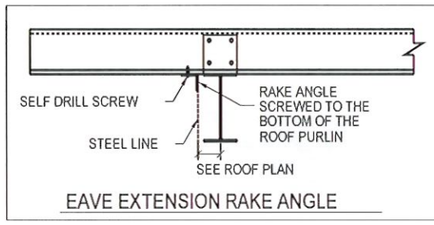
REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: REACTIONS
CUSTOMER NAME: FUN ABOUNDS INC
END USER: BASTROP CO PCT 2
SCALE: NONE
SALESMAN: WESKEY CARTER
JOBSITE ADDRESS: 911 E. MLK BLVD SMITHVILLE, TX 78957
DETAILER: TRG
CHECKER:
DATE: 10/21/2024
JOB #: 6971245
DWG #: AB6
REV: 0

Tekla Structures

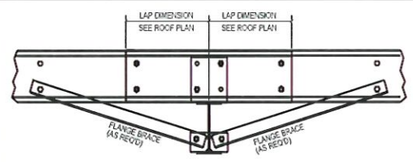




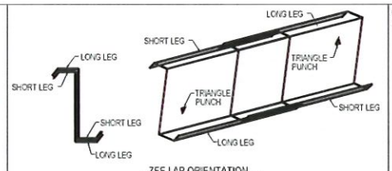
EAVE EXTENSION RAKE ANGLE

ROOF PLAN

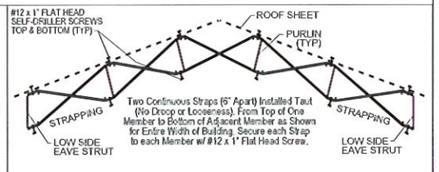
Bill of Materials				
Qty	Mark	Profile	Finish	Length
2	CB1	CB5/16D	GZ	26'-7 1/4"
2	CB2	CB1/4D	GZ	26'-10 3/8"
2	CB3	CB1/4D	GZ	25'-3"
2	CB4	CB5/16D	GZ	28'-6 5/16"
2	ES1	82E14DU-2	GZ	27'-11 1/2"
4	ES2	82E14DU-2	GZ	24'-11 1/2"
2	ES3	82E14DU-2	GZ	27'-11 1/2"
1	ES4	82E14DU-2	GZ	11'-11 1/2"
1	ES5	82E14DD-2	GZ	11'-11 1/2"
16	P1	8X25Z14	GZ	31'-1 1/2"
16	P2	8X25Z16	GZ	29'-3 1/2"
16	P3	8X25Z16	GZ	29'-3 1/2"
16	P4	8X25Z14	GZ	31'-1 1/2"
3	P5	8X25Z16	GZ	11'-11 1/2"
12	SA1	L4X2x14GA	GZ	23'-1 5/8"
12	SA2	L4X2x14GA	GZ	7'-7 13/16"
2	SA3	L4X2x14GA	GZ	11'-9 3/4"



ROOF PURLIN LAP DETAIL
@ DETAIL PC003 ONLY



ZEE LAP ORIENTATION
TRIANGLE PUNCHES AT ENDS OF ZEE MEMBERS ALWAYS POINT TO LONG LEG



GABLE ROOF STRAPPING
INSTALLATION DETAIL

F-2689
STATE OF TEXAS
MATTHEW S. MALLEY
121601
LICENSED PROFESSIONAL ENGINEER
10/21/2024

APPROVAL DRAWINGS FOR REVIEW

Please mark one selection, sign, date and return

( ) Approved with NO Changes:
Proceed with Fabrication

( ) Approved with Changes Noted:
Revise and Proceed with Fabrication

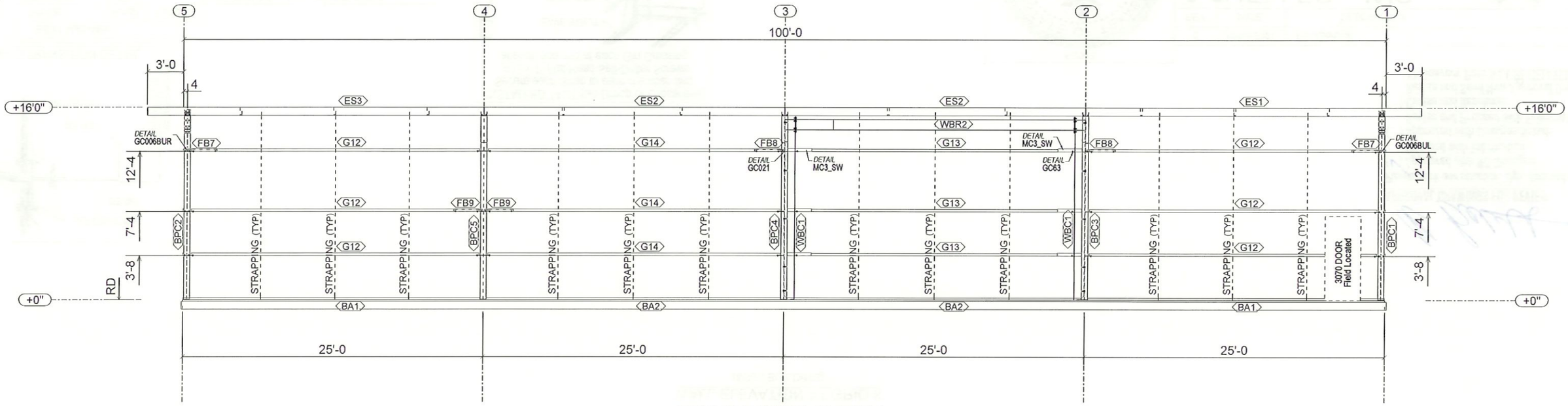
( ) Revise and Resubmit:
Revise and Send New Approval Drawing
** Delivery Date WILL BE DELAYED **

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: ROOF PLAN			
CUSTOMER NAME: FUN ABOUNDS INC	END USER: BASTROP C0 PCT 2		SCALE: 1:62
SALESMAN: WESKEY CARTER	JOBSITE ADDRESS: 911 E. MLK BLVD SMITHVILLE, TX 78957		
DETAILER: TRG / CHECKER	DATE: 10/21/2024	JOB #: 6971245	DWG #: E1 / REV.: 0

Tekla Structures



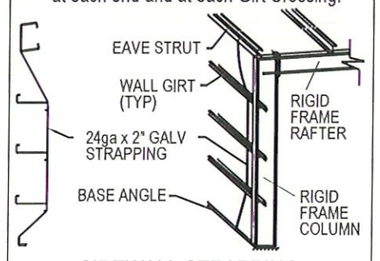
WALL ELEVATION AT GRID A

Bill of Materials				
Qty	Mark	Profile	Finish	Length
2	WBC1	PL3/16"X10"	RO	
1	WBR2	PL1/8"X10"	RO	
2	BA1	L4X2x14GA	GZ	24'-8 1/2"
2	BA2	L4X2x14GA	GZ	24'-5 1/2"
2	FB7	2X2L12	GZ	2'-5 1/2"
2	FB8	2X2L12	GZ	2'-9 1/16"
2	FB9	2X2L12	GZ	2'-6 1/2"
6	G12	10X25C14	GZ	23'-11 3/8"
3	G13	10X25C14	GZ	23'-2 5/16"
3	G14	10X25C14	GZ	24'-3 5/16"

WINDBENT BUILT UP MEMBER TABLE			
Mark	Type	Thick x Max Width	x Length
WBC1	WB	PL3/16"X10"	x 179 1/4"
WBR2	WB	PL1/8"X10"	x 37 5/16"

Wind Bent Connection Bolt Table			
Connected Assemblies			Bolt Description
WBC1	------>	BPC4	10 ~ 3/4" x 2 1/2" A325N
WBC1	------>	BPC3	10 ~ 3/4" x 2 1/2" A325N
WBC1	------>	WBR2	8 ~ 3/4" x 2 1/2" A325N

INSTALLED TAUT (No Droop or Looseness)
Secure each Strap to each member with #12 x 1" Flat Head Self-Driller Screws at each end and at each Girt Crossing.



SIDEWALL STRAPPING

APPROVAL DRAWINGS FOR REVIEW

Please mark one selection, sign, date and return

(✓) Approved with NO Changes:
Proceed with Fabrication

( ) Approved with Changes Noted:
Revise and Proceed with Fabrication

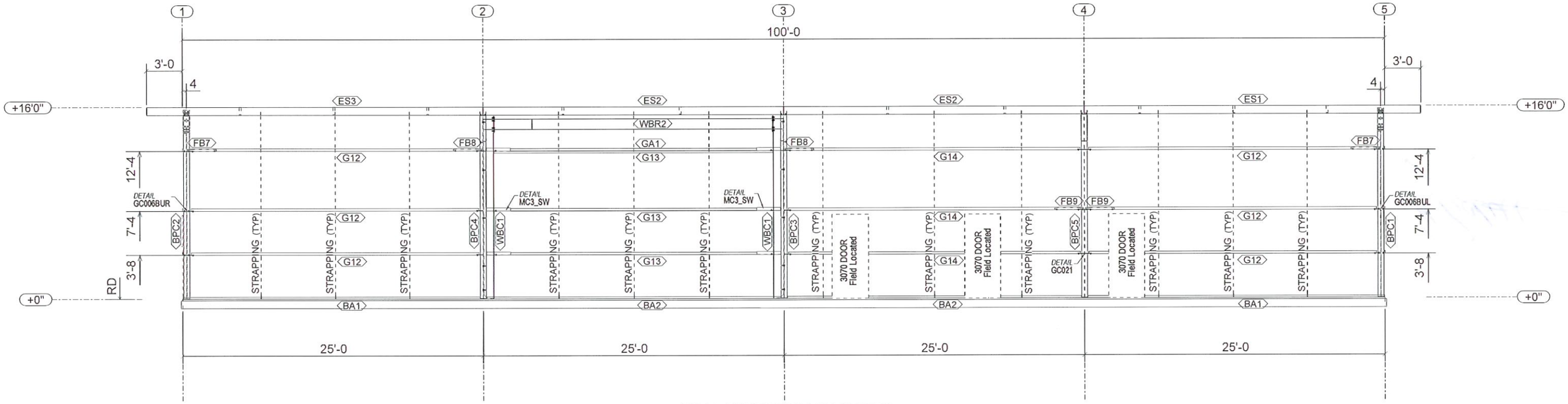
( ) Revise and Resubmit:
Revise and Send New Approval Drawing
** Delivery Date WILL BE DELAYED **

F-2689
STATE OF TEXAS
MATTHEW S. MALLEY
121601
LICENSED PROFESSIONAL ENGINEER
10/21/2024

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

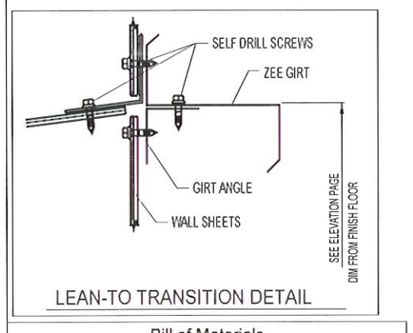
MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: WALL ELEVATION AT GRID A
CUSTOMER NAME: FUN ABOUNDS INC
END USER: BASTROP CO PCT 2
SCALE: 1:45
SALESMAN: WESKEY CARTER
JOBSITE ADDRESS: 911 E. MLK BLVD SMITHVILLE, TX 78957
DETAILER: TRG
CHECKER:
DATE: 10/21/2024
JOB #: 6971245
DWG #: E2
REV.: 0



WALL ELEVATION AT GRID K

(MAIN BUILDING)



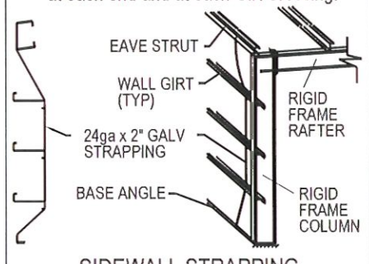
LEAN-TO TRANSITION DETAIL

Bill of Materials				
Qty	Mark	Profile	Finish	Length
2	WBC1	PL3/16"X10"	RO	
1	WBR2	PL1/8"X10"	RO	
2	BA1	L4X2x14GA	GZ	24'-8 1/2"
2	BA2	L4X2x14GA	GZ	24'-5 1/2"
2	FB7	2X2L12	GZ	2'-5 1/2"
2	FB8	2X2L12	GZ	2'-9 1/16"
2	FB9	2X2L12	GZ	2'-6 1/2"
6	G12	10X25C14	GZ	23'-11 5/16"
3	G13	10X25C14	GZ	23'-2 5/16"
3	G14	10X25C14	GZ	24'-3 5/16"
1	GA1	L4X2x14GA	GZ	23'-2 5/16"

WINDBENT BUILT UP MEMBER TABLE			
Mark	Type	Thick x Max Width x Length	
WBC1	WB	PL3/16"X10"	x 179 1/4"
WBR2	WB	PL1/8"X10"	x 37 5/16"

Wind Bent Connection Bolt Table			
Connected Assemblies			Bolt Description
WBC1	------>	BPC4	10 ~ 3/4" x 2 1/2" A325N
WBC1	------>	BPC3	10 ~ 3/4" x 2 1/2" A325N
WBC1	------>	WBR2	8 ~ 3/4" x 2 1/2" A325N

INSTALLED TAUT (No Droop or Looseness)
Secure each Strap to each member with #12 x 1" Flat Head Self-Driller Screws at each end and at each Girt Crossing.



SIDEWALL STRAPPING

F-2689

STATE OF TEXAS
MATTHEW S. MALLEY
121601
REGISTERED PROFESSIONAL ENGINEER
10/21/2024

APPROVAL DRAWINGS FOR REVIEW

Please mark one selection, sign, date and return

(✓) Approved with NO Changes:
Proceed with Fabrication

( ) Approved with Changes Noted:
Revise and Proceed with Fabrication

( ) Revise and Resubmit:
Revise and Send New Approval Drawings
** Delivery Date WILL BE DELAYED **

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

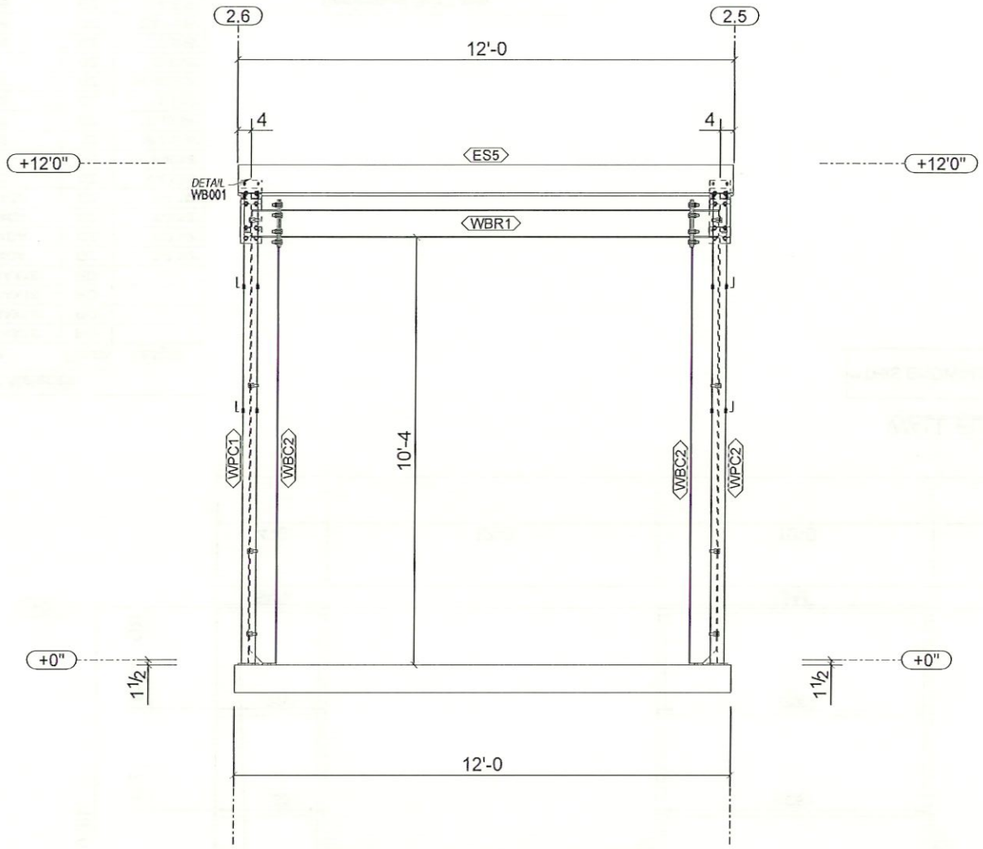
MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: WALL ELEVATION AT GRID K

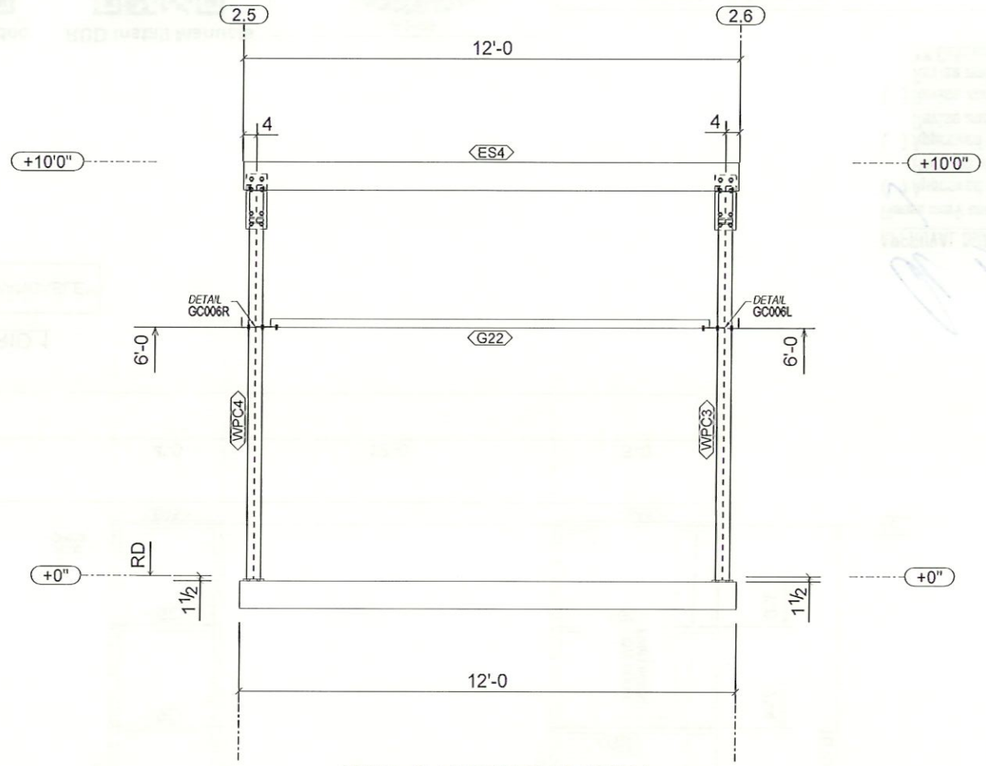
CUSTOMER NAME	END USER	SCALE
FUN ABOUNDS INC	BASTROP CO PCT 2	1:45

SALESMAN	JOBSITE ADDRESS
WESKEY CARTER	911 E. MLK BLVD SMITHVILLE, TX 78957

DETAILER	CHECKER	DATE	JOB #	DWG #	REV.
TRG		10/21/2024	6971245	E3	0



WALL ELEVATION AT GRID K



WALL ELEVATION AT GRID L

APPROVAL DRAWINGS FOR REVIEW

Please mark one selection, sign, date and return

(✓) Approved with NO Changes:
Proceed with Fabrication

( ) Approved with Changes Noted:
Revise and Proceed with Fabrication

( ) Revise and Resubmit:
Revise and Send New Approval Drawing
** Delivery Date WILL BE DELAYED **

Bill of Materials				
Qty	Mark	Profile	Finish	Length
2	WBC2	W8X13	RO	
1	WBR1	W8X13	RO	
1	G22	8X25C16	GZ	10'-7 5/16"

Wind Bent Connection Bolt Table		
Connected Assemblies		Bolt Description
WBC2 ------>	WPC1	8 ~ 3/4" x 2 1/2" A325N
WBC2 ------>	WPC2	8 ~ 3/4" x 2 1/2" A325N
WBC2 ------>	WBR1	8 ~ 3/4" x 2 1/2" A325N

F-2689

STATE OF TEXAS
MATTHEW S. MALLEY
121601
REGISTERED PROFESSIONAL ENGINEER

10/21/2024

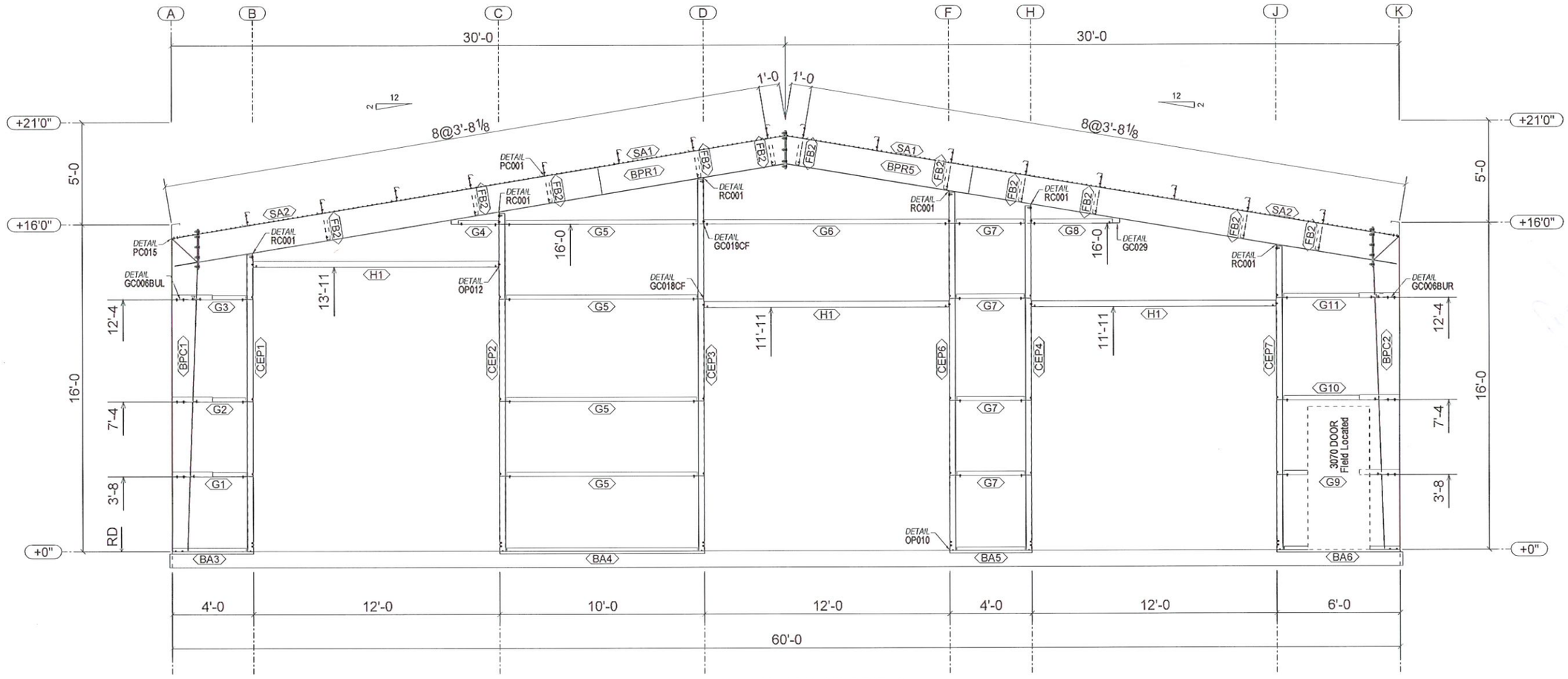
REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: WALL ELEVATION AT GRID K, L

CUSTOMER NAME	END USER	SCALE
FUN ABOUNDS INC	BASTROP C0 PCT 2	1:20

SALESMAN	JOBSITE ADDRESS			
WESKEY CARTER	911 E. MLK BLVD SMITHVILLE, TX 78957			
DETAILER / CHECKER	DATE	JOB #	DWG #	REV.
TRG	10/21/2024	6971245	E4	0



WALL ELEVATION AT GRID 1

THIS ENDWALL FRAME IS NOT EXPANDABLE

Bill of Materials				
Qty	Mark	Profile	Finish	Length
1	BPC1	SHT10GAX15"	RO	
1	BPC2	SHT10GAX15"	RO	
1	BPR1	SHT10GAX16"	RO	
1	BPR5	SHT10GAX16"	RO	
1	BA3	L4X2X14GA	GZ	3'-7 1/2"
1	BA4	L4X2X14GA	GZ	9'-3 1/2"
1	BA5	L4X2X14GA	GZ	3'-3 1/2"
1	BA6	L4X2X14GA	GZ	5'-7 1/2"
1	CEP1	8X35C12	GZ	14'-6 5/16"
1	CEP2	8X35C12	GZ	16'-6 3/8"
1	CEP3	8X35C12	GZ	18'-2 5/16"
1	CEP4	8X35C12	GZ	16'-10 3/8"
1	CEP6	8X35C12	GZ	17'-6 5/16"
1	CEP7	8X35C12	GZ	14'-10 5/16"
11	FB2	2X2L12	GZ	2'-9 5/8"
1	G1	8X25C16	GZ	2'-8 5/16"
1	G2	8X25C16	GZ	2'-6 11/16"
1	G3	8X25C16	GZ	2'-4 9/16"
1	G4	8X25C16	GZ	1'-11 1/2"
4	G5	8X25C16	GZ	9'-3 5/16"
1	G6	8X25C16	GZ	11'-11 1/2"
4	G7	8X25C16	GZ	3'-3 5/16"
1	G8	8X25C16	GZ	3'-11 1/2"
1	G9	8X25C16	GZ	4'-8 5/16"
1	G10	8X25C16	GZ	4'-6 11/16"
1	G11	8X25C16	GZ	4'-4 9/16"
3	H1	8X35C14	GZ	11'-11 1/2"

Component Bolt Table			
Detail ID	Connected Assemblies ↓	Conn. Clip ↓	Bolt Description
RC001			
	BPR1→ CEP1	2 ~ 5/8"x 2"	A325N
	BPR1→ CEP2	2 ~ 5/8"x 2"	A325N
	BPR1→ CEP3	2 ~ 5/8"x 2"	A325N
	BPR5→ CEP4	2 ~ 5/8"x 2"	A325N
	BPR5→ CEP6	2 ~ 5/8"x 2"	A325N
	BPR5→ CEP7	2 ~ 5/8"x 2"	A325N

RUD Install Video

RUD Install Manuals

For additional help with installation of your building, please visit our website:
www.muellerinc.com/downloads/download-manuals

ALL ENDWALL COLUMNS AND JAMBS ARE DESIGNED AS "POSTS" AS DEFINED BY OSHA AND ARE NOT INTENDED TO BE CLIMBED ON UNTIL FULLY BRACED.

F-2689

STATE OF TEXAS
MATTHEW S. MALLEY
121601
LICENSED
PROFESSIONAL ENGINEER

10/21/2024

APPROVAL DRAWINGS FOR REVIEW

Please mark one selection, sign, date and return

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Proceed with Fabrication

( ) Approved with Changes Noted:
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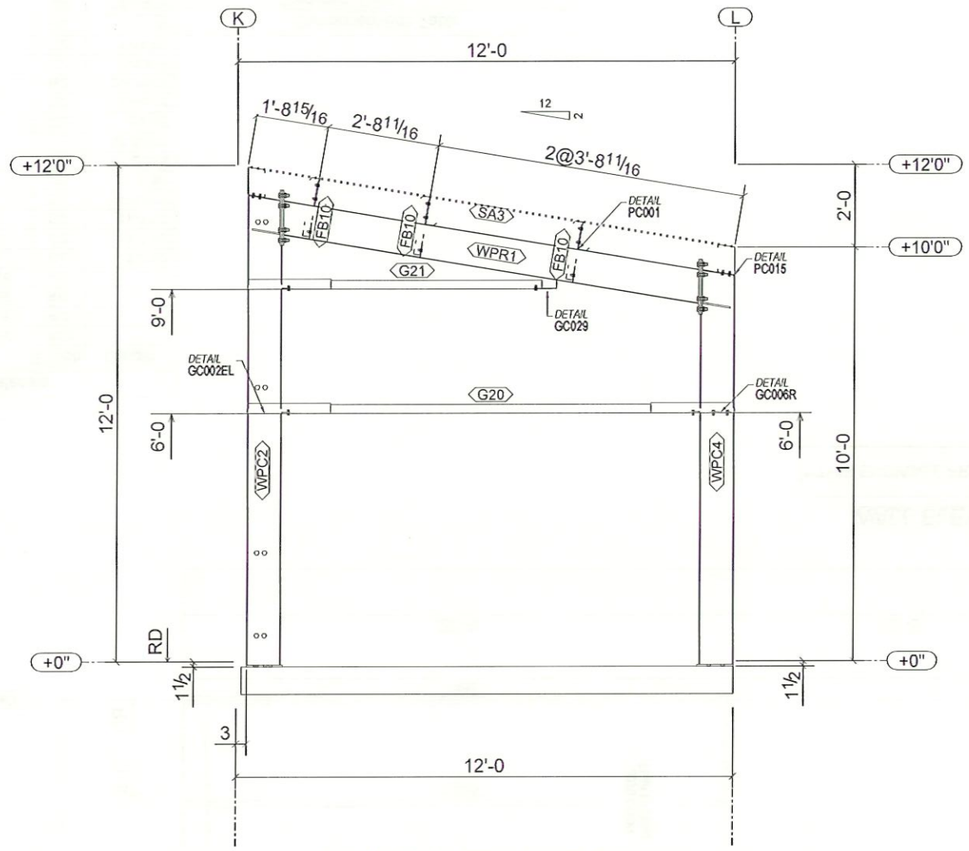
( ) Revise and Resubmit:
Revise and Send New Approval Drawings
** Delivery Date WILL BE DELAYED **

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

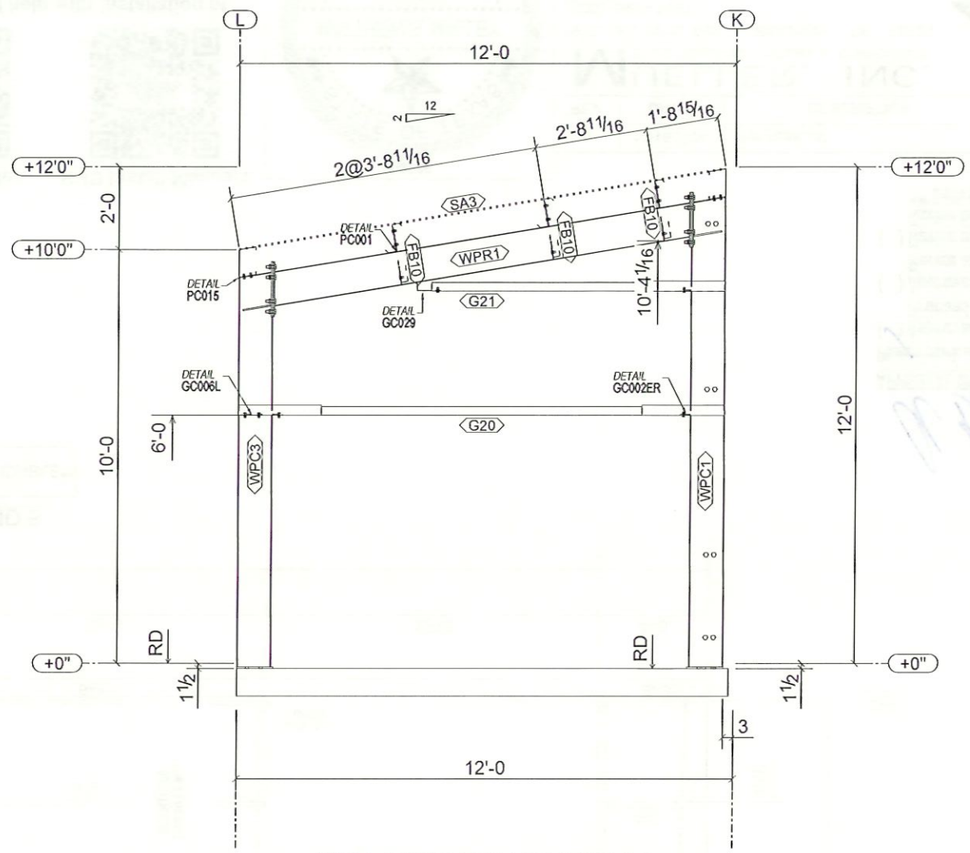
MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: WALL ELEVATION AT GRID 1
CUSTOMER NAME: FUN ABOUNDS INC
END USER: BASTROP CO PCT 2
SCALE: 1:30
SALESMAN: WESKEY CARTER
JOBSITE ADDRESS: 911 E. MLK BLVD SMITHVILLE, TX 78957
DETAILER: TRG
CHECKER:
DATE: 10/21/2024
JOB #: 6971245
DWG #: E5
REV.: 0

Tekla Structures



WALL ELEVATION AT GRID 2.5



WALL ELEVATION AT GRID 2.6

APPROVAL DRAWINGS FOR REVIEW

Please mark one selection, sign, date and return

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Proceed with Fabrication

( ) Approved with Changes Noted:
Revise and Proceed with Fabrication

( ) Revise and Resubmit:
Revise and Send New Approval Drawing
** Delivery Date WILL BE DELAYED **

Bill of Materials				
Qty	Mark	Profile	Finish	Length
1	WPC1	W10X12	RO	
1	WPC2	W10X12	RO	
1	WPC3	W10X12	RO	
1	WPC4	W10X12	RO	
2	WPR1	W10X12	RO	
6	FB10	2X2L12	GZ	2'-6 5/8"
2	G20	8X25C16	GZ	10'-0 3/4"
2	G21	8X25C16	GZ	6'-3 1/8"

Tekla Structures

ALL ENDWALL COLUMNS AND JAMBS ARE DESIGNED AS "POSTS" AS DEFINED BY OSHA AND ARE NOT INTENDED TO BE CLIMBED ON UNTIL FULLY BRACED.

F-2689

STATE OF TEXAS
MATTHEW S. MALLEY
121601
REGISTERED
PROFESSIONAL ENGINEER

10/21/2024

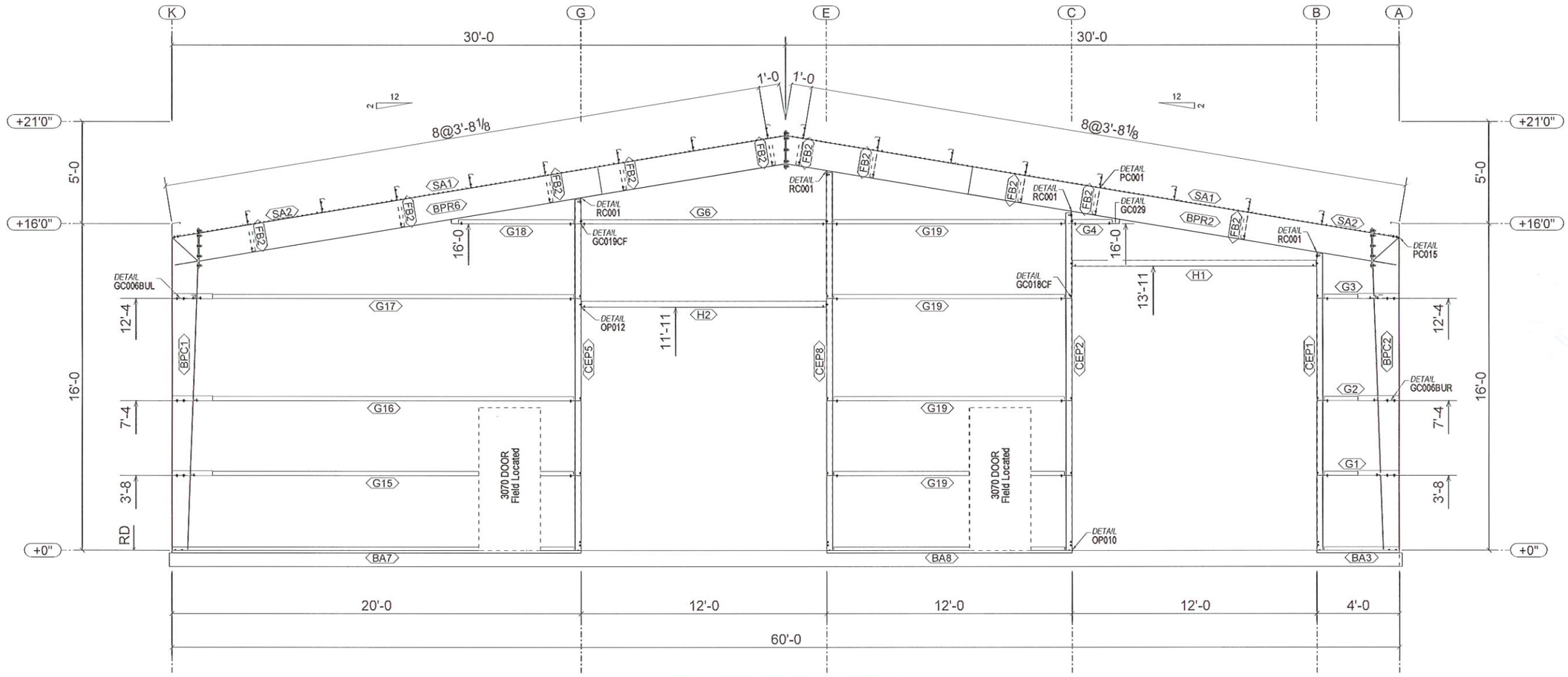
REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: WALL ELEVATION AT GRID 2.5, 2.6

CUSTOMER NAME	END USER	SCALE
FUN ABOUNDS INC	BASTROP C0 PCT 2	1:20

SALESMAN	JOBSITE ADDRESS			
WESKEY CARTER	911 E. MLK BLVD SMITHVILLE, TX 78957			
DETAILER: TRG	CHECKER:	DATE: 10/21/2024	JOB #: 6971245	DWG #: E6	REV.: 0



WALL ELEVATION AT GRID 5

THIS ENDWALL FRAME IS NOT EXPANDABLE

Bill of Materials				
Qty	Mark	Profile	Finish	Length
1	BPC1	SHT10GAX15"	RO	
1	BPC2	SHT10GAX15"	RO	
1	BPR2	SHT10GAX16"	RO	
1	BPR6	SHT10GAX16"	RO	
1	BA3	L4X2X14GA	GZ	3'-7 1/2"
1	BA7	L4X2X14GA	GZ	19'-7 1/2"
1	BA8	L4X2X14GA	GZ	11'-3 1/2"
1	CEP1	8X35C12	GZ	14'-6 5/16"
1	CEP2	8X35C12	GZ	16'-6 3/8"
1	CEP5	10X35C12	GZ	17'-2 5/16"
1	CEP8	10X35C12	GZ	18'-6 5/16"
10	FB2	2X2L12	GZ	2'-9 5/8"
1	G1	8X25C16	GZ	2'-8 5/16"
1	G2	8X25C16	GZ	2'-6 11/16"
1	G3	8X25C16	GZ	2'-4 9/16"
1	G4	8X25C16	GZ	1'-11 1/2"
1	G6	8X25C16	GZ	11'-11 1/2"
1	G15	8X25C14	GZ	18'-8 5/16"
1	G16	8X25C12	GZ	18'-6 11/16"
1	G17	8X25C12	GZ	18'-4 9/16"
1	G18	8X25C16	GZ	5'-7 7/16"
4	G19	8X25C16	GZ	11'-3 5/16"
1	H1	8X35C14	GZ	11'-11 1/2"
1	H2	10X35C14	GZ	11'-11 1/2"

Component Bolt Table			
Detail ID	Connected Assemblies ↓	Conn. Clip ↓	Bolt Description
RC001			
	BPR2→ CEP1	2 ~ 5/8"x 2"	A325N
	BPR2→ CEP2	2 ~ 5/8"x 2"	A325N
	BPR2→ CEP8	2 ~ 5/8"x 2"	A325N
	BPR6→ CEP5	2 ~ 5/8"x 2"	A325N

RUD Install Video

RUD Install Manuals

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F-2689
STATE OF TEXAS
MATTHEW S. MALLEY
121601
PROFESSIONAL ENGINEER
10/21/2024

APPROVAL DRAWINGS FOR REVIEW

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( ) Approved with Changes Noted:
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( ) Revise and Resubmit:
Revise and Send New Approval Drawings
** Delivery Date WILL BE DELAYED **

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

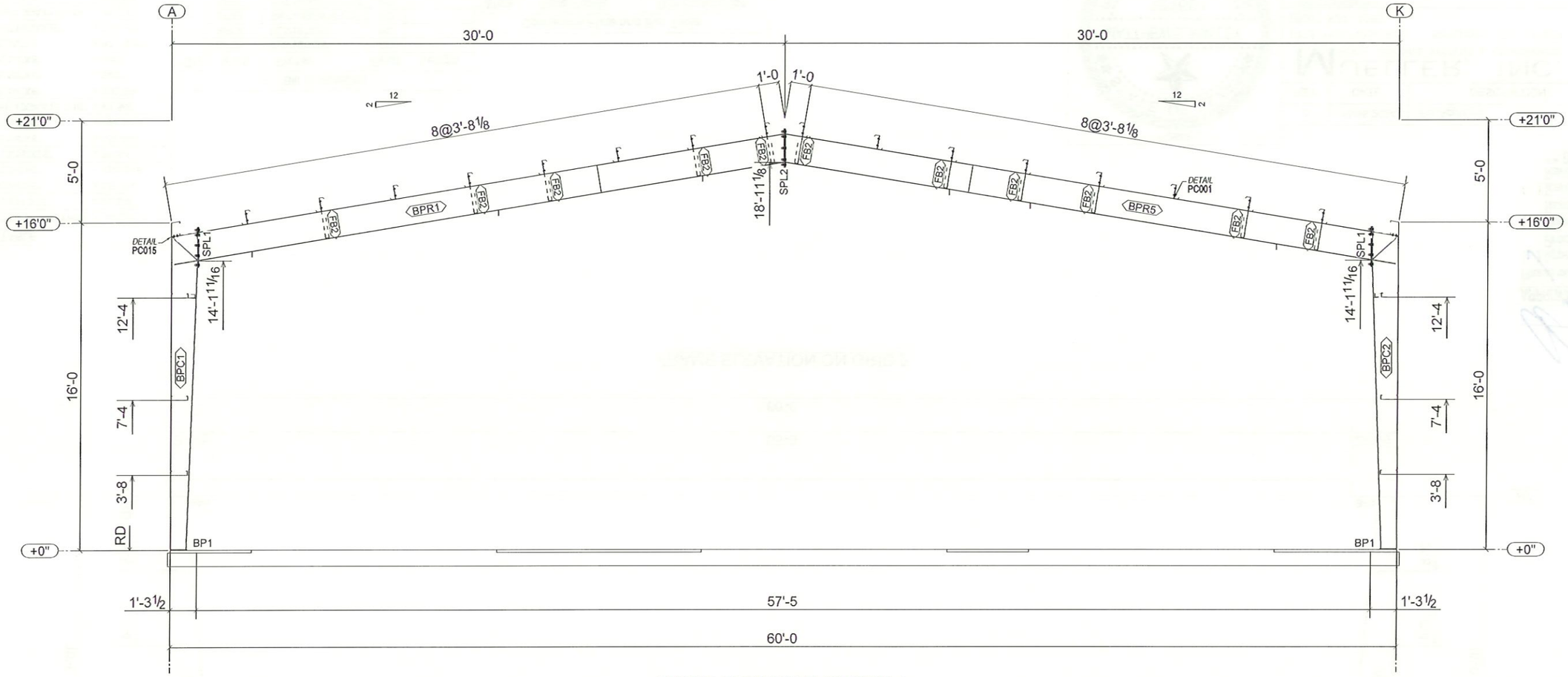
DRAWING DESCRIPTION: WALL ELEVATION AT GRID 5

CUSTOMER NAME	END USER	SCALE
FUN ABOUNDS INC	BASTROP C0 PCT 2	1:30

SALESMAN	JOBSITE ADDRESS
WESKEY CARTER	911 E. MLK BLVD SMITHVILLE, TX 78957

DETAILER	CHECKER	DATE	JOB #	DWG #	REV.
TRG		10/21/2024	6971245	E7	0

Tekla Structures



FRAME ELEVATION ON GRID 1

THIS ENDWALL FRAME IS NOT EXPANDABLE

BUILT UP MEMBER TABLE			
Mark	Type	Thick x Max Width	x Length
BPC1		SHT10GAX15"	x 17 7/8"
	IF	PL1/4"X6"	x 165 1/2"
	OF	PL1/4"X6"	x 183 3/16"
BPC2		SHT10GAX15"	x 17 7/8"
	IF	PL1/4"X6"	x 165 1/2"
	OF	PL1/4"X6"	x 183 3/16"
BPR1		SHT10GAX16"	x 83 3/16"
	IF	PL5/16"X6"	x 107 15/16"
	IF	PL5/16"X6"	x 240"
	OF	PL1/4"X6"	x 107 15/16"
	OF	PL1/4"X6"	x 240"
	WB	SHT10GAX16"	x 239 1/2"
BPR5		SHT10GAX16"	x 83 3/16"
	IF	PL5/16"X6"	x 107 15/16"
	IF	PL5/16"X6"	x 240"
	OF	PL1/4"X6"	x 107 15/16"
	OF	PL1/4"X6"	x 240"
	WB	SHT10GAX16"	x 239 1/2"

Bill of Materials				
Qty	Mark	Profile	Finish	Length
1	BPC1	SHT10GAX15"	RO	
1	BPC2	SHT10GAX15"	RO	
1	BPR1	SHT10GAX16"	RO	
1	BPR5	SHT10GAX16"	RO	
11	FB2	2X2L12	GZ	2'-9 5/8"

Connection Plate and Bolt Table		
Mark	Plate Profile	Bolt Description
BP1	PL1/2"X6" x 10"	REF. AB PLAN
SPL1	PL1/2"X6" x 23 1/2"	10 ~ 3/4" x 2 1/2" A325N
SPL2	PL1/2"X6" x 22 1/2"	10 ~ 3/4" x 2 1/2" A325N

APPROVAL DRAWINGS FOR REVIEW

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Proceed with Fabrication

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Revise and Proceed with Fabrication

( ) Revise and Resubmit:
Revise and Send New Approval Drawing
** Delivery Date WILL BE DELAYED **

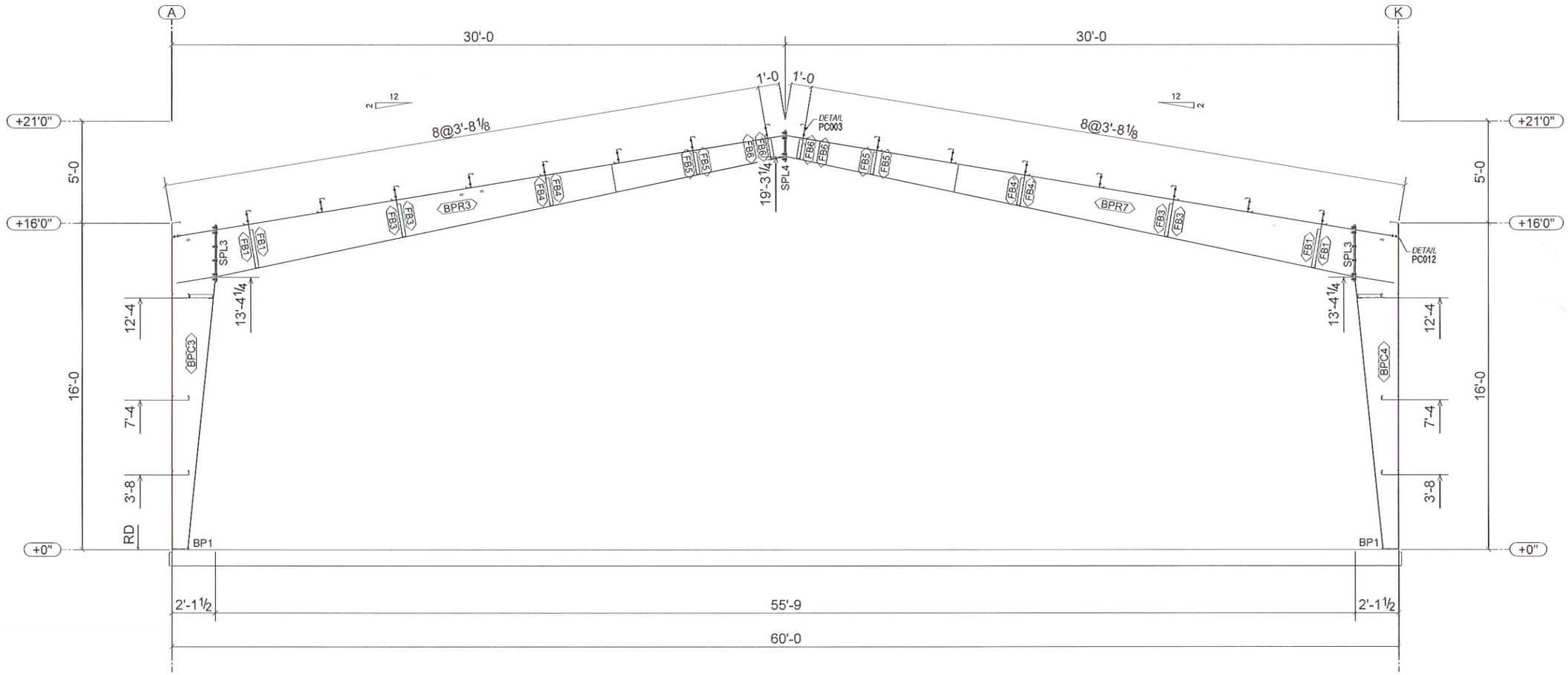
F-2689
STATE OF TEXAS
MATTHEW S. MALLEY
121601
PROFESSIONAL ENGINEER
10/21/2024

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: FRAME ELEVATION ON GRID 1
CUSTOMER NAME: FUN ABOUNDS INC
END USER: BASTROP C0 PCT 2
SCALE: 1:30
SALESMAN: WESKEY CARTER
JOBSITE ADDRESS: 911 E. MLK BLVD SMITHVILLE, TX 78957
DETAILER: TRG
CHECKER:
DATE: 10/21/2024
JOB #: 6971245
DWG #: E8
REV.: 0

Tekla Structures



FRAME ELEVATION ON GRID 2

APPROVAL DRAWINGS FOR REVIEW

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( ) Revise and Resubmit:
Revise and Send New Approval Drawings
** Delivery Date WILL BE DELAYED **

BUILT UP MEMBER TABLE			
Mark	Type	Thick x Max Width	x Length
BPC3		PL3/16"X25"	x 25 3/4"
	IF	PL1/4"X6"	x 157 3/4"
	OF	PL1/4"X6"	x 183 3/16"
BPC4		PL3/16"X25"	x 25 3/4"
	IF	PL1/4"X6"	x 157 3/4"
	OF	PL1/4"X6"	x 183 3/16"
BPR3		SHT10GAX16 7/16"	x 91 5/8"
	IF	PL1/4"X6"	x 100 5/8"
	IF	PL1/4"X6"	x 240"
	OF	PL1/4"X6"	x 240"
	OF	PL1/4"X6"	x 97 13/16"
	WB	SHT10GAX27"	x 239 1/2"
BPR7		SHT10GAX16 7/16"	x 91 5/8"
	IF	PL1/4"X6"	x 100 5/8"
	IF	PL1/4"X6"	x 240"
	OF	PL1/4"X6"	x 240"
	OF	PL1/4"X6"	x 97 13/16"
	WB	SHT10GAX27"	x 239 1/2"

Bill of Materials				
Qty	Mark	Profile	Finish	Length
1	BPC3	PL3/16"X25"	RO	
1	BPC4	PL3/16"X25"	RO	
1	BPR3	SHT10GAX16 7/16"	RO	
1	BPR7	SHT10GAX16 7/16"	RO	
4	FB1	2X2L12	GZ	3'-3 15/16"
4	FB3	2X2L12	GZ	3'-1 1/4"
4	FB4	2X2L12	GZ	2'-10 7/8"
4	FB5	2X2L12	GZ	2'-8 3/4"
4	FB6	2X2L12	GZ	2'-7 7/8"

Connection Plate and Bolt Table		
Mark	Plate Profile	Bolt Description
BP1	PL1/2"X6" x 10"	REF. AB PLAN
BP2	PL1/2"X6" x 7"	REF. AB PLAN
SPL3	PL1/2"X6" x 33 1/2"	12 ~ 3/4" x 2 1/2" A325N
SPL4	PL1/2"X6" x 18 1/2"	8 ~ 3/4" x 2 1/2" A325N
SPL6	PL1/2"X6" x 16 1/4"	8 ~ 3/4" x 2 1/2" A325N

F-2689

STATE OF TEXAS
MATTHEW S. MALLEY
121601
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10/21/2024

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

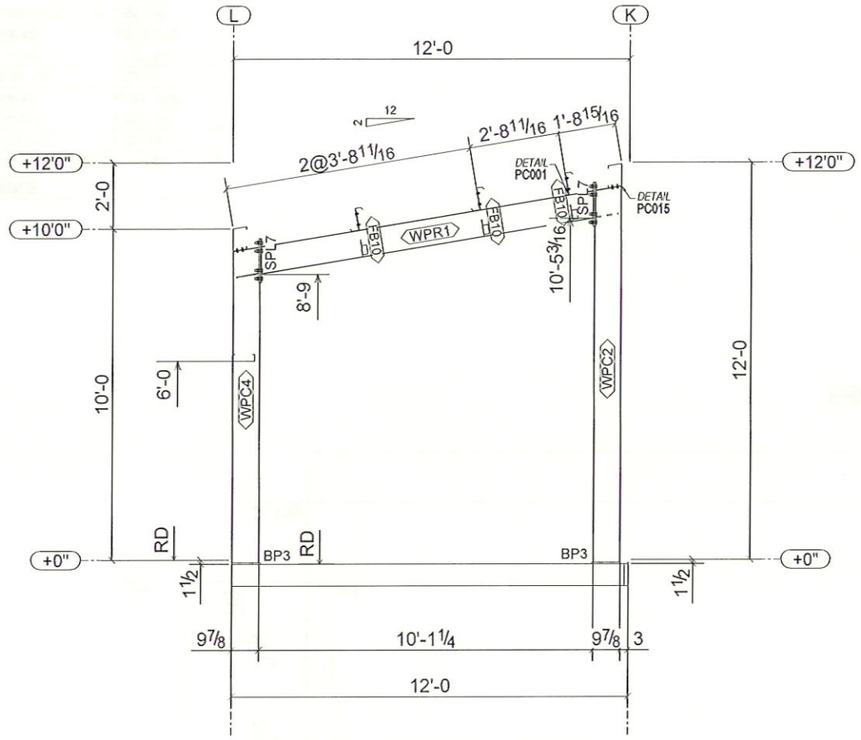
MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: FRAME ELEVATION ON GRID 2

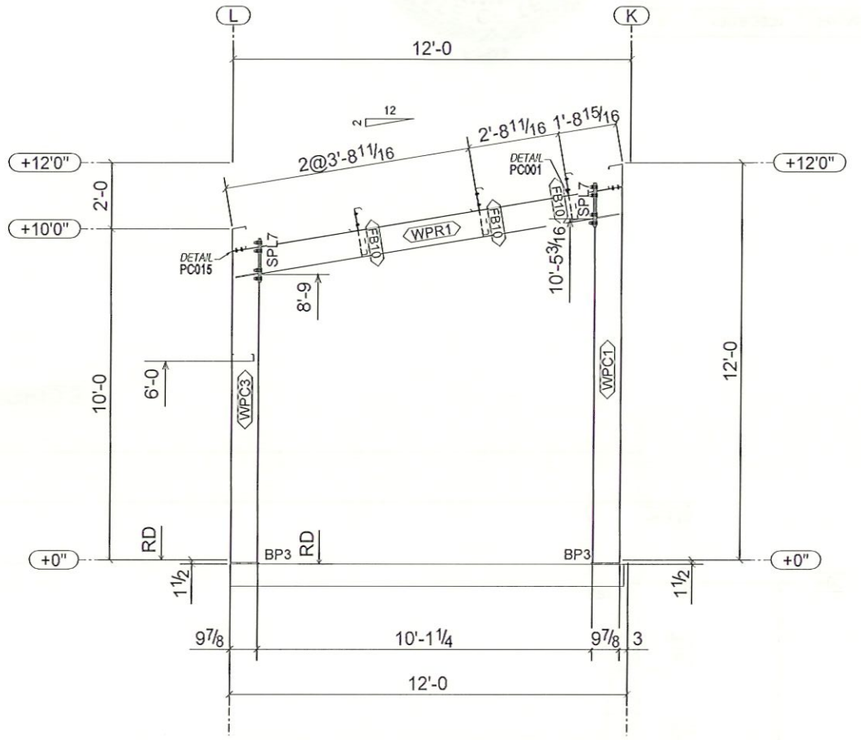
CUSTOMER NAME	END USER	SCALE
FUN ABOUNDS INC	BASTROP CO PCT 2	1:30

SALESMAN	JOBSITE ADDRESS			
WESKEY CARTER	911 E. MLK BLVD SMITHVILLE, TX 78957			
DETAILER: TRG	CHECKER	DATE: 10/21/2024	JOB #: 6971245	DWG #: E9	REV.: 0

Tekla Structures



FRAME ELEVATION ON GRID 2.5



FRAME ELEVATION ON GRID 2.6

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Revise and Send New Approval Drawing
** Delivery Date WILL BE DELAYED **

Bill of Materials				
Qty	Mark	Profile	Finish	Length
1	WPC1	W10X12	RO	
1	WPC2	W10X12	RO	
1	WPC3	W10X12	RO	
1	WPC4	W10X12	RO	
2	WPR1	W10X12	RO	
6	FB10	2X2L12	GZ	2'-6 5/8"

Connection Plate and Bolt Table		
Mark	Plate Profile	Bolt Description
BP3	PL1/2"X6" x 10 1/2"	REF. AB PLAN
SPL7	PL1/2"X6" x 16"	8 ~ 3/4" x 2 1/2" A325N
SPL7	PL1/2"X6" x 16"	8 ~ 3/4" x 2 1/2" A325N

F-2689

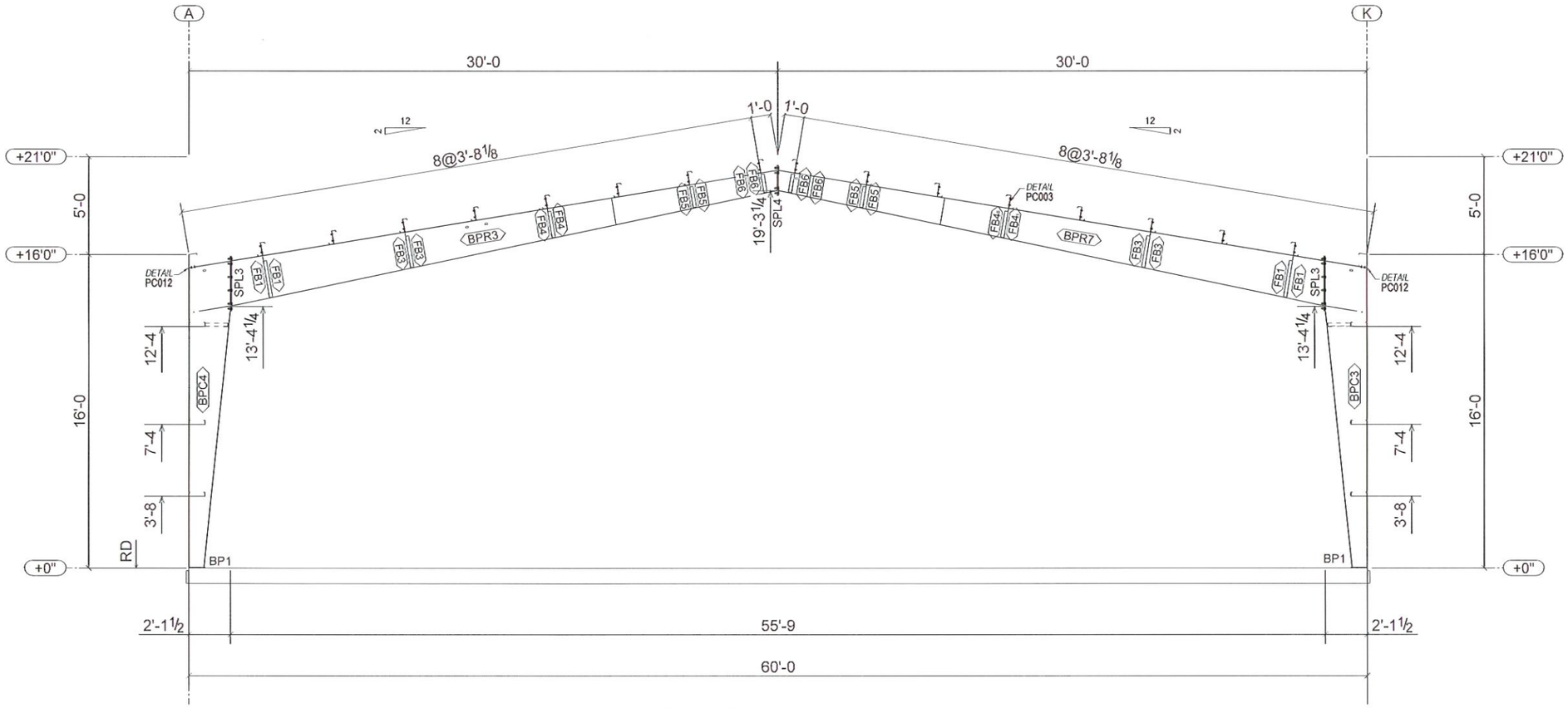
STATE OF TEXAS
MATTHEW S. MALLEY
121601
PROFESSIONAL ENGINEER
10/21/2024

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: FRAME ELEVATION ON GRID 2.5, 2.6
CUSTOMER NAME: FUN ABOUNDS INC
END USER: BASTROP C0 PCT 2
SCALE: 1:25
SALESMAN: WESKEY CARTER
JOBSITE ADDRESS: 911 E. MLK BLVD SMITHVILLE, TX 78957
DETAILER: TRG
CHECKER:
DATE: 10/21/2024
JOB #: 6971245
DWG #: E10
REV.: 0

Tekla Structures



FRAME ELEVATION ON GRID 3

APPROVAL DRAWINGS FOR REVIEW

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( ) Revise and Resubmit:
Revise and Send New Approval Drawings
** Delivery Date WILL BE DELAYED **

BUILT UP MEMBER TABLE

Mark	Type	Thick x Max Width	x Length
BPC3		PL3/16"X25"	x 25 3/4"
	IF	PL1/4"X6"	x 157 3/4"
	OF	PL1/4"X6"	x 183 3/16"
BPC4		PL3/16"X25"	x 25 3/4"
	IF	PL1/4"X6"	x 157 3/4"
	OF	PL1/4"X6"	x 183 3/16"
BPR3		SHT10GAX16 7/16"	x 91 5/8"
	IF	PL1/4"X6"	x 100 5/8"
	IF	PL1/4"X6"	x 240"
	OF	PL1/4"X6"	x 240"
	OF	PL1/4"X6"	x 97 13/16"
	WB	SHT10GAX27"	x 239 1/2"
BPR7		SHT10GAX16 7/16"	x 91 5/8"
	IF	PL1/4"X6"	x 100 5/8"
	IF	PL1/4"X6"	x 240"
	OF	PL1/4"X6"	x 240"
	OF	PL1/4"X6"	x 97 13/16"
	WB	SHT10GAX27"	x 239 1/2"

Bill of Materials

Qty	Mark	Profile	Finish	Length
1	BPC3	PL3/16"X25"	RO	
1	BPC4	PL3/16"X25"	RO	
1	BPR3	SHT10GAX16 7/16"	RO	
1	BPR7	SHT10GAX16 7/16"	RO	
4	FB1	2X2L12	GZ	3'-3 7/8"
4	FB3	2X2L12	GZ	3'-1 1/4"
4	FB4	2X2L12	GZ	2'-10 13/16"
4	FB5	2X2L12	GZ	2'-8 3/4"
4	FB6	2X2L12	GZ	2'-7 13/16"

Connection Plate and Bolt Table

Mark	Plate Profile	Bolt Description
BP1	PL1/2"X6" x 10"	REF. AB PLAN
BP2	PL1/2"X6" x 7"	REF. AB PLAN
SPL3	PL1/2"X6" x 33 1/2"	12 ~ 3/4" x 2 1/2" A325N
SPL4	PL1/2"X6" x 18 1/2"	8 ~ 3/4" x 2 1/2" A325N
SPL6	PL1/2"X6" x 16 1/4"	8 ~ 3/4" x 2 1/2" A325N

F-2689

STATE OF TEXAS
MATTHEW S. MALLEY
121601
PROFESSIONAL ENGINEER

10/21/2024

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

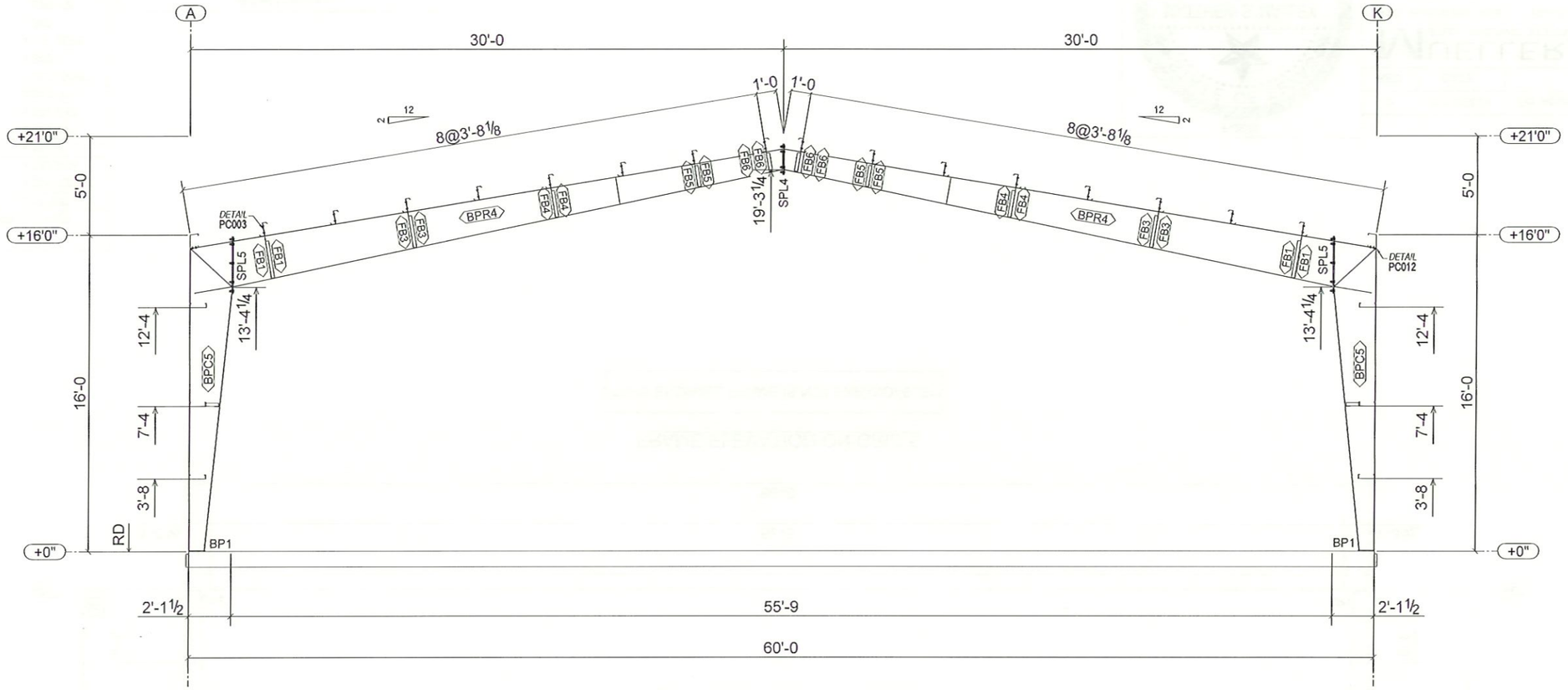
DRAWING DESCRIPTION: FRAME ELEVATION ON GRID 3

CUSTOMER NAME	END USER	SCALE
FUN ABOUNDS INC	BASTROP CO PCT 2	1:35

SALESMAN	JOBSITE ADDRESS
WESKEY CARTER	911 E. MLK BLVD SMITHVILLE, TX 78957

DETAILER	CHECKER	DATE	JOB #	DWG #	REV.
TRG		10/21/2024	6971245	E11	0

Tedds Structures



FRAME ELEVATION ON GRID 4

APPROVAL DRAWINGS FOR REVIEW

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( ) Approved with Changes Noted:
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( ) Revise and Resubmit:
Revise and Send New Approval Drawing
** Delivery Date WILL BE DELAYED **

BUILT UP MEMBER TABLE

Mark	Type	Thick x Max Width x Length	
BPC5		SHT10GAX25"	x 25 3/4"
	IF	PL1/4"X6"	x 156 3/4"
	OF	PL1/4"X6"	x 183 3/16"
BPR4		SHT10GAX16 7/16"	x 92 5/8"
	IF	PL1/4"X6"	x 100 5/8"
	IF	PL1/4"X6"	x 240"
	OF	PL1/4"X6"	x 240"
	OF	PL1/4"X6"	x 97 13/16"
	WB	SHT10GAX27"	x 239 1/2"

Bill of Materials

Qty	Mark	Profile	Finish	Length
2	BPC5	SHT10GAX25"	RO	
2	BPR4	SHT10GAX16 7/16"	RO	
4	FB1	2X2L12	GZ	3'-3 15/16"
4	FB3	2X2L12	GZ	3'-1 1/4"
4	FB4	2X2L12	GZ	2'-10 7/8"
4	FB5	2X2L12	GZ	2'-8 3/4"
4	FB6	2X2L12	GZ	2'-7 7/8"

Connection Plate and Bolt Table

Mark	Plate Profile	Bolt Description
BP1	PL1/2"X6" x 10"	REF. AB PLAN
SPL4	PL1/2"X6" x 18 1/2"	8 ~ 3/4" x 2 1/2" A325N
SPL5	PL1/2"X6" x 34 1/2"	10 ~ 3/4" x 2 1/2" A325N

F-2689

STATE OF TEXAS
MATTHEW S. MALLEY
121601
LICENSED
PROFESSIONAL ENGINEER

10/21/2024

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

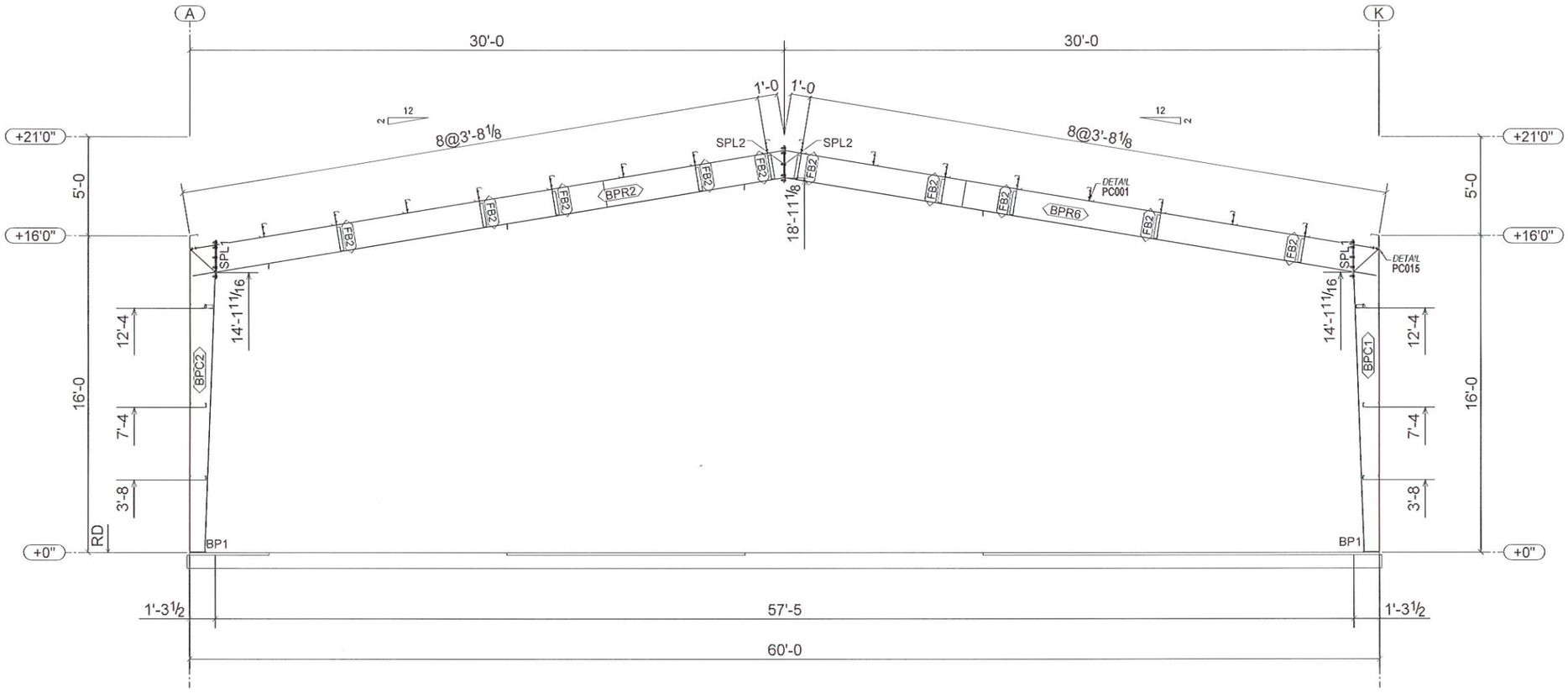
MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: FRAME ELEVATION ON GRID 4

CUSTOMER NAME	END USER	SCALE
FUN ABOUNDS INC	BASTROP C0 PCT 2	1:35

SALESMAN	JOBSITE ADDRESS				
WESKEY CARTER	911 E. MLK BLVD SMITHVILLE, TX 78957				
DETAILER: TRG	CHECKER:	DATE: 10/21/2024	JOB # 6971245	DWG # E12	REV. 0

Tekla Structures



FRAME ELEVATION ON GRID 5

THIS ENDWALL FRAME IS NOT EXPANDABLE

APPROVAL DRAWINGS FOR REVIEW

Please mark one selection, sign, date and return

(✓) Approved with NO Changes:
Proceed with Fabrication

( ) Approved with Changes Noted:
Revise and Proceed with Fabrication

( ) Revise and Resubmit:
Revise and Send New Approval Drawings
** Delivery Date WILL BE DELAYED **

BUILT UP MEMBER TABLE

Mark	Type	Thick x Max Width x Length
BPC1		SHT10GAX15" x 17 7/8"
	IF	PL1/4"X6" x 165 1/2"
	OF	PL1/4"X6" x 183 3/16"
BPC2		SHT10GAX15" x 17 7/8"
	IF	PL1/4"X6" x 165 1/2"
	OF	PL1/4"X6" x 183 3/16"
BPR2		SHT10GAX16" x 83 3/16"
	IF	PL5/16"X6" x 107 15/16"
	IF	PL5/16"X6" x 240"
	OF	PL1/4"X6" x 107 15/16"
	OF	PL1/4"X6" x 240"
	WB	SHT10GAX16" x 239 1/2"
BPR6		SHT10GAX16" x 83 3/16"
	IF	PL5/16"X6" x 107 15/16"
	IF	PL5/16"X6" x 240"
	OF	PL1/4"X6" x 107 15/16"
	OF	PL1/4"X6" x 240"
	WB	SHT10GAX16" x 239 1/2"

Bill of Materials

Qty	Mark	Profile	Finish	Length
1	BPC1	SHT10GAX15"	RO	
1	BPC2	SHT10GAX15"	RO	
1	BPR2	SHT10GAX16"	RO	
1	BPR6	SHT10GAX16"	RO	
10	FB2	2X2L12	GZ	2'-9 5/8"

Connection Plate and Bolt Table

Mark	Plate Profile	Bolt Description
BP1	PL1/2"X6" x 10"	REF. AB PLAN
SPL1	PL1/2"X6" x 23 1/2"	10 ~ 3/4" x 2 1/2" A325N
SPL2	PL1/2"X6" x 22 1/2"	10 ~ 3/4" x 2 1/2" A325N

F-2689

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MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

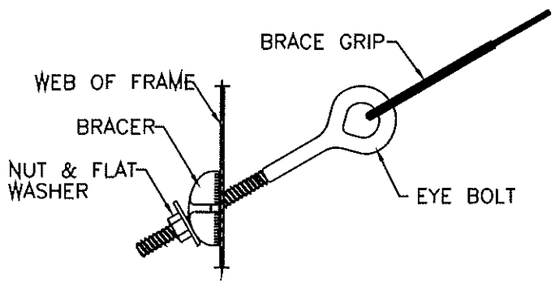
DRAWING DESCRIPTION: FRAME ELEVATION ON GRID 5

CUSTOMER NAME	END USER	SCALE
FUN ABOUNDS INC	BASTROP C0 PCT 2	1:35

SALESMAN	JOBSITE ADDRESS
WESKEY CARTER	911 E. MLK BLVD SMITHVILLE, TX 78957

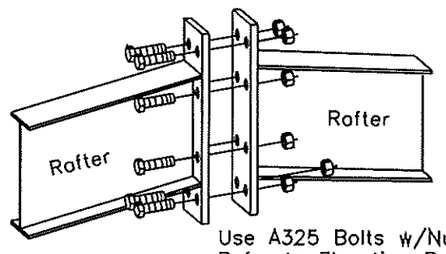
DETAILER	CHECKER	DATE	JOB #	DWG #	REV.
TRG		10/21/2024	6971245	E13	0

Tekla Structures

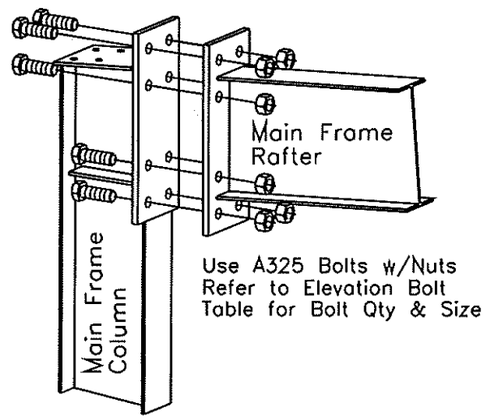


Cable to be installed as shown and tensioned so that building will not sway or rock when wind blows. Care should be taken: however, to not over-tighten and bend structural members.

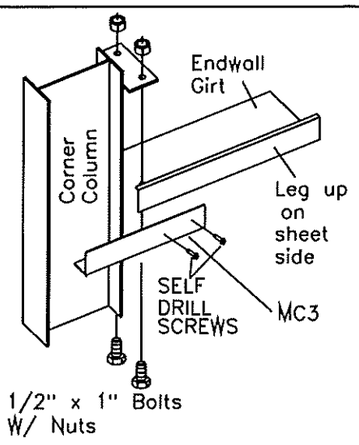
BR001 CABLE TO COLUMN OR RAFTER WEB WITH EYEBOLT ATTACHMENT



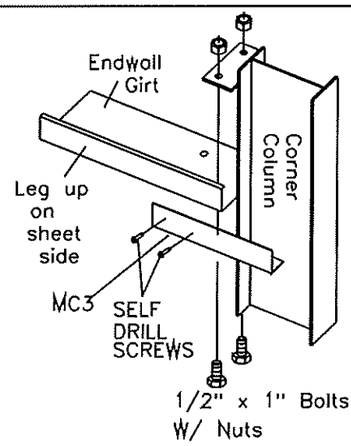
TYPICAL RAFTER SPLICE CONNECTION AT PEAK



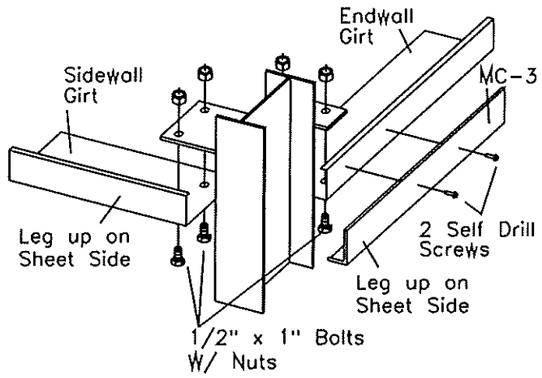
TYPICAL FLUSH COLUMN TO MAINFRAME RAFTER



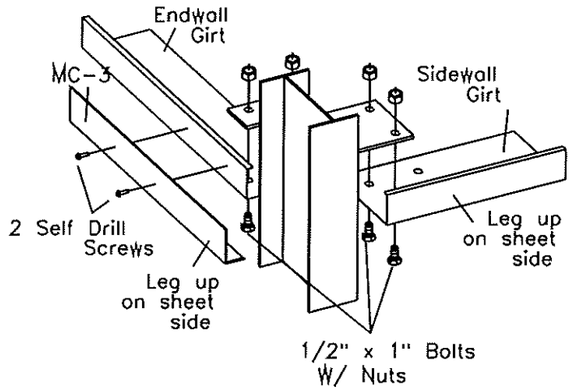
GC002EL CORNER COLUMN TO ENDWALL GIRT



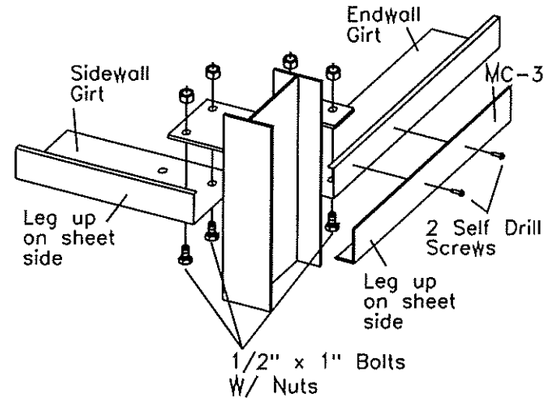
GC002ER CORNER COLUMN TO ENDWALL GIRT



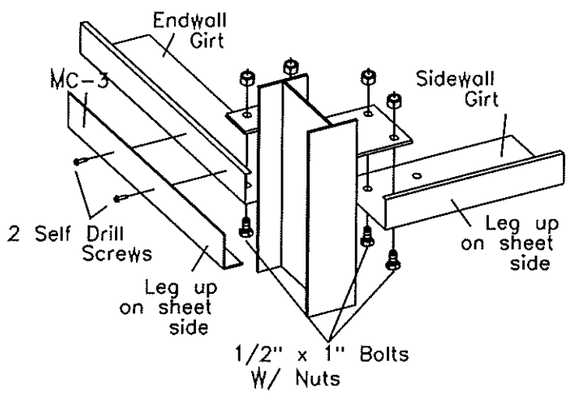
GC006BUL CORNER COLUMN TO WALL GIRTS



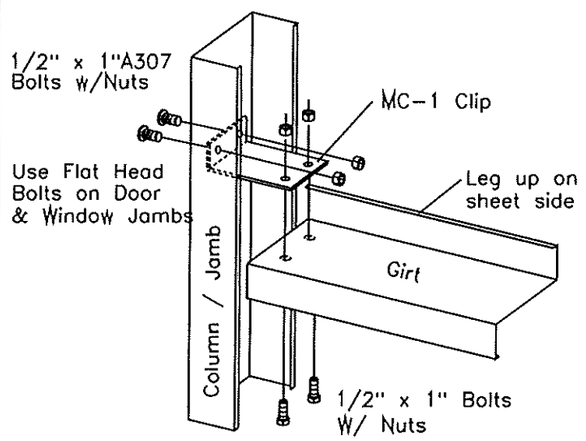
GC006BUR CORNER COLUMN TO WALL GIRTS



GC006L CORNER COLUMN TO WALL GIRTS



GC006R CORNER COLUMN TO WALL GIRTS



GC018CF JAMB / COLUMN TO WALL GIRT

APPROVAL DRAWINGS FOR REVIEW

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F-2689
STATE OF TEXAS
MATTHEW S. MALLEY
121601
LICENSED PROFESSIONAL ENGINEER
10/21/2024

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REV	DATE	DESCRIPTION
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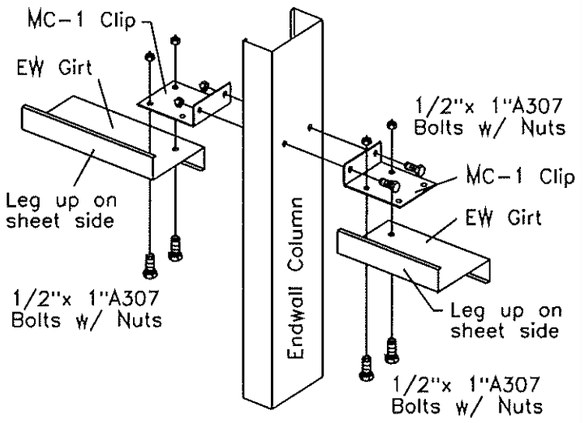
MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: ERECTION DETAILS

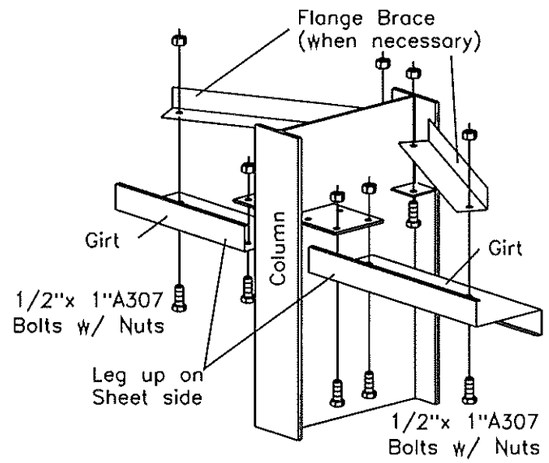
CUSTOMER NAME	END USER	SCALE
FUN ABOUNDS INC	BASTROP CO PCT 2	NONE

SALESMAN	JOBSITE ADDRESS
WESKEY CARTER	911 E. MLK BLVD SMITHVILLE, TX 78957

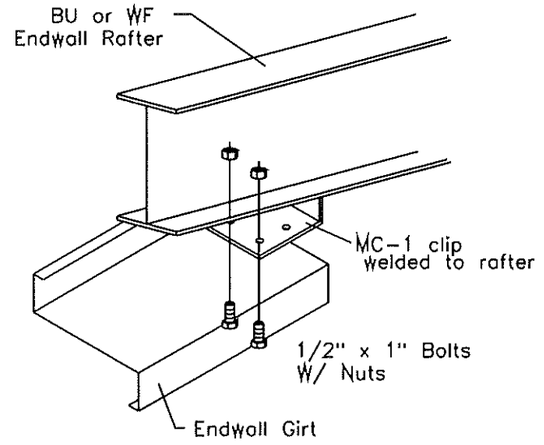
DETAILER	CHECKER	DATE:	JOB #	DWG #	REV.
TRG		10/21/2024	6971245	E101	0



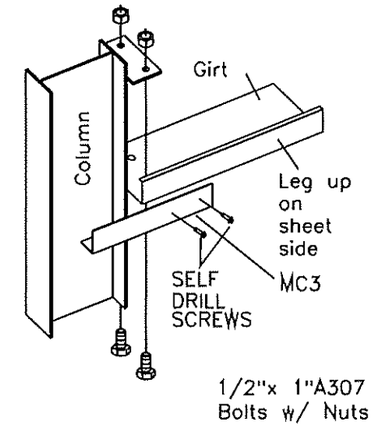
GC019CF INTERIOR ENDWALL COLUMN TO WALL GIRTS



GC021 INTERIOR COLUMN TO WALL GIRT

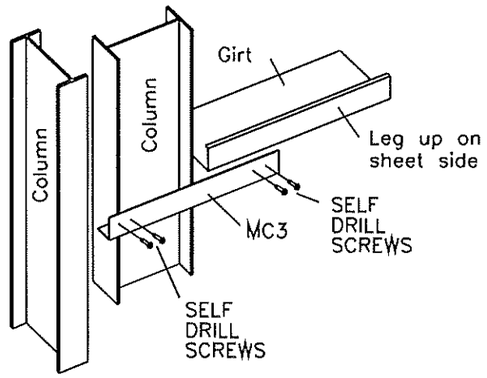


GC029 ENDWALL GIRT TO RAFTER

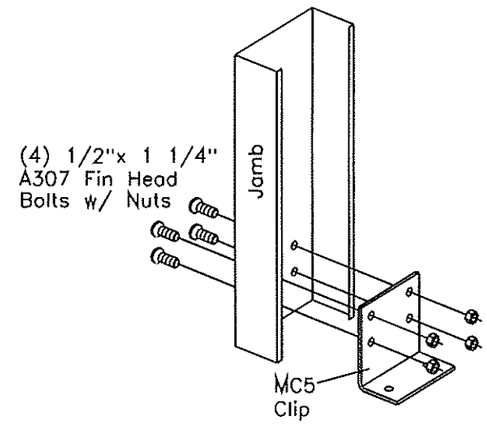


GC63 COLUMN TO WALL GIRT

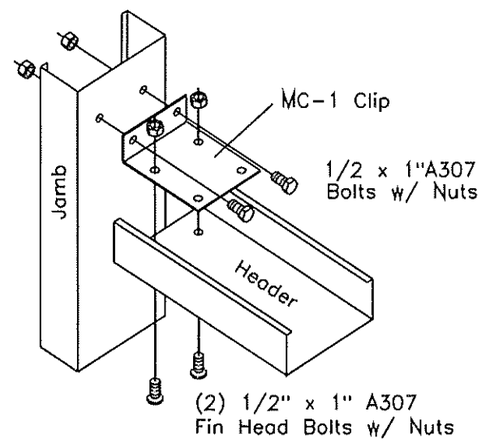
ATTACH PROVIDED MC3 ANGLE AS NEEDED TO FILL GAPS WHERE SHEETS NEED SCREW SUPPORT



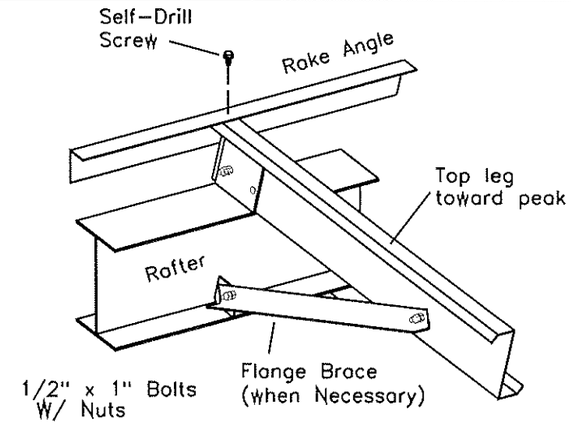
MC3_SW ADDING MC3 FILLER ANGLE



OP010 BASE TO JAMB



OP012 HEADER TO JAMB



PC001 ENDWALL RAFTER TO ROOF PURLIN

APPROVAL DRAWINGS FOR REVIEW

Please mark one selection, sign, date and return.

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ALL A325 STRUCTURAL BOLT CONNECTIONS SHOWN IN THESE DETAILS HAVE STANDARD MINIMUM BOLT INFORMATION. FOR SPECIFIC BOLT QUANTITIES AND SIZES, REFER TO COMPONENT BOLT TABLES LOCATED ON FRAME AND WALL ELEVATION DWGS.

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F-2689
STATE OF TEXAS
MATTHEW S. MALLEY
121601
LICENSED PROFESSIONAL ENGINEER
10/21/2024

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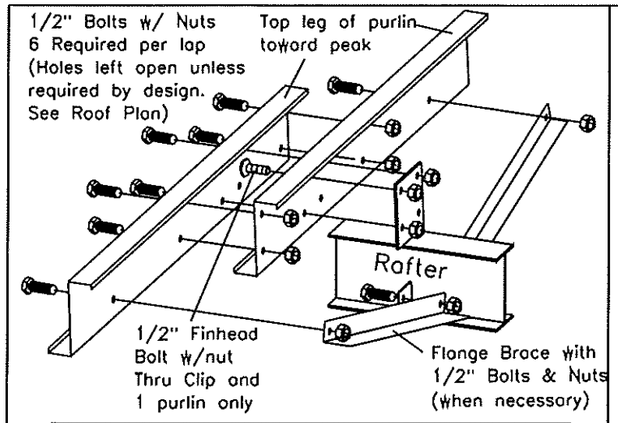
0	10/16/2024	For Approval

MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

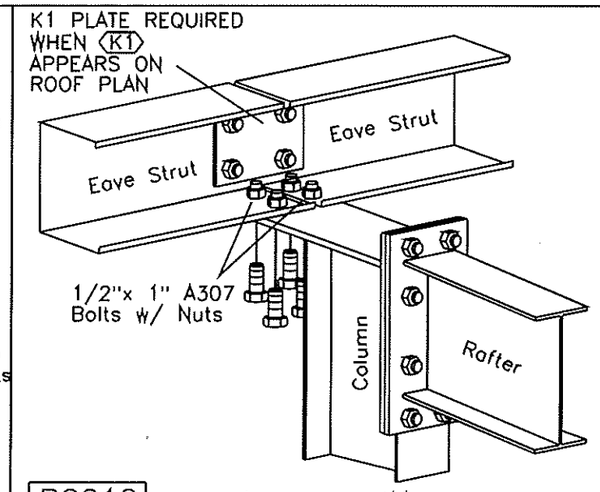
DRAWING DESCRIPTION: ERECTION DETAILS
CUSTOMER NAME: FUN ABOUNDS INC
END USER: BASTROP CO PCT 2
SCALE: NONE
SALESMAN: WESKEY CARTER
JOBSITE ADDRESS: 911 E. MLK BLVD SMITHVILLE, TX 78957
DETAILER: TRG
CHECKER:
DATE: 10/21/2024
JOB #: 6971245
DWG #: E102
REV: 0

Tools Clipboard

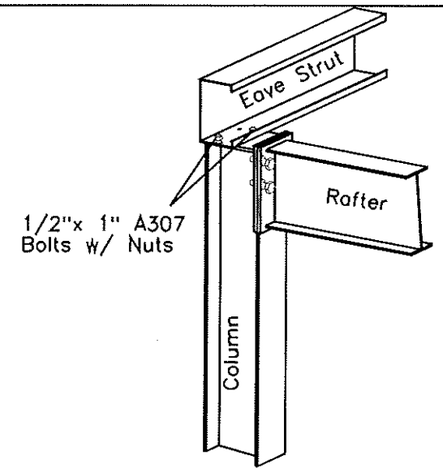


FOR SPECIFIC FLANGE BRACE ATTACHMENT TO PURLIN
** SEE PURLIN LAP DETAIL ON ROOF PLAN **

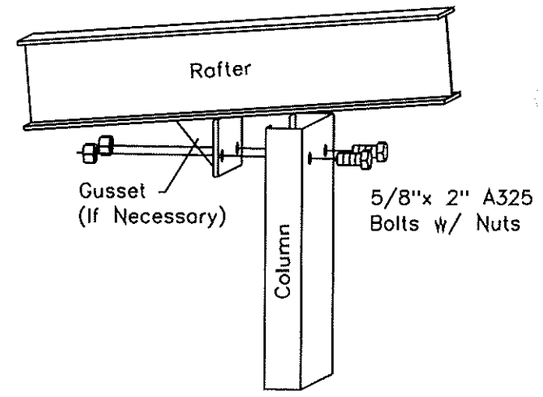
PC003 INTERIOR RAFTER TO ROOF PURLIN



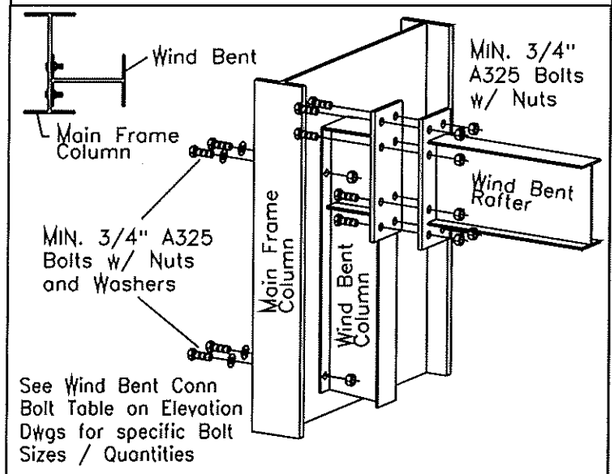
PC012 INTERIOR FRAME COLUMN TO EAVE STRUTS



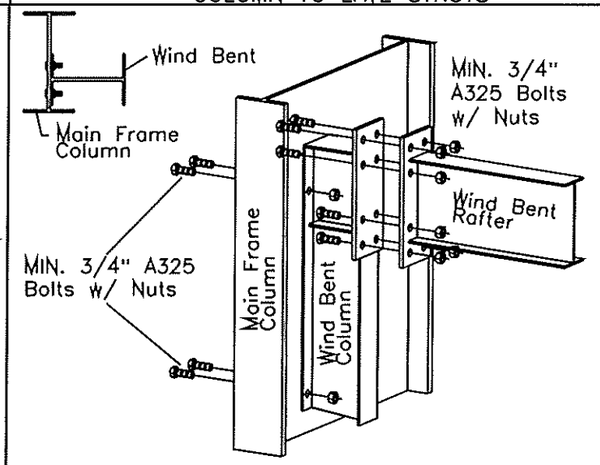
PC015 ENDWALL CORNER COLUMN TO EAVE STRUT



RC001 ENDWALL RAFTER TO COLUMN



TYPICAL MAINFRAME COLUMN TO WIND BENT FRAME



WB001 MAINFRAME COLUMN TO WIND BENT FRAME

APPROVAL DRAWINGS FOR REVIEW

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STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
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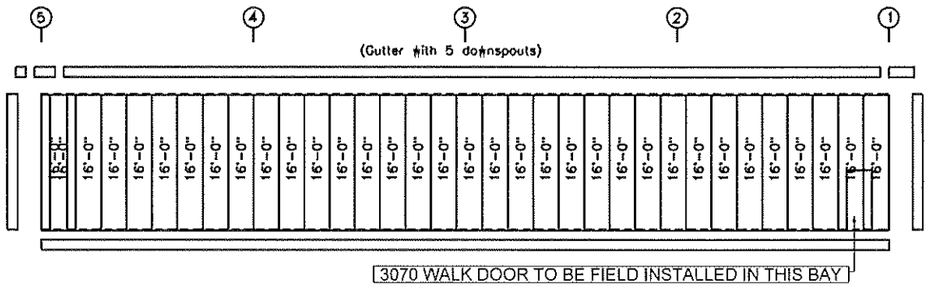
FUN ABOUNDS INC	BASTROP CO PCT 2	NONE

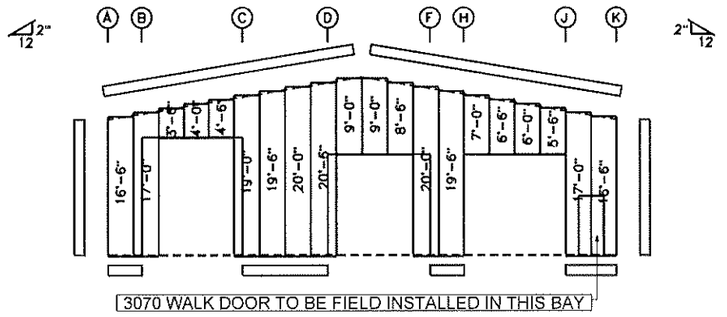
SALESMAN	JOBSITE ADDRESS
WESKEY CARTER	911 E. MLK BLVD SMITHVILLE, TX 78957

DETAILER	CHECKER	DATE	JOB #	DWG #	REV.
TRG		10/21/2024	6971245	E103	0



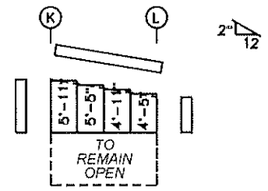
SIDEWALL SHEETING & TRIM: FRAME LINE A

PANELS: 26 Ga. PR - LGR Lt Gray



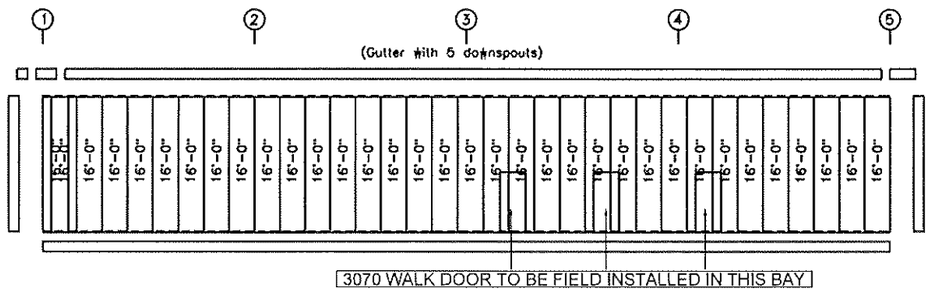
ENDWALL SHEETING & TRIM: FRAME LINE 1

PANELS: 26 Ga. PR - LGR Lt Gray



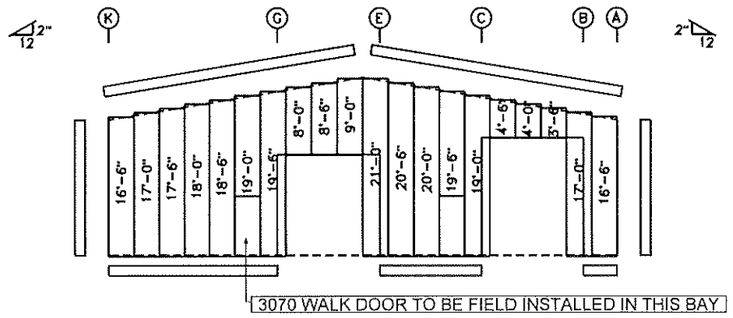
ENDWALL SHEETING & TRIM: FRAME LINE 2.5

PANELS: 26 Ga. PR - LGR Lt Gray



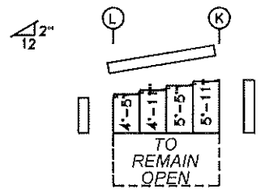
SIDEWALL SHEETING & TRIM: FRAME LINE K

PANELS: 26 Ga. PR - LGR Lt Gray



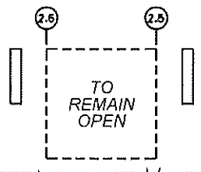
ENDWALL SHEETING & TRIM: FRAME LINE 5

PANELS: 26 Ga. PR - LGR Lt Gray

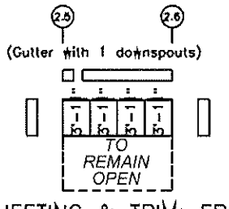


ENDWALL SHEETING & TRIM: FRAME LINE 2.6

PANELS: 26 Ga. PR - LGR Lt Gray



SIDEWALL SHEETING & TRIM: FRAME LINE K



SIDEWALL SHEETING & TRIM: FRAME LINE L

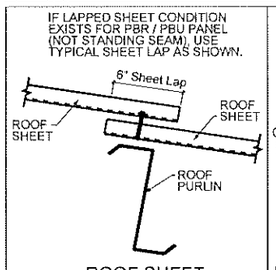
PANELS: 26 Ga. PR - LGR Lt Gray

GENERAL NOTES:

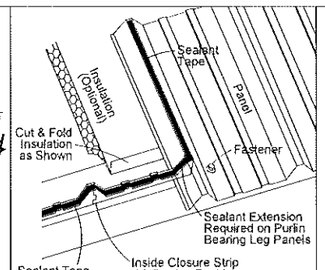
CAUTION
THE FOLLOWING MAXIMUM ADDITIONAL LINEAR FOOTAGE MEASURED (HORIZONTIALLY) OF PANELS MAY BE REMOVED FOR FIELD LOCATED FRAMED OPENINGS WITHOUT AFFECTING THE DIAPHRAGM STRENGTH OF THE PANELS.

LEFT ENDWALL: N/A
RIGHT ENDWALL: N/A

ROOF SLOPES GREATER THAN 1:12 REQUIRE ENDWALL PANELS BE FIELD CUT TO MATCH ROOF SLOPE.



ROOF SHEET LAP DETAIL



F-2689

STATE OF TEXAS
MATTHEW S. MALLEY
121601
LICENSED PROFESSIONAL ENGINEER

10/21/2024

APPROVAL DRAWINGS FOR REVIEW

Please mark one selection, sign, date and return

( ) Approved with NO Changes:
Proceed with Fabrication

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Revise and Proceed with Fabrication

( ) Revise and Resubmit:
Revise and Send New Approval Drawings
** Delivery Date WILL BE DELAYED **

REV	DATE	DESCRIPTION
0	10/16/2024	For Approval

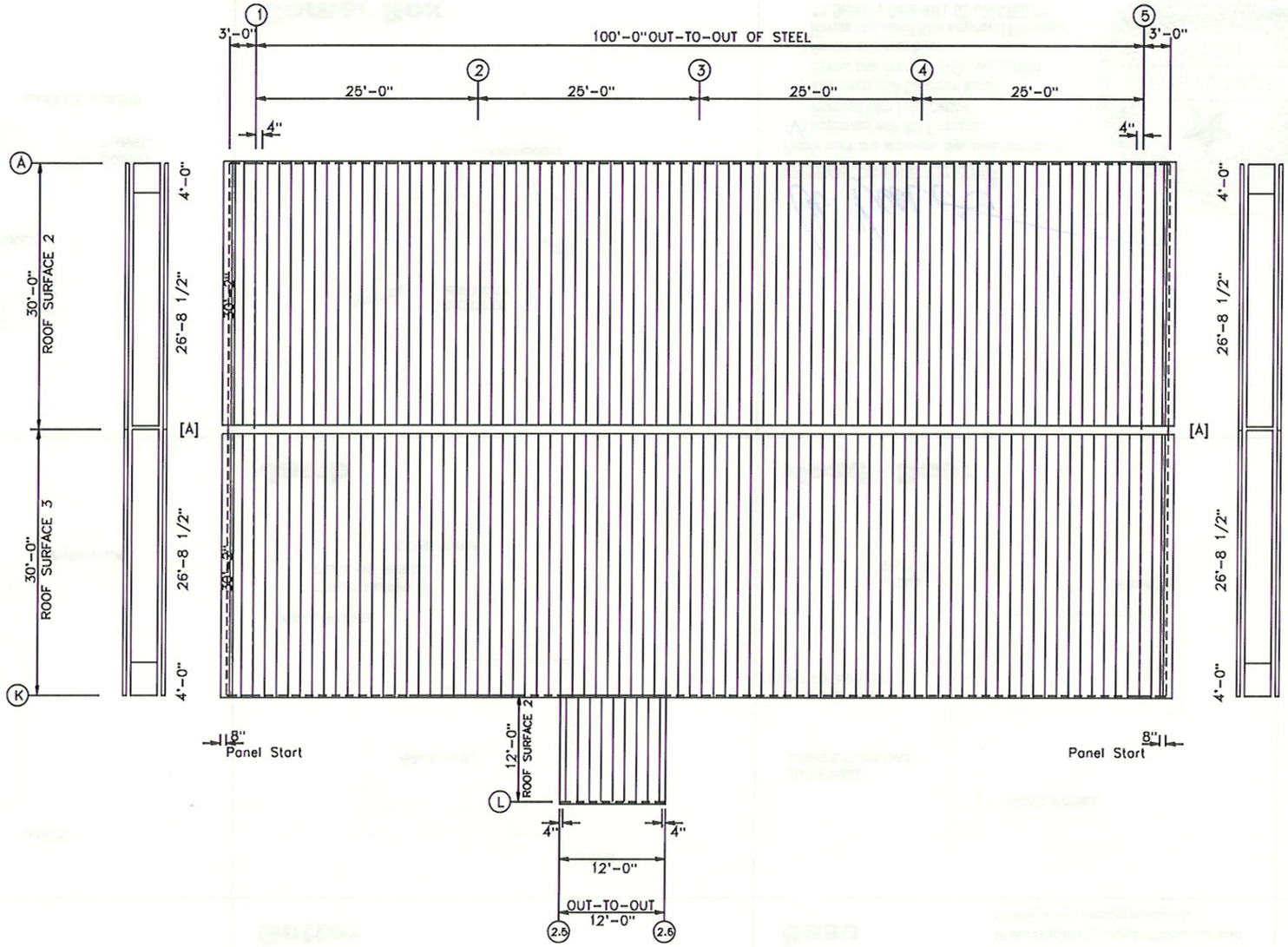
MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: SHEETING DETAILS

CUSTOMER NAME	END USER	SCALE
FUN ABOUNDS INC	BASTROP CO PCT 2	NONE

SALESMAN	JOBSITE ADDRESS
WESKEY CARTER	911 E. MLK BLVD SMITHVILLE, TX 78957

DETAILER	CHECKER	DATE	JOB #	DWG #	REV.
TRG		10/21/2024	6971245	S101	0

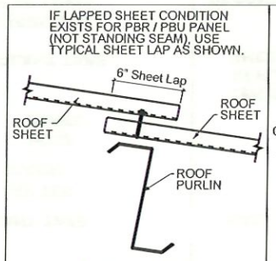


ROOF SHEETING PLAN

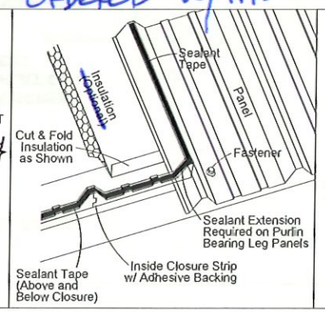
PANELS: 24 Ga. MLK - SIL Silver
[A] SOFFIT PANELS: 26 Ga. PU - LGR Lt Gray

ORDERED W/INSULATION

IF LAPPED SHEET CONDITION EXISTS FOR PBR / PBU PANEL (NOT STANDING SEAM), USE TYPICAL SHEET LAP AS SHOWN.



ROOF SHEET LAP DETAIL



F-2689

STATE OF TEXAS
MATTHEW S. MALLEY
121601
REGISTERED PROFESSIONAL ENGINEER

10/21/2024

APPROVAL DRAWINGS FOR REVIEW

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( ) Revise and Resubmit:
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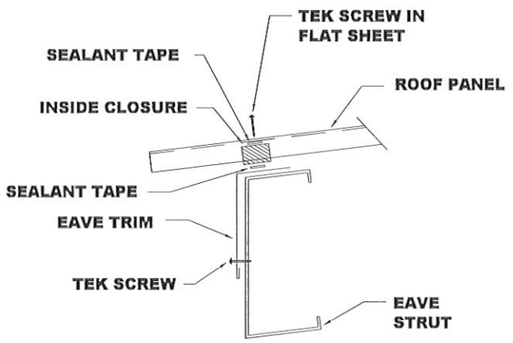
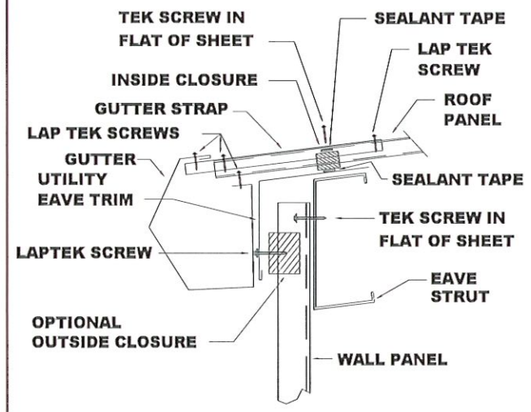
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

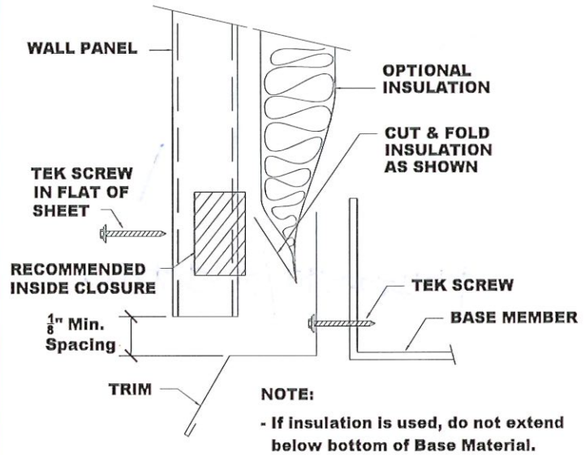
DRAWING DESCRIPTION: SHEETING DETAILS
CUSTOMER NAME: FUN ABOUNDS INC
END USER: BASTROP CO PCT 2
SCALE: NONE
SALESMAN: WESKEY CARTER
JOBSITE ADDRESS: 911 E. MLK BLVD SMITHVILLE, TX 78957
DETAILER: TRG
CHECKER:
DATE: 10/21/2024
JOB #: 6971245
DWG #: S102
REV: 0



Eave



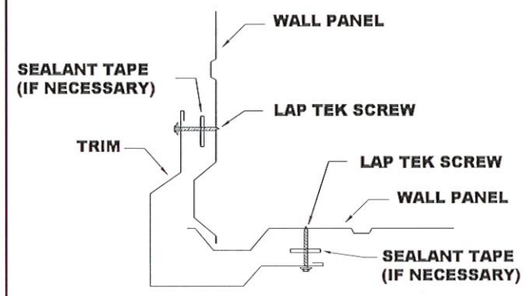
Gutter



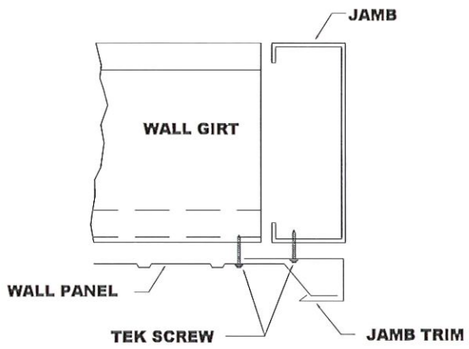
NOTE:

- If insulation is used, do not extend below bottom of Base Material.
- If insulation is used, Closures and Sealant are recommended.

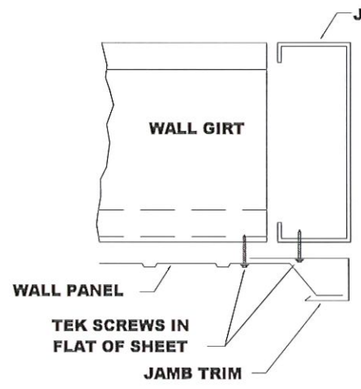
Base



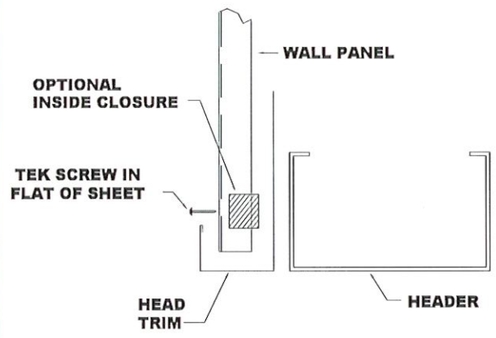
Outside Corner



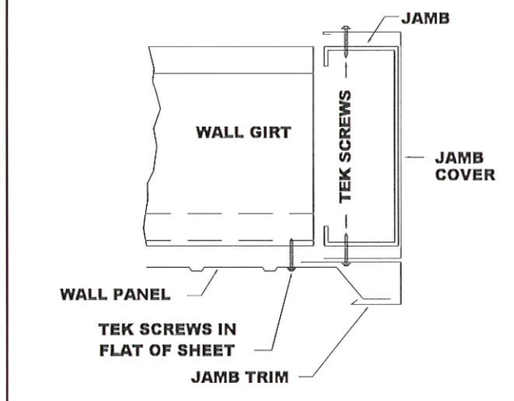
Open End



Jamb



Head - Door



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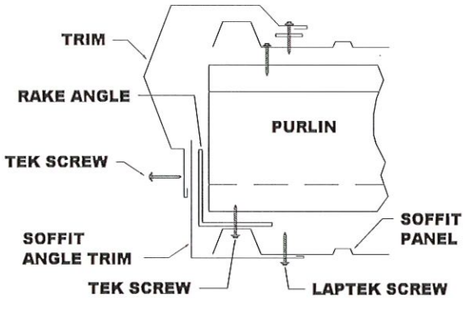
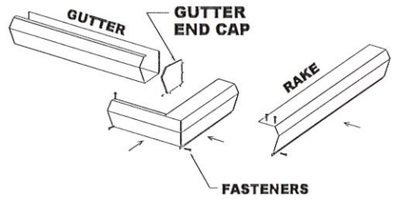


Soffit to Rake



Corner Box

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MATTHEW S. MALLEY
121601
LICENSED PROFESSIONAL ENGINEER
10/21/2024

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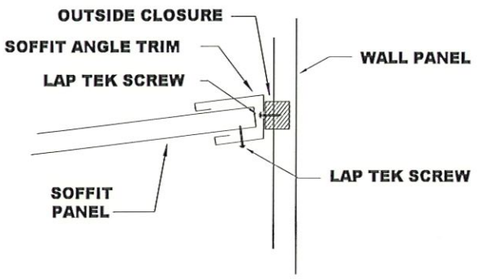
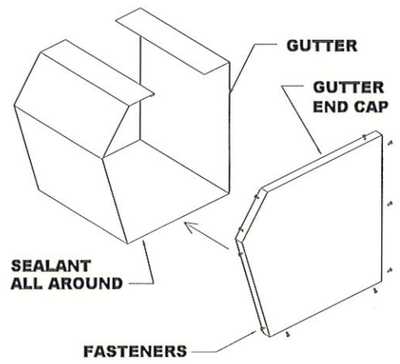
MUELLER, INC.
STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

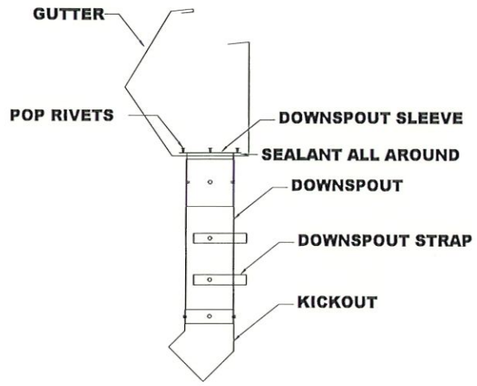
DRAWING DESCRIPTION: TRIM DETAILS
CUSTOMER NAME: FUN ABOUNDS INC
END USER: BASTROP CO PCT 2
SCALE: NON
SALESMAN: WESKEY CARTER
JOBSITE ADDRESS: 911 E. MLK BLVD SMITHVILLE, TX 78957
DETAILER: TRG
CHECKER:
DATE: 10/21/2024
JOB #: 6971245
DWG #: T101
REV.: 0



Sidewall Soffit to Wall Panel

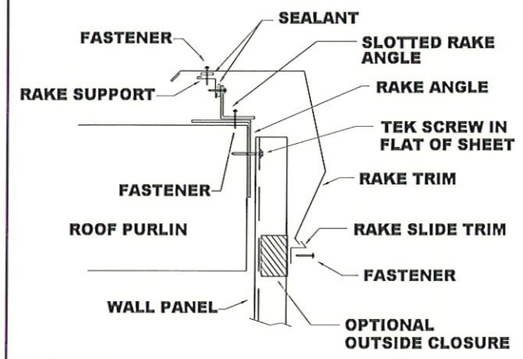


Gutter End Cap

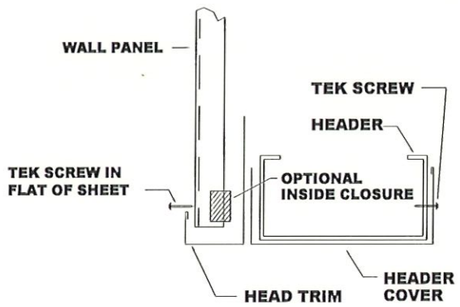


Downspout

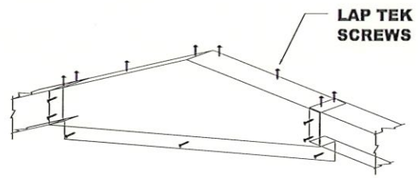
NOTE:
SEE STANDING SEAM ROOF INSTRUCTION MANUAL



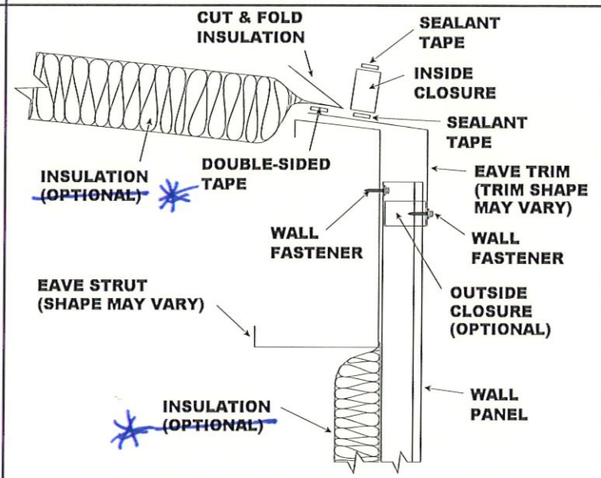
Rake



Head Cover - Door



Peak Box



Insulation @ Eave

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STEEL BUILDING SYSTEMS & COMPONENTS
1913 Hutchins Ave. Ballinger, TX 76821
(800) 527-1087

DRAWING DESCRIPTION: TRIM DETAILS
CUSTOMER NAME: FUN ABOUNDS INC
END USER: BASTROP C0 PCT 2
SCALE: NONE
SALESMAN: WESKEY CARTER
JOBSITE ADDRESS: 911 E. MLK BLVD SMITHVILLE, TX 78957
DETAILER: TRG
CHECKER:
DATE: 10/21/2024
JOB #: 6971245
DWG #: T102
REV: 0

Tekla Structures

CURB RAMPS AND SIDEWALKS

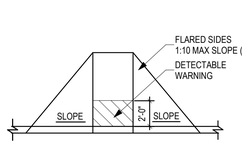


FIG. 406.3 SIDES OF CURB RAMPS

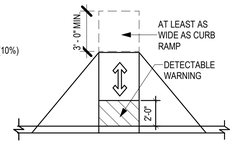


FIG. 406.4 LANDINGS AT THE TOP OF CURB RAMPS

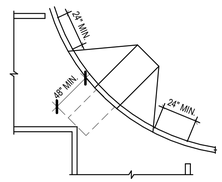


FIG. 406.6 DIAGONAL OR CORNER TYPE CURB RAMPS

TABLE 405.2 MAXIMUM RAMP SLOPE AND RISE FOR EXISTING SITES, BUILDINGS, AND FACILITIES

SLOPE*	MAX. RISE
STEEPER THAN 1:10 BUT NOT STEEPER THAN 1:8	3 INCHES
STEEPER THAN 1:12 BUT NOT STEEPER THAN 1:10	6 INCHES

* A SLOPE STEPPER THAN 1:8 IS PROHIBITED

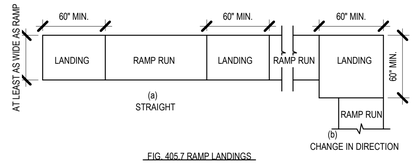


FIG. 405.7 RAMP LANDINGS

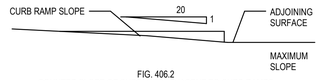


FIG. 406.2
COUNTER SLOPE OF SURFACES ADJACENT TO CURB RAMPS

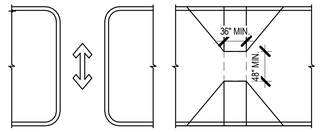


FIG. 406.7 ISLANDS IN CROSSINGS

SIGNAGE

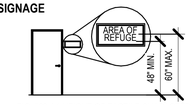


FIG. 703.4.1 HEIGHT OF TACTILE CHARACTERS ABOVE FINISH FLOOR OR GROUND

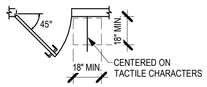


FIG. 703.4.2 LOCATION OF TACTILE SIGNS AT DOORS

FIG. 704.1.1 PARALLEL APPROACH TO TELEPHONE

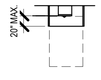


FIG. 704.2.1.2 FRONT APPROACH TO TELEPHONE

FIG. 703.7.2.1 INTERNATIONAL SYMBOL OF ACCESSIBLITY

FIG. 703.7.2.4 INTERNATIONAL SYMBOL OF ACCESS FOR HEARING LOSS

FIG. 703.7.2.2 INTERNATIONAL SYMBOL OF TTY

FIG. 703.7.2.3 VOLUME CONTROL TELEPHONE

PARKING SPACES AND SIGNAGE

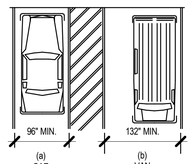


FIG. 502.2 VEHICLE PARKING SPACES

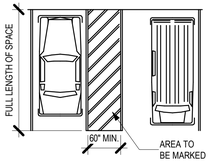


FIG. 502.2 VEHICLE PARKING SPACES

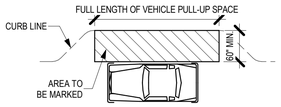
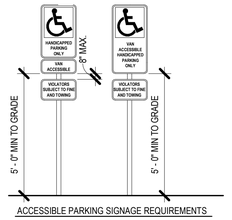


FIG. 503.3 PASSENGER LOADING ZONE ACCESS AISLE



ACCESSIBLE PARKING SIGNAGE REQUIREMENTS

ACCESSIBLE PARKING SIGNS NOTES:

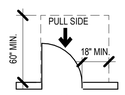
CHARACTERS AND BACKGROUND TO BE OF CONTRASTING COLORS. LIGHT CHARACTERS ON DARK BACKGROUND OR DARK CHARACTERS ON A LIGHT BACKGROUND ARE ACCEPTABLE.

CHARACTERS AND BACKGROUD SHALL HAVE AN EGGSHELL, MATTE, OR OTHER NON-GLARE FINISH ON THE FACE OF THE SIGNS.

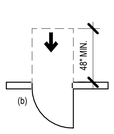
CHARACTERS ARE TO BE AT A WIDTH TO HEIGHT RATIO BETWEEN 3:5 AND 1:1.

PROVIDE ONE PARKING SIGN PER ACCESSIBLE PARKING SPACE.

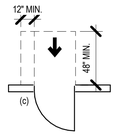
DOOR CLEAR SPACE



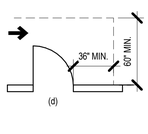
FRONT APPROACH, PULL SIDE



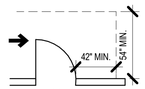
FRONT APPROACH, PUSH SIDE



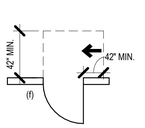
FRONT APPROACH, PUSH SIDE. DOOR PROVIDED WITH BOTH CLOSER AND LATCH



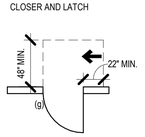
HINGE APPROACH, PULL SIDE



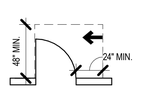
HINGE APPROACH, PULL SIDE



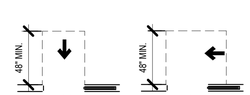
HINGE APPROACH, PUSH SIDE



HINGE APPROACH, PUSH SIDE DOOR PROVIDED WITH BOTH CLOSER AND LATCH

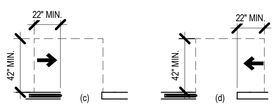


HINGE APPROACH, PULL SIDE



FRONT APPROACH

SIDE APPROACH



POCKET OR HINGE APPROACH

STOP OR LATCH SIDE APPROACH

FIG. 404.2.4.2 MANEUVERING CLEARANCES AT DOORWAYS WITHOUT DOORS,SLIDING DOORS, GATES AND FOLDING DOORS

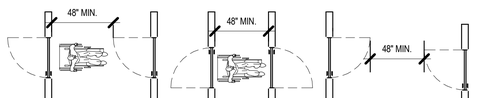
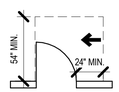
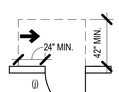


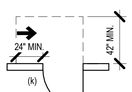
FIG. 404.2.6 DOORS IN SERIES AND GATES IN SERIES



LATCH APPROACH, PULL SIDE, DOOR PROVIDED WITH CLOSER

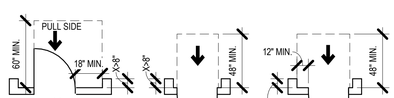


LATCH APPROACH, PUSH SIDE



LATCH APPROACH, PUSH SIDE DOOR PROVIDED WITH CLOSER

FIG. 404.2.4.1 MANEUVERING CLEARANCES AT MANUAL SWINGING DOORS AND GATES



PUSH SIDE,DOOR PROVIDED WITH BOTH CLOSER AND LATCH

FIG. 404.2.4.3 MANEUVERING CLEARANCES AT RECESSED DOORS AND GATES

CLEAR SPACE & TURN AROUNDS

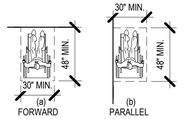


FIG. 305.5 POSITION OF CLEAR FLOOR OR GROUND SPACE

FIG. 305.7.1
MANEUVERING CLEARANCE
IN AN ALCOVE, FORWARD APPROACH

FIG.305.7.2
MANEUVERING CLEARANCE
IN AN ALCOVE, PARALLEL APPROACH

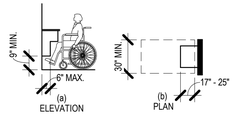


FIG. 306.2 TOE CLEARANCE

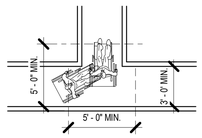
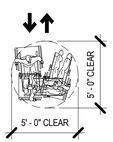


FIGURE 304.3.2
T-SHAPED TURNING SPACE



60" DIAMETER SPACE
WHEELCHAIR TURNING SPACE

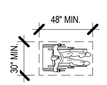


FIG. 305.3
CLEAR FLOOR SPACE OR GROUND SPACE

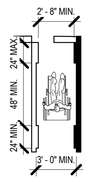


FIG. 403.5.1
CLEAR WIDTH OF AN ACCESSIBLE ROUTE

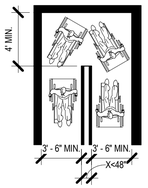


FIG.403.5.2
CLEAR WIDTH AT TURN

HANDRAILS

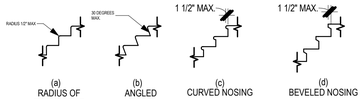


FIG. 504.5 STAIR NOSING

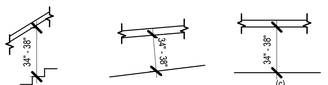


FIG. 505.4 HANDRAIL HEIGHT

FIG. 405.9.2 CURB OR BARRIER EDGE PROECTION

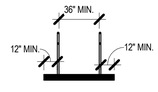


FIG. 405.9.1 EXTENDED FLOOR OR GROUND SURFACE EDGE PROTECTION

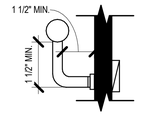


FIG. 505.5 HANDRAIL CLEARANCE

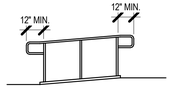


FIG.505.10.1 TOP AND BOTTOM HANDRAIL EXTENSION AT RAMPS

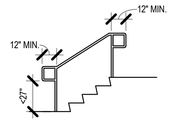


FIG. 505.10.2 TOP HANDRAIL EXTENSION AT STAIRS

FIG. 505.10.3 BOTTOM HANDRAIL EXTENSION AT STAIRS

PROTRUDING OBJECTS

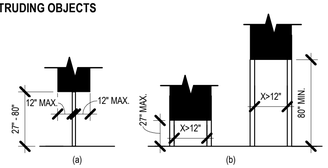


FIG 307.3 POST-MOUNTED PROTRUDING OBJECTS

PROTRUDING OBJECTS

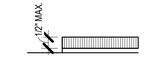


FIG. 302.2 CARPET PILE HEIGHT

FIGURE 303.2
VERTICAL CHANGE IN LEVEL

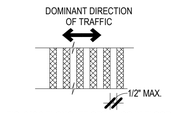


FIG. 302.3 ELONGATE OPENINGS IN FLOOR OR GROUND SURFACES

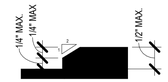


FIGURE 303.3
BEVELED CHANGE IN LEVEL

TOILET COMPARTMENTS

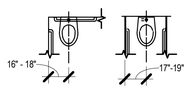


FIG. 604.2 WATER CLOSET LOCATION

FIG. 604.3.1 SIZE OF CLEARANCE AT WATER CLOSETS

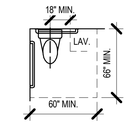


FIG. 604.3.2 (EXCEPTION) OVERLAP OF WATER CLOSET CLEARANCE IN RESIDENTIAL DWELLING UNITS

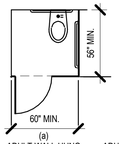


FIG. 604.8.1.1 SIZE OF WHEELCHAIR ACCESSIBLE TOILET COMPARTMENTS

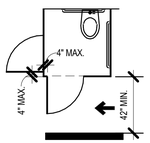


FIG. 604.8.1.2 WHEELCHAIR ACCESSIBLE TOILET COMPARTMENT DOORS

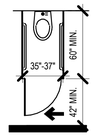


FIG. 604.8.2 AMBULATORY ACCESSIBLE TOILET COMPARTMENT

GENERAL NOTES - TAS 002

1	THE MINIMUM REQUIRED ACCESSIBILITY COMPLIANCE INCLUDES BUT IS NOT LIMITED TO THE INFORMATION SHOWN WITHIN. THE MINIMUM REQUIRED ACCESSIBILITY COMPLIANCE INCLUDES BUT IS NOT LIMITED TO THE INFORMATION SHOWN WITHIN.
2	NOT ALL CONDITIONS SHOWN ON THIS SHEET MAY BE REQUIRED BY THIS PROJECT. COMPARE THE REQUIREMENTS OF THE ARCHITECTURAL DRAWINGS WITH THIS SHEET FOR RELEVANCE OF INFORMATION.
3	DIMENSIONS INDICATED ARE THE MINIMUM CLEAR DIMENSIONS REQUIRED BY ACCESSIBILITY GUIDELINES. THE CONTRACTOR IS RESPONSIBLE FOR LAYOUT OF BUILDING ELEMENTS TO ASSURE THAT DIMENSIONS SHOWN ARE APPROVED.
4	NOTIFY THE ARCHITECT IMMEDIATELY OF ANY DISCREPANCIES BETWEEN THE ARCHITECTURAL DRAWINGS AND THE INFORMATION GIVEN ON THIS SHEET. NOTIFY THE ARCHITECT IMMEDIATELY OF ANY DISCREPANCIES BETWEEN THE ARCHITECTURAL DRAWINGS AND THE INFORMATION GIVEN ON THIS SHEET.
5	DO NOT SCALE THESE DRAWINGS.
6	THE MAJORITY OF THESE FIGURES AND NOTES REFER TO TAS (TEXAS ACCESSIBILITY STANDARDS OF THE ARCHITECTURAL BARRIERS DIVISION OF THE TEXAS DEPARTMENT OF LICENSING AND REGULATION (TDLR)).
7	OUTDOOR SURFACES SHALL BE CONSTRUCTED SO THAT WATER WILL NOT ACCUMULATE ON WALKING SURFACES.
8	2012 TEXAS ACCESSIBILITY STANDARDS 402.2: ACCESSIBLE ROUTES SHALL CONSIST OF ONE OR MORE OF THE FOLLOWING COMPONENTS: WALKING SURFACES WITH A RUNNING SLOPE NOT STEEPER THAN 1:20(5%), DOORWAYS, RAMPS, CURB RAMPS EXCLUDING THE FLARED SIDES, ELEVATORS, AND PLATFORMS. ALL COMPONENTS OF AN ACCESSIBLE ROUTE SHALL COMPLY WITH THE APPLICABLE REQUIREMENTS OF CHAPTER 4. WALKING SURFACES MUST HAVE RUNNING SLOPES NOT STEEPER THAN 1:20, OTHER COMPONENTS OF ACCESSIBLE ROUTES, SUCH AS RAMPS AND CURBS RAMPS ARE PERMITTED TO BE MORE STEEPLY SLOPED.

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03/03/2025

REVISIONS			
NO.	DATE	DESCRIPTION	BY

BASTROP COUNTY
PRECINCT 2 ROAD & BRIDGE FACILITY
911 SE Martin Luther King Blvd.
Smithville, TX 78957

PROJECT NUMBER:	202415
PROJECT PHASE:	CONSTRUCTION DOCUMENTS
DRAWN BY:	CBA
CHECKED BY:	CBA
ISSUE DATE:	03.03.2025

ACCESSIBILITY STANDARDS

SHEET
A001

PLOTTED: 3/3/2025 2:35:30 PM

ACCESSIBLE MOUNTING HEIGHTS SCHEDULE

DESCRIPTION	MOUNTING HEIGHT CHILDREN 3–4 *THIS COLUMN STATES BASIS OF DIMENSION*	MOUNTING HEIGHT CHILDREN 5–8	MOUNTING HEIGHT CHILDREN 9–12	MOUNTING HEIGHT ADULT	NOTES
ACCESSORIES					
GRAB BARS @ HC STALL	18" TO 20" (TOP OF GRIPPING SURFACE, TYP.)	20" TO 25"	25" TO 27"	33" TO 36"	MEET ADA STRENGTH STD.; CLEARANCES PER DTL. 7 ON THIS SHEET
WALL-MOUNTED SOAP DISPENSER	20" TO 36" A.F.F. (TO CONTROL, TYP.)	18" TO 40" A.F.F.	16" TO 44" A.F.F.	44" MAX. A.F.F.	MEET ADA STANDARD FOR VALVE FORCE
PAPER TOWEL DISPENSER /DISPOSAL	20" TO 36" A.F.F. (TO CONTROL, TYP.)	18" TO 40" A.F.F.	16" TO 44" A.F.F.	48" MAX. A.F.F.	27" MAX. CLEARANCE A.F.F.; OR IF NOT, 4" MAX. PROJECTION FROM WALL
PAPER TOWEL DISPENSER ONLY	20" TO 36" A.F.F. (TO CONTROL, TYP.)	18" TO 40" A.F.F.	16" TO 44" A.F.F.	44" MAX. A.F.F.	MOUNTED ABOVE COUNTER; OR IF NOT, 4" MAX. PROJECTION FROM WALL
TOILET PAPER DISPENSER	14" A.F.F. (TO DISPENSER, TYP.)	14" TO 17" A.F.F.	17" TO 19" A.F.F.	15" TO 48" A.F.F.	ALLOW CONT. PAPER FLOW
COAT HOOKS	20" TO 36" A.F.F. (TO HOOK, TYP.)	18" TO 40" A.F.F.	16" TO 44" A.F.F.	15" TO 48" A.F.F.	
SHELVES	SAME AS ADULT	SAME AS ADULT	SAME AS ADULT	40" TO 48" A.F.F.	
MIRROR ABOVE COUNTER OR LAV.; ACCESSIBLE	SAME AS ADULT (TO REFLECTIVE SURFACE, TYP.)	SAME AS ADULT	SAME AS ADULT	40" MAX. A.F.F.	74" MIN. A.F.F TO TOP EDGE
MIRROR WITH CLEAR WALL BELOW, ACCESSSIBLE	SAME AS ADULT (TO REFLECTIVE SURFACE, TYP.)	SAME AS ADULT	SAME AS ADULT	35" MAX. A.F.F.	74" MIN. A.F.F TO TOP EDGE
BABY CHANGING STATION	SAME AS ADULT (TO RIM OF TABLE, TYP.)	SAME AS ADULT	SAME AS ADULT	34" MAX. A.F.F.	REFER TO DETAIL 3 ON THIS SHEET FOR TOE & KNEE CLEARANCE
PLUMBING FIXTURES					
WATER CLOSET, ACCESSIBLE	11" TO 12" A.F.F. (TO RIM OF SEAT, TYP.)	12" TO 15" A.F.F.	15" TO 17" A.F.F.	17" TO 19" A.F.F.	FLUSH HANDLE TO WIDE SIDE OF TOILET COMPARTMENT
FLUSH HANDLE	36" MAX. A.F.F. (TO CONTROL, TYP.)	36" MAX. A.F.F.	36" MAX. A.F.F.	44" MAX. A.F.F.	
LAVATORY, WALL MOUNTED	28" MAX. A.F.F. (TO RIM OF SINK, TYP.)	31" MAX. A.F.F.	31" MAX. A.F.F.	34" MAX. A.F.F.	ADA-LEVER FAUCET; PROVIDE ADA COMPLIANT PIPE PROTECTION
KNEE CLEARANCE	N/A; SIDE-APPROACH PER DTL. 16 THIS SHEET	24" HIGH MIN.	24" HIGH MIN.	SEE DTL. 3 ON THIS SHEET	REFER TO DETAIL 3 ON THIS SHEET FOR TOE & KNEE CLEARANCE
LAVATORY, COUNTER MOUNTED	28" MAX. A.F.F. (TO COUNTER SURFACE, TYP.)	31" MAX. A.F.F.	31" MAX. A.F.F.	34" MAX. A.F.F.	ADA-LEVER FAUCET; PROVIDE ADA COMPLIANT PIPE PROTECTION
KNEE CLEARANCE	N/A; SIDE-APPROACH PER DTL. 16 THIS SHEET	24" HIGH MIN.	24" HIGH MIN.	SEE DTL. 3 ON THIS SHEET	REFER TO DETAIL 3 ON THIS SHEET FOR TOE & KNEE CLEARANCE
URINAL, ACCESSIBLE	SEE ACCESSORY SCHEDULE	SEE ACCESSORY SCHED.	SEE ACCESSORY SCHED.	17" MAX. A.F.F. TO RIM OF BASIN	13.5" DEEP MIN. FROM WALL TO FRONT OF RIM
FLUSH HANDLE	20" TO 36" A.F.F. (TO CONTROL, TYP.)	18" TO 40" A.F.F.	16" TO 44" A.F.F.	15" TO 48" A.F.F.	
ELECTRICAL FIXTURES					
ELECTRIC WATER COOLER, ACCESSIBLE	30" MAX. A.F.F. (TO OUTLET OF SPOUT, TYP)	30" MAX. A.F.F.	30" MAX. A.F.F.	36" MAX. A.F.F.	PROVIDE MANUFACTURED APRON FOR ADA COMPLIANCE
KNEE CLEARANCE	N/A; SIDE-APPROACH PER DTL. 16 THIS SHEET	SIDE-APPROACH	SIDE-APPROACH	SEE DTL. 3 ON THIS SHEET	REFER TO DETAIL 3 ON THIS SHEET FOR TOE & KNEE CLEARANCE

ACCESSIBLE WATER CLOSET CENTERLINE DISTANCES FROM WALL

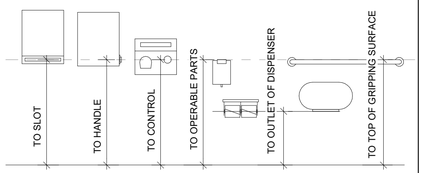
AGES 3–4	AGES 5–8	AGES 9–12	AGES 12 & UP (ADULT)
12" (FROM WALL, TYP.)	12" TO 15"	15" TO 18"	16" TO 18"

ACCESSIBLE VERTICAL REACH RANGES

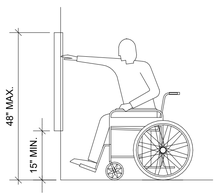
	FORWARD OR SIDE REACH	
	LOW (MIN.)	HIGH (MAX.)
AGES 3–4	20" A.F.F.	36" A.F.F.
AGES 5–8	18" A.F.F.	40" A.F.F.
AGES 9–12	16" A.F.F.	44" A.F.F.
AGES 12 & UP	SEE DETAILS 14–17 ON THIS SHEET	

GENERAL NOTES - TAS 003

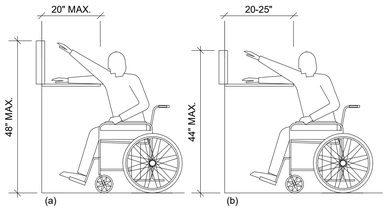
1	DIMENSIONS SHOWN ON DIAGRAMS ARE FOR ADULT FACILITIES UNLESS OTHERWISE NOTED. DIMENSIONS WILL VARY FOR FACILITIES USED PRIMARILY BY CHILDREN AGED 12 & YOUNGER – SEE MOUNTING HEIGHTS SCHEDULE.
2	PER §307.2, OBJECTS WITH LEADING EDGES MORE THAN 27" AND NOT MORE THAN 80" ABOVE THE FINISH FLOOR OR GROUND SHALL PROTRUDE NO MORE THAN 4" HORIZONTALLY INTO THE CIRCULATION PATH.
3	IN EACH TOILET ROOM THAT A LAVATORY, WATER CLOSET, MIRROR, OR URINAL IS PROVIDED, AT LEAST ONE OF EACH FIXTURE SHALL BE MADE ACCESSIBLE (TOGETHER WITH ITS ACCESSORIES) IN ACCORDANCE WITH THESE TAS SHEETS.
4	FOR ALL SINKS (LAVATORIES):A CLEAR FLOOR SPACE AT LEAST 30" BY 48" SHALL BE PROVIDED IN FRONT OF A SINK TO ALLOW FORWARD APPROACH. THE CLEAR FLOOR SPACE SHALL BE ON AN ACCESSIBLE ROUTE. TOE & KNEE CLEARANCE THAT IS AT LEAST 30" WIDE AND COMPLIES WITH DETAIL 1 ON THIS SHEET SHALL BE PROVIDED UNDERNEATH SINKS.
5	HOT WATER AND DRAIN PIPES EXPOSED UNDER SINKS SHALL BE INSULATED OR OTHERWISE CONFIGURED SO AS TO PROTECT AGAINST CONTACT. THERE SHALL BE NO SHARP OR ABRASIVE SURFACES UNDER SINKS.
6	EACH SINK SHALL BE A MAXIMUM OF 6 1/2" DEEP.
7	FAUCETS SHALL COMPLY WITH 4.27.4, LEVER-OPERATED, PUSH-TYPE, TOUCH-TYPE OR ELECTRONICALLY CONTROLLED MECHANISMS ARE ACCEPTABLE DESIGNS.
8	ELECTRIC WATER COOLERS (AKA DRINKING FOUNTAINS, EWC'S): 50% OF ALL EWC'S IN THE BUILDING SHALL BE MADE ACCESSIBLE IN ACCORDANCE WITH THESE TAS SHEETS. THE REMAINING 50% SHALL BE MOUNTED AT 38" TO 43" A.F.F. TO SPOUT FOR STANDING-HEIGHT USERS.
9	COUNTERS, DINING AND WORK SURFACES: ACCESSIBLE PORTIONS OF COUNTERS, DINING AND WORK SURFACES SHALL HAVE TOE & KNEE CLEARANCE COMPLYING WITH DETAIL ON THIS PAGE.



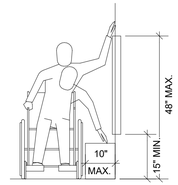
BASIS OF MOUNTING HEIGHTS



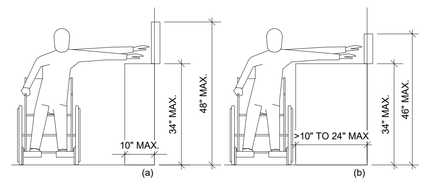
UNOBSTRUCTED FORWARD REACH



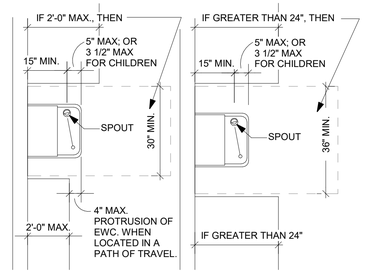
OBSTRUCTED HIGH FORWARD REACH



UNOBSTRUCTED SIDE REACH



OBSTRUCTED HIGH SIDE REACH

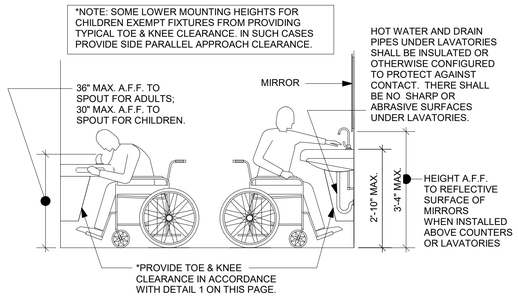


NOTE: ADJACENT STANDING-HEIGHT EWC'S ARE PERMITTED WITHIN THE CLEAR FLOOR SPACE OF AN ACCESSIBLE EWC, PROVIDED THE STANDING-HEIGHT EWC DOES NOT OBSTRUCT THE CONTROLS OR REQUIRED TOE & KNEE CLEARANCE OF THE ACCESSIBLE EWC.

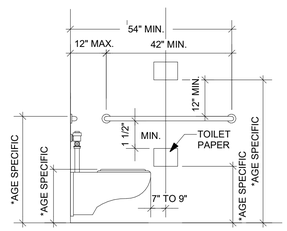
NOTE: STANDING-HEIGHT EWC'S SHALL BE MOUNTED 38" TO 43" A.F.F. TO SPOUT.

EWC CLEAR FLOOR SPACE

*NOTE: SOME LOWER MOUNTING HEIGHTS FOR CHILDREN EXEMPT FIXTURES FROM PROVIDING TYPICAL TOE & KNEE CLEARANCE. IN SUCH CASES PROVIDE SIDE PARALLEL APPROACH CLEARANCE.



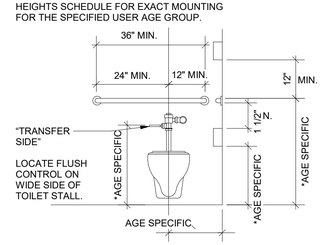
EWC & LAVATORY CLEARANCES



NOTE: PER §609.3, THE SPACE BETWEEN THE WALL AND THE GRAB BAR SHALL BE 1 1/2". PROTRUDING OBJECTS MAY NOT BE LOCATED BEHIND THE GRAB BAR.

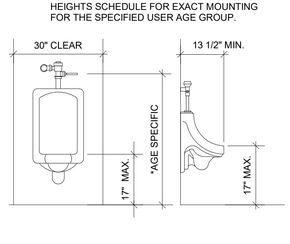
TOILET STALL - SIDE WALL

*NOTE: REFER TO ACCESSIBLE MOUNTING HEIGHTS SCHEDULE FOR EXACT MOUNTING FOR THE SPECIFIED USER AGE GROUP.



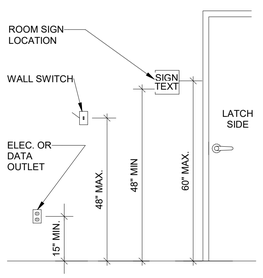
TOILET STALL - REAR WALL

*NOTE: REFER TO ACCESSIBLE MOUNTING HEIGHTS SCHEDULE FOR EXACT MOUNTING FOR THE SPECIFIED USER AGE GROUP.

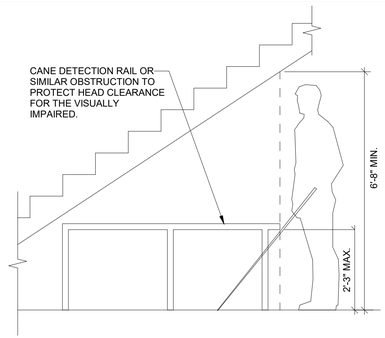


ACCESSIBLE WALL-HUNG URINAL

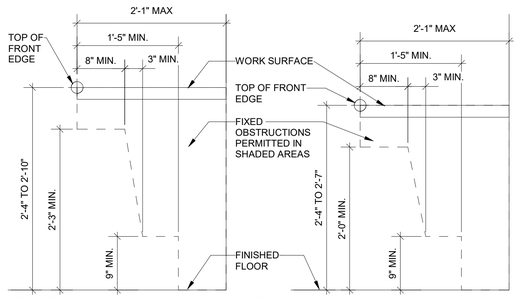
NOTE: WALL-MOUNTED TOILET ACCESSORIES SUCH AS GRAB BARS AND VARIOUS DISPENSERS ARE PERMITTED WITHIN THE REQUIRED CLEAR FLOOR SPACES FOR FIXTURES. **



MOUNTING HEIGHTS

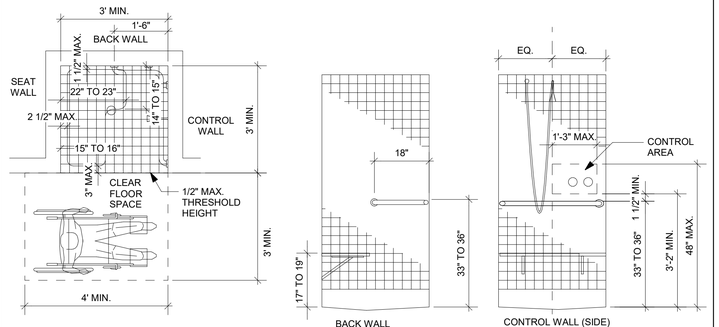


VERTICAL CLEARANCE @ STAIR



NOTE: THE TOE & KNEE CLEARANCE DIAGRAMS ABOVE APPLY TO THE FOLLOWING FORWARD-APPROACH ACCESSIBLE ELEMENTS: **LAVATORIES** (COUNTER AND WALL-MOUNTED), **DRINKING FOUNTAINS**, **COUNTERS**, **BABY CHANGING STATIONS**, AND ANY OTHER **WORK SURFACE** OR **DINING SURFACE**

TOE & KNEE CLEARANCE



NOTE: SHOWER SEAT SHALL BE FOLDING TYPE, WITH STRUCTURAL CAPACITY OF AT LEAST 250 LB FOR ALL COMPONENTS (SEAT, FASTENERS, MOUNTING, SUPPORTS)

NOTE: PER §608.6, PROVIDE SHOWER HEAD TO BE USED AS BOTH FIXED-POSITION & HAND-HELD, W/ HOSE 59" IN LENGTH. SHOWER SPRAY UNIT SHALL HAVE ON/OFF CONTROL WITH NON-POSITIVE SHUT-OFF.

SHOWER SIZE & CLEARANCES

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REGISTERED ARCHITECT — JOHN M. BEAMAN — 28889 — STATE OF TEXAS

03/03/2025

REVISIONS			
NO.	DATE	DESCRIPTION	BY

BASTROP COUNTY
PRECINCT 2 ROAD & BRIDGE FACILITY
911 SE Martin Luther King Blvd.
Smithville, TX 78957

PROJECT NUMBER:	202415
PROJECT PHASE:	CONSTRUCTION DOCUMENTS
DRAWN BY:	CBA
CHECKED BY:	CBA
ISSUE DATE:	03.03.2025

ACCESSIBILITY STANDARDS

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SCOPE OF WORK

NEW ONE STOREY PRE- ENGINEERED METAL BUILDING AND CONCRETE SLAB WITH INSULATED ELECTRIC OVERHEAD DOORS.
CONDITIONED SPACE AT OFFICES, BREAK ROOM, RESTROOM AND LOCKER ROOM. UNCONDITIONED SPACES AT SHOP AREAS.
PEMB SUPPLIER TO PROVIDE PEMB STRUCTURE, ROOF AND WALL PANELS, EXTERIOR SWINGING METAL DOORS AND FRAMES, INSULATION, PREFABRICATED METAL DOWNSPOUTS AND GUTTERS.
CONTRACTOR TO COORDINATE CIVIL, MECHANICAL, ELECTRICAL AND PLUMBING WITH ENGINEERS.

CODE INFORMATION

APPLICABLE CODES

2006 INTERNATIONAL BUILDING CODE
2015 INTERNATIONAL ENERGY CONSERVATION CODE
2006 UNIFORM FIRE CODE
2012 TEXAS ACCESSIBILITY STANDARDS

GENERAL NOTES

1. CONTRACTOR SHALL VISIT THE SITE AND VERIFY FIELD CONDITIONS PRIOR TO STARTING WORK.
2. CONTRACTOR SHALL NOTIFY THE ARCHITECT OF ANY DISCREPANCIES IN THE DRAWINGS AND ACTUAL FIELD CONDITIONS PRIOR TO START OF WORK
3. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DAMAGE TO THE EXISTING PROPERTY, BUILDINGS OR OWNER'S EQUIPMENT INCURRED BY HIS STAFF OR SUBCONTRACTORS.
4. CONTRACTOR TO PROTECT AREAS AND SURFACES ADJACENT TO THE CONSTRUCTION AREA FROM DAMAGE AND DEBRIS. ALL AREAS ARE TO BE CLEAN AND SERVICEABLE AT THE COMPLETION OF DEMOLITION, PRIOR TO COMMENCEMENT OF NEW CONSTRUCTION.
5. WRITTEN DIMENSIONS GOVERN; DO NOT SCALE DRAWINGS.
6. CONTRACTOR SHALL COORDINATE THE LOCATION OF ALL EXISTING UTILITIES: TO BE REMOVED, TO BE RELOCATED TEMPORARILY, OR TO REMAIN.
7. ALL UTILITIES AND CONDUIT NOT TO BE REUSED SHALL BE CAPPED OFF AT THE FLOOR OR WALL LINES, IN METHODS ACCEPTABLE TO APPLICABLE CODES.
8. THE ARCHITECT WILL NOT BE RESPONSIBLE FOR, NOR HAVE CONTROL OF, NOR BE IN CHARGE OF CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES OR PROCEDURES, NOR FOR SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE WORK, AND WILL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S FAILURE TO CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS. THE ARCHITECT WILL NOT BE RESPONSIBLE, NOR HAVE CONTROL OF, NOR BE IN CHARGE OF THE ACTS OR OMISSIONS OF THE CONTRACTOR, SUBCONTRACTOR, OR ANY OF THEIR AGENTS OR EMPLOYEES, OR ANY OTHER PERSONS PERFORMING ANY OF THE WORK.
9. ALL DEMOLITION BUILDING MATERIALS ARE TO BE REMOVED FROM THE SITE, EXCEPT WHERE NOTED TO BE SALVAGED FOR THE OWNER'S USE MATERIAL SHALL BE DISPOSED IN A MANNER AND LOCATION IN ACCORDANCE WITH LOCAL CODES.
10. ANY REFERENCE TO SPECIFIC MANUFACTURER'S PRODUCTS IS FOR THE PURPOSE OF ESTABLISHING A STANDARD FOR PATTERNS, COLORS, AND TEXTURES. IT IS NOT INTENDED TO LIMIT SELECTIONS OF ANOTHER MANUFACTURER'S PRODUCTS.
11. CONTRACTOR TO INCLUDE IN HIS BID ALL COSTS FOR REPAIR AND PATCHING OF ADJACENT FLOORS, WALLS, CEILINGS, DOORS, AND ANY OTHER SURFACES AFFECTED BY THE WORK. ALL REPAIRS TO MATCH EXISTING UNLESS OTHERWISE NOTED IN THE DRAWINGS.
12. IF CONTRACTOR DISCOVERS WHAT HE SUSPECTS IS ASBESTOS CONTAINING MATERIALS (ACM) DURING THE WORK, HE SHALL NOTIFY THE REPRESENTATIVE OF THE OWNER AND THE ARCHITECT, AND TAKE SUCH ACTION AS REASONABLY NECESSARY AND FEASIBLE TO PROVIDE AN INTERIM SAFE AND SECURE ENVIRONMENT FOR ITS EMPLOYEES AND THIRD PARTIES UNTIL DETERMINATION CAN BE MADE AS TO HOW TO PROCEED.
13. ANY WORK REQUIRING SHUTTING OFF OF UTILITIES, BLOCK FIRE ESCAPE ROUTES, OR ANY OTHER WORK AFFECTING LIFE AND SAFETY IS TO BE COORDINATED WITH THE OWNER AND ARCHITECT PRIOR TO START OF WORK.

LOCATION PLAN

ARCHITECTURAL SYMBOLS

ROOM NAME 100 — ROOM TAG
X — GRID/COLUMN CENTER LINE
100A — DOOR TAG
E1 — WINDOW/STOREFRONT TAG
TA-1 — TOILET ACCESSORIES TAG
1 — REVISION TAG
℄ — CENTERLINE
#' - #" — ELEVATION INDICATOR
#' - #" — ELEVATION CHANGE
ROOF CRICKET
1/A100 — BUILDING SECTION / WALL SECTION
1 / 4 A1.1 2 / 3 — ELEVATION INDICATOR
1/A100 — ELEVATION
1/A100 — CALLOUT DETAIL
CG — CORNER GUARDS
NEW WALLS
EXISTING WALLS
DEMOLISHED WALLS
SMOKE PARTITION / 1/2 HOUR RATED PARTITION
1 HOUR FIRE-RATED PARTITION
2 HOUR FIRE-RATED PARTITION
3 HOUR FIRE-RATED PARTITION
4 HOUR FIRE-RATED PARTITION
A / A0.1 — PARTITION
ALIGN — ALIGN ITEMS SHOWN
BREAK LINE
PROPERTY LINE
AIR BARRIER / VAPOR BARRIER
MATCHLINE

MATERIAL CUT PATTERNS

EARTH FILL
SAND
CONCRETE
CONCRETE MASONRY UNIT
BRICK
STONE
STEEL
ALUMINUM
WOOD
EIFS
LUMBER (THROUGH MEMBER)
LUMBER (INTERRUPTED MEMBER)
GYPSUM WALL BOARD
RIGID INSULATION
BATT INSULATION

DRAWING ABBREVIATIONS

A.F.F	ABOVE FINISH FLOOR	M.O.	MASONRY OPENING
A.H.U.	AIR HANDLER UNIT	N.I.C.	NOT IN CONTRACT
ALT.	ALTERNATE	O.C.	ON CENTER
ALUM.	ALUMINUM	O.D.	OUTSIDE DIAMETER
APPROX.	APPROXIMATELY	O.F.	OWNER FURNISHED
@	AT	O.H.	OPPOSITE HAND
BD.	BOARD	O.I.	OWNER INSTALLED
B.O.	BOTTOM OF	P.E.M.B.	PRE-ENGINEERED METAL BUILDING
CAB.	CABINET	PLAM	PLASTIC LAMINATE
CG	CORNER GUARD	PTD.	PAINTED
C.I.	CONTRACTOR INSTALLED	RAD.	RADIUS
C.J.	CONTROL JOINT	RE:	REFER TO
CL	CENTER LINE	REINF.	REINFORCED
CLG.	CEILING	R.O.	ROUGH OPENING
COL.	COLUMN	SIM.	SIMILAR
CONC.	CONCRETE	SPEC.	SPECIFICATION
CPT.	CARPET	S.T.C.	SOUND TRANSMISSION COEFFICIENT
C.T.	CERAMIC TILE	SUSP.	SUSPENDED
D.F.	DRINKING FOUNTAIN	S.V.T.	SOLID VINYL TILE
DIA.	DIAMETER	T.B.	TACK BOARD
DN	DOWN	T.O.	TOP OF
D.S.	DOWNSPOUT	U.N.O.	UNLESS NOTED OTHERWISE
E.J.	EXPANSION JOINT	V.C.T.	VINYL COMPOSITION TILE
EQ.	EQUAL	W.C.	WATER CLOSET
EQUIP.	EQUIPMENT	WD.	WOOD
EXP.	EXPOSED	WDPL	WOOD WITH PLASTIC LAMINATE
F.A.C.P.	FIRE ALARM CONTROL PANEL	W.H.	WATER HEATER
F.D.	FLOOR DRAIN	W.W.M.	WELDED WIRE MESH
F.E.C.	FIRE EXTINGUISHER CABINET		
F.F.	FINISH FLOOR		
F.V.	FIELD VERIFY		
GA.	GAUGE		
G.W.B.	GYPSUM WALL BOARD		
H.K.	HOUSE KEEPING		
H.M.	HOLLOW METAL		
ID.D	INSIDE DIAMETER		
MB	MINI-BLINDS		
M.B.	MARKER BOARD		
MFR.	MANUFACTURER		

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AUSTIN TEXAS 78738
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REGISTERED ARCHITECT BEAMAN 8889 STATE OF TEXAS
03/03/2025

REVISIONS

NO.	DATE	DESCRIPTION	BY

BASTROP COUNTY
PRECINCT 2 ROAD & BRIDGE FACILITY
911 SE Martin Luther King Blvd,
Smithville, TX 78957

PROJECT NUMBER:	202415
PROJECT PHASE:	CONSTRUCTION DOCUMENTS
DRAWN BY:	Author
CHECKED BY:	Checker
ISSUE DATE:	03.03.2025

ARCHITECTURAL GENERAL INFORMATION

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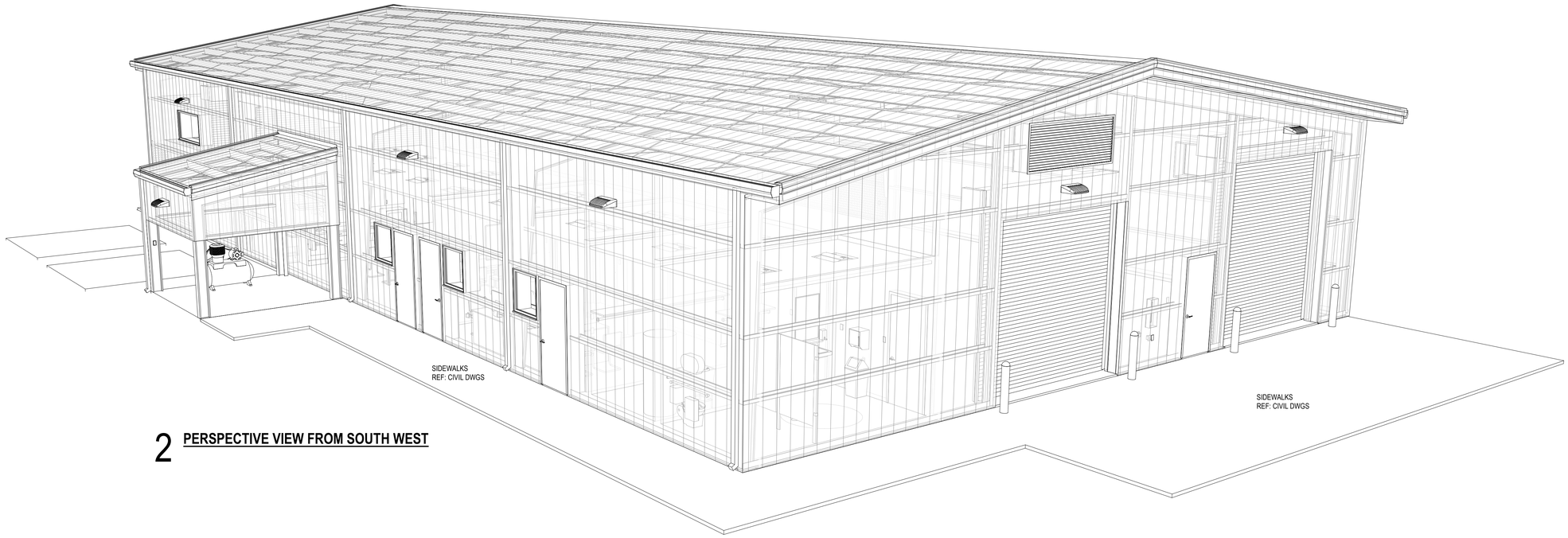
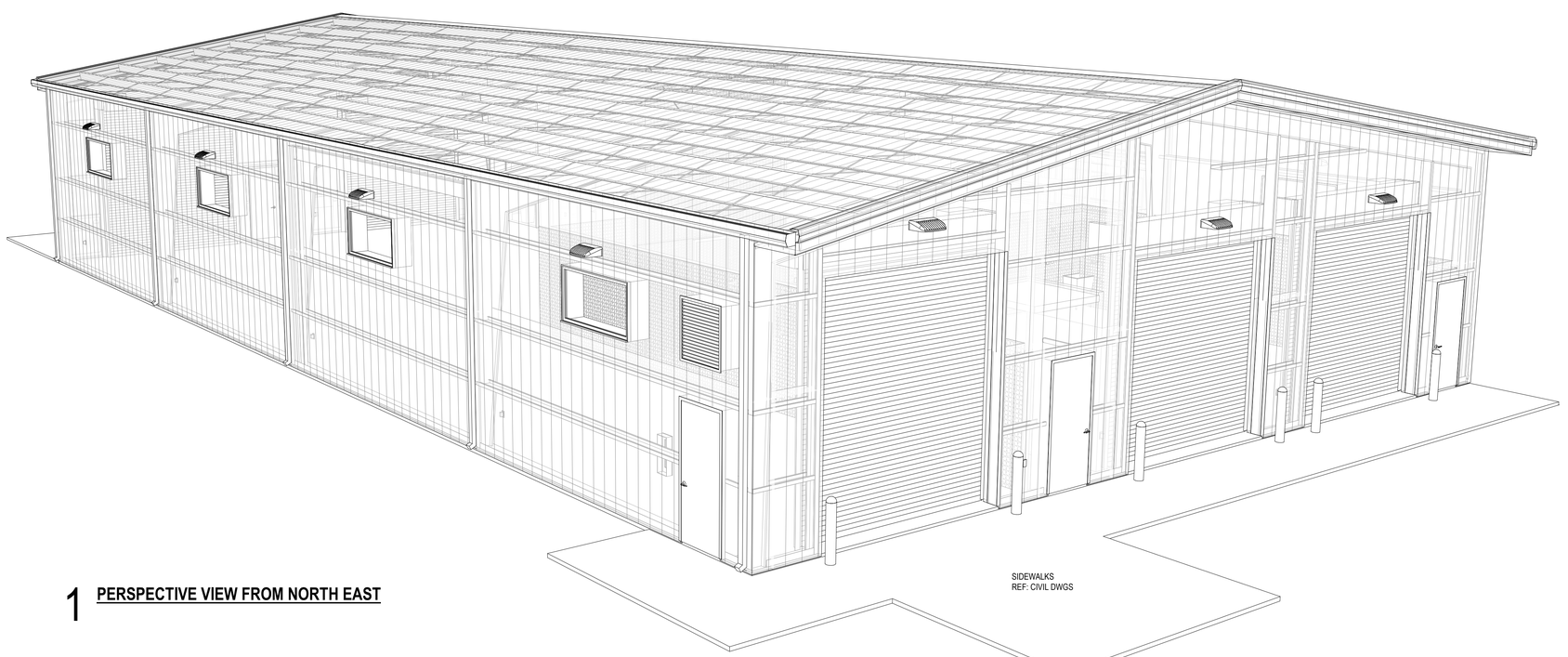


2 PERSPECTIVE VIEW FROM SOUTH WEST



1 PERSPECTIVE VIEW FROM NORTH EAST

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REGISTERED ARCHITECT
JOSEPH BEAMAN
STATE OF TEXAS
8889

03/03/2025

REVISIONS

NO.	DATE	DESCRIPTION	BY

BASTROP COUNTY

PRECINCT 2 ROAD & BRIDGE FACILITY

911 SE Martin Luther King Blvd,
Smithville, TX 78957

PROJECT NUMBER:	202415
PROJECT PHASE:	CONSTRUCTION DOCUMENTS
DRAWN BY:	JG
CHECKED BY:	JB
ISSUE DATE:	03.03.2025

PERSPECTIVE VIEWS

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SPECIFICATIONS

REFER TO CIVIL, STRUCTURAL (PEMB SUPPLIER), & MEP DRAWINGS FOR ADDITIONAL SPECIFICATIONS

CONTRACTOR TO COORDINATE ALL OF PEMB STRUCTURE W/ PEMB SUPPLIER; WALLS (CHARCOAL GREY), ROOF (GALVALUME FINISH), EXTERIOR WALL & ROOF INSULATION, EXTERIOR SWINGING DOORS, GUTTERS & DOWNSPOUTS,

DIVISION 1 - GENERAL REQUIREMENTS:
COORDINATE WITH OWNER

1. SUBMITTALS – REFER TO UNIFORM GENERAL CONDITIONS (UGC) FOR ADDITIONAL INFORMATION AND REQUIREMENTS. PROVIDE SUBMITTALS (ARCHITECTURAL) FOR THE FOLLOWING:

05 METALS- PROVIDE SHOP DRAWINGS OF CAGE AREA W/ GALVANIZED EXPANDED METAL, POST, BRACKETS, INSTALL.
06 FINISH CARPENTRY - MILLWORK & SHELVES
07 THERMAL & MOISTURE PROTECTION- INSULATION & SEALANTS
08 OPENINGS - INTERIOR DOORS, FRAME & WINDOWS, LOUVER
09 FINISHES- GYP. BD., SEALANTS, TILE, ACT CEILING SYSTEM, INTERIOR PAINT, EXTERIOR PAINT, WALL BASE, ALUM. DIAMOND CHECKER PLATE SHEET ROLL, LVT
10 SPECIALTIES - BUILDING & ROOM SIGNAGE, TOILET ACCESSORIES, TOILET PARTITION
21 FIRE SUPPRESSION - PROVIDE SHOP DRAWINGS, DESIGN SEALED BY ENGINEER

2. SUBSTITUTION PROCEDURES – SUBSTITUTION REQUESTS SHALL BE SUBMITTED DURING THE BIDDING PROCESS, A MINIMUM OF ONE WEEK PRIOR TO THE BID DUE DATE. CHANGES PROPOSED BY CONTRACTOR THAT ARE REQUIRED DUE TO CHANGED PROJECT CONDITIONS MAY BE CONSIDERED DURING THE SUBMITTAL PHASE. REFER TO THE UNIFORM GENERAL CONDITIONS (UGC), SECTION 8.3.5 FOR ADDITIONAL INFORMATION. SUBSTITUTION REQUESTS FOR CONVENIENCE OR FOR LACK OF PLANNING WILL NOT BE ACCEPTED.
PRODUCT REQUIREMENTS (STORAGE & HANDLING) – THE MANUFACTURER'S PRODUCT REQUIREMENTS FOR STORAGE AND HANDLING OF HAZARDOUS AND/OR TOXIC MATERIALS. COORDINATE WITH OWNER.

3. CLOSEOUT DOCUMENTS – PROVIDE CLOSEOUT DOCUMENTS, INCLUDING AS-BUILT DRAWINGS & OPERATION & MAINTENANCE (O&M) MANUALS.

4. WARRANTIES & GUARANTEES – UNLESS NOTED OTHERWISE IN THE DOCUMENTS & MANUFACTURER'S, ALL WARRANTIES MUST BE GOOD FOR AT LEAST ONE (1) YEAR AFTER THE DATE OF SUBSTANTIAL COMPLETION. REFER TO UNIFORM GENERAL CONDITIONS (UGC) FOR ADDITIONAL INFORMATION.

5. ALLOWANCE- NO.1 -CONTRACTOR TO INCLUDE $9,900 FOR INTERIOR DOOR HARDWARE (11 DOORS). THIS IS FOR THE PURCHASE, COORDINATION & INSTALLATION OF ALL INTERIOR DOOR HARDWARE.

6. ADA/TDLR- BEFORE SUBSTANTIAL COMPLETION, CONTRACTOR TO COORDINATE W/ OWNER TO SCHEDULE RAS INSPECTION. DURING CONSTRUCTION, CONTRACTOR TO COORDINATE & COMPLY WITH TAS COMPLIANCE FOR THE PROJECT. IF CONTRACTOR OBSERVES ANY DISCREPANCIES OR HAS QUESTIONS; COORDINATE WITH ARCHITECT & OWNER.

DIVISION 2 - SITE CONSTRUCTION:
COORDINATE ON SITE AND WITH OWNER ON EXISTING EXTERIOR METAL TANKS.
REF. TO CIVIL DRAWINGS

DIVISION 3 - CONCRETE:
REFER TO CIVIL & STRUCTURAL DRAWINGS FOR CONCRETE SLAB, FLOOR DRAIN COORDINATION & LOCATION.

CONCRETE BOLLARDS: PAINTED YELLOW, TYP., REF. CIVIL

DIVISION 4 - MASONRY: NOT USED

DIVISION 5 - METALS:
AT WALL PANELS:
ALUM. DIAMOND CHECKER PLATE SHEET ROLL
MANUF: METAL ROOFING SCREWS.COM
FINISH: GREY
SIZE: 1/32", 48" WIDE X 10 FT LONG
INSTALL: HIGH-STRENGTH CONSTRUCTION ADHESIVE FOR METAL

AT CAGE AREA:
GALVANIZED EXPANDED METAL MESH: 1/4" X #18, 1/2" , 4'X8'
MANUF: METALS DEPOT
GALVANIZED METAL POST: 2 3/8" DIA. 16 GA. FENCE CORNER POST, INCLUDE ALL ACCESSORIES FOR ATTACHING POST TO FLOOR, WALL & EXPANDED METAL CAGE DOOR REF. DIV. 08 OR SIMILAR TO MATCH CAGE WALL

DIVISION 6 - WOODS, PLASTICS & COMPOSITES:

ROUGH CARPENTRY: WOOD BLOCKING AS REQUIRED & SHOWN ON DRAWINGS;
AT RESTROOM GRAB BARS, AT CAGE WALL BRACING, TV/ SCREEN, LOCKER ROOM SHELVING, TOILET & URINAL WALL PARTITIONS,

FINISH CARPENTRY:
PLYWOOD WALL PANEL: 5/8" (4'X8') PANEL- PREMIUM ACX SANDED (MENARDS), PATTERN-STACK BOND, SCREWS-STAINLESS STEEL, FLAT TOP, EQUAL SPACING & ALIGNED

LOCKER ROOM:
1" WOOD SHELVING, EXPOSED EDGES-ROUNDED, METAL SUPPORT BRACKETS (WHITE) W/ ROD, PAINTED-WHITE, GLOSSY

BREAKROOM:
CABINETS: 3/4" PLYWOOD W/ PLASTIC LAMINATE AT EXPOSED FACES, WHITE MELAMINE INSIDE & AT SHELVING, RECESSED ADJUSTABLE METAL TRACKS & BRACKETS FOR SHELVING, PLAM COLOR: TBD- BY OWNER & ARCHITECT
HARDWARE: HANDLES- 4" WIDE STAINLESS STEEL WIRE, HINGES: EUROPEAN CONCEALED STYLE, SOFT CLOSE
COUNTER: W/ BULLNOSE(ROUNDED EDGE) & BACKSPLASH (4"). PLAM: TBD- BY OWNER

DIVISION 7 - THERMAL & MOISTURE PROTECTION:
PARTITION INSULATION: UNFACED ONE-SIDE BATT INSULATION, SIZE AS SHOWN ON DRAWINGS, SIM TO MANUF.: CERTAINTEED CORP.,
JOINT SEALANT: AT GYPSUM BOARD, AT FLOOR & WALL BASE AREA

CONT.:

DIVISION 8 - DOORS AND WINDOWS:
OVERHEAD ROLLING METAL DOORS, ELECTRIC: COLOR TO MATCH WALL PANEL-CHARCOAL GREY, SIZE INDICATED ON DWGS, INSULATED R-VALUE 8.0, W/ LOCK,
SIM. TO MANUF.: CORNELL, ROLLING SERVICE DOOR, GALVANIZED STEEL W/ GALVANEX FINISH, SERIES ESD20CR / , ELECTRIC W/ ALL ACCESSORIES,
EXTERIOR DOORS: BY PEMB SUPPLIER (INSULATED METAL)
PAINT BY CONTRACTOR; COORDINATE COLOR W/ OWNER
INTERIOR DOOR FRAMES: PRE-FINISHED METAL, SIM TO: TIMELY, PREFINISHED, TA-8 STANDARD STEEL, S-SERIES, 20 GA., ADJUSTABLE FRAME, COLOR: TBD
INTERIOR DOORS:
SOLID CORE: PARTICLEBOARD CORE, 1 3/4" THICKNESS,
PLAM FINISH: HIGH PRESSURE DECORATIVE PLASTIC LAMINATE TYPE 1 WATER-RESISTANT ADHESIVE, COLOR: TBD BY OWNER
MANUF: VT INDUSTRIES, INC.
METAL DOOR: INSULATED, FACTORY PRIMED, PAINTED ON SITE, SIM. TO MANUF: CECO DOOR, STEEL SHEET ,LEVEL 1 -STANDARD DUTY, 18 GA., FLUSH - VISION PANEL STANDARD GLAZING,
CAGE DOOR: SIMILAR TO :MANUF. ULINE, HINGED DOOR W/ MTL. MESH 3' X 7' , MESH TO MATCH EXPANDED MTL. MESH AT WALLS, HARDWARE: STAINLESS PULL, W/ BRACKETS FOR PADLOCK, HINGES-STAINLESS STEEL/ GALV.
WINDOWS: ALUMINUM FINISH, EXTRUDED ALUM. WINDOWS W/ FIXED SASH, WARRANTY: 5 YRS, STANDARD 2" FRAMING, BASIS OF DESIGN: KAWNEER EXTERIOR 451-T CLASS II NATURAL ANODIZED AT EXTERIOR & INTERIOR FINISH, FACTORY FABRICATED, FACTORY FINISHED,THERMALLY BROKEN
GLAZING- S1/23, LOW-E, 1/4" INSULATED HEAT STRENGTHENED, BLUE/GREEN TINT
SILLS- EXTRUDED ALUMINUM , SLOPED FOR POSITIVE WASH, FIT UNDER SASH LEG TO 1/2" BEYOND WALL FACE, ONE PIECE FULL WIDTH OF OPENING
FINISHED HARDWARE: REF. ALLOWANCE

LOUVERS: GALV. METAL, FACTORY PRIMED, 18 GA., FINISH COAT IN FIELD, SIZE: TBD, COLOR: TO MATCH MTL. WALL PANEL

DIVISION 9 - FINISHES:
GYPSUM BOARD: 5/8" THICK, PAPER-FACED GYP. BD., FOR VERTICAL SURFACES, SIM. TO MANUF: GEORGIA PACIFIC GYPSUM (TOUGHROCK), CERTAINTEED CORP(TYPE C DRYWALL)., USG(SHEETROCK BRAND), AMERICAN GYP. COMPANY(LIGHT ROC),
PROVIDE ORANGE PEEL TEXTURE W/ LEVEL 4 PAINT FINISH, TYP.
PROVIDE GYP. BD. CONTROL JOINTS EVERY 30 FT OF UNINTERRUPTED & AT BOTH SIDES OF DOOR AT GYP. BD. WALLS, TYP. VINYL CONTROL JOINT ACCESSORIES
HARDIE BOARD @WET AREAS-RESTROOM & LOCKER RM- WHERE TILED, SIM TO MANUF:HARDIE-BOARD, GEORGIA PACIFIC DENSARMOR PLUS ABUSE-RESISTANT,
METAL STUDS: SIZE AS INDICATED ON DRAWINGS, SHEET STEEL SUPPORT MEMBER ASTM A1003/A1003M, SIM. TO : CLARKDIETRICH, R-STUD, JAMES INDUSTRIES W/ RUNNERS & TRACK, AISI S201
SUSPENDED CEILING: 2X2 3/4" THICK PANELS, WHITE W/ METAL GRID, SIM TO: ARMSTRONG WORLD IND., SQUARE, TYPE: DUNE, STANDARD TYPE
INTERIOR PAINT:
GYPSUM BOARD: SIM TO: SHERWIN WILLIAMS, PROMAR 200 ZERO VOC LATEX & PRIMER 1 COAT, EGGSHELL FINISH, COLOR : TBD , 2 COATS
PLYWOOD PANELS: SIM TO: SHERWIN WILLIAMS, PROMAR 200 ZERO VOC LATEX & PREMIUM WOOD PRIMER 1 COAT, GLOSSY FINISH, WHITE, 2 COATS
EXTERIOR PAINT:
METAL EXTERIOR & INTERIOR DOORS
1 COAT KEM KROMIK UNIVERSAL METAL PRIMER & 1 COAT DTM ALKYD ENAMEL, SEMI - GLOSS, SHERWIN WILLIAMS SW-B55-100 SERIES,
CONCRETE BOLLARDS- SW LOXON CONCRETE MASONRY PRIMER SEALER, A-100 EXTERIOR LATEX GLOSS A8, COLOR: TYP. CAUTION YELLOW
RUBBER WALL BASE: 4" HIGH W/ COVE, 1/8" THICK AT OFFICES, SIM TO: ROPPE 700 SERIES, BLACK/BROWN
TILE: AT FLOOR: PORCELAIN, WOOD LOOK PLANK -MANUF. FLORIDA HOME COLLECTION (HOME DEPOT), 6"X24", WOOD RIVER BEIGE
AT WALL: CORSO ITALIA-HOME DEPOT-ALPE IVORY, 12X24, MATTE FINISH, PORCELAIN
GROUT: FUSION PRO-MANUF. CUSTOM, SANDED, STAIN PROOF, COLOR: TBD

LUXURY VINYL PLANK: LIFEPROOF-TRAIL OAK 22 MIL 8.7X59 CLICK LOCK WATERPROOF, FLOATING FLOOR -HOME DEPOT, INSTALL PER MANUFACTURER INSTRUCTIONS

EPOXY COATING W/ ANTI-SLIP: RUST-OLEUM-SAFETEX-HIGH PERFORMANCE FOR VEHICLE TRAFFIC, BASIS OF DESIGN: AS9100 SYSTEM ANTI-SLIP HIGH PERFORMANCE, 5 STANDARD COLORS (NAVY GRAY OR SILVER GRAY) COORDINATE W/ OWNER, FINISH: GLOSS, ETCH CONCRETE W/ 108 CLEANING & ETCHING SOLUTION FOR PROPER EPOXY ADHERSION , THEN RINCE THROUGHLY AND ALLOW TO DRY. INSTALLATION , APPLICATION & CLEAN UP PER MANUFACTURERS INSTRUCTIONS.

DIVISION 10 - SPECIALITIES:
FIRE EXTINGUISHER: AT MECHSHOP- MANUF- BASIS OF DESIGN- ULINE- AT MECHSHOP -10LB ABC S-9874, AT BREAKROOM- ABC 5LB -S-22291, AT SHOP AREA-10LB ABC S-9874
FIRE EXTINGUISHER CABINET: ALL CABINETS STAINLESS STEEL(TYPE 304), CLEAR PLEXIGLASS WINDOW, SURFACE MOUNTED(BOTTOM OF CABINET 27" MAX AFF), ZINC PLATED MOUNTED HARDWARE, CONTINUOUS HINGE, MANUF-BASIS OF DESIGN, ULINE H-10025 (PROVIDE 2) & H-10026(PROVIDE ONE)
INTERIOR ROOM SIGNAGE: ACCOUNT FOR (7) SEVEN SIGNS, 1/8" THICK, SQUARED EDGES, ONE PIECE INJECTION MOLDED ACRYLIC PLASTIC W/ RAISED LETTERS & BRAILLE, TACTILE CHARACTERS, CHARCOAL BACKGROUND, WHITE ARIAL FONT UPPERCASE, ADA COMPLIANT
RESTROOM SIGNAGE: ACCOUNT FOR (1) ONE 1/8" THICK, SQUARED EDGES, ONE PIECE INJECTION MOLDED ACRYLIC PLASTIC W/ RAISED LETTERS & BRAILLE, TACTILE CHARACTERS, CHARCOAL BACKGROUND, WHITE ARIAL FONT UPPERCASE, ADA COMPLIANT W/ ACCESSIBLY SYMBOL, STANDARD DOOR HARDWARE-STAINLESS STEEL
EXTERIOR ROOM SIGNAGE:
BUILDING SIGNAGE: COORDINATE W/ OWNER
TOILET PARTITIONS & URINAL SCREEN: SIM: MANUF: ASI - SOLID PLASTIC (PRIVACY DOORS W/ PRIVACY HINGES & ACCESSORIES), OVERHEAD & FLOOR BRACED, COLOR: TBD(MOSS, BROWN/OLIVE, OR METALLIC BRONZE)
TOILET ACCESSORIES: REF. TO TOILET ACCESSORY SCHEDULE ON DRAWINGS,
PIPE COVERS AT WALL MOUNTED SINKS
BREAK ROOM ACCESSORIES: WALL MOUNTED SOAP DISPENSER (ULINE-GOJO MANUAL H-1175), SOAP S24959 ANTIBACTERIAL, PAPER TOWEL DISPENSER -ROLL TYPE MANUAL (ULINE KIMBERLY-CLARK 8" DEPTH, H9608), WASTE RECEPTACLE (ULINE 23 GAL BLACK H2445)

DIVISION 11 - EQUIPMENT: NOT USED
DIVISION 12 - FURNISHINGS: NOT USED
DIVISION 13 - SPECIAL CONSTRUCTION: REF. PEMB SUPPLIER & THEIR SHOP DRAWINGS
DIVISION 14 - CONVEYING SYSTEMS: NOT USED

DIVISIONS 21- FIRE SUPPRESSION
WET PIPE FIRE SPRINKLER SYSTEM - EXPOSED SPRINKLER HEADS IN SHOP AREAS & CONCEALED SPRINKLER HEADS AT BREAKROOM & OFFICES W/ SUSPENDED CEILINGS, REQUIRED: TESTING & INSPECTIONS, HYDRAULIC CALCULATIONS, & FLOW TEST. DESIGNED, FABRICATED & INSTALLED TO MEET NFPA 13 & LOCAL CODES IN JURISDICTION, DESIGN SEALED BY LICENSED FIRE PROTECTION ENGINEER, MECHANICAL ENGINEER, REGISTERED PROFESSIONAL ENGINEER

DIVISIONS 22 - 48: REFER TO CIVIL & MEP ENGINEER DRAWINGS

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BASTROP COUNTY
PRECINCT 2 ROAD & BRIDGE FACILITY
911 SE Martin Luther King Blvd.
Smithville, TX 78957

PROJECT NUMBER:	202415
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SPECIFICATIONS

SHEET
A005

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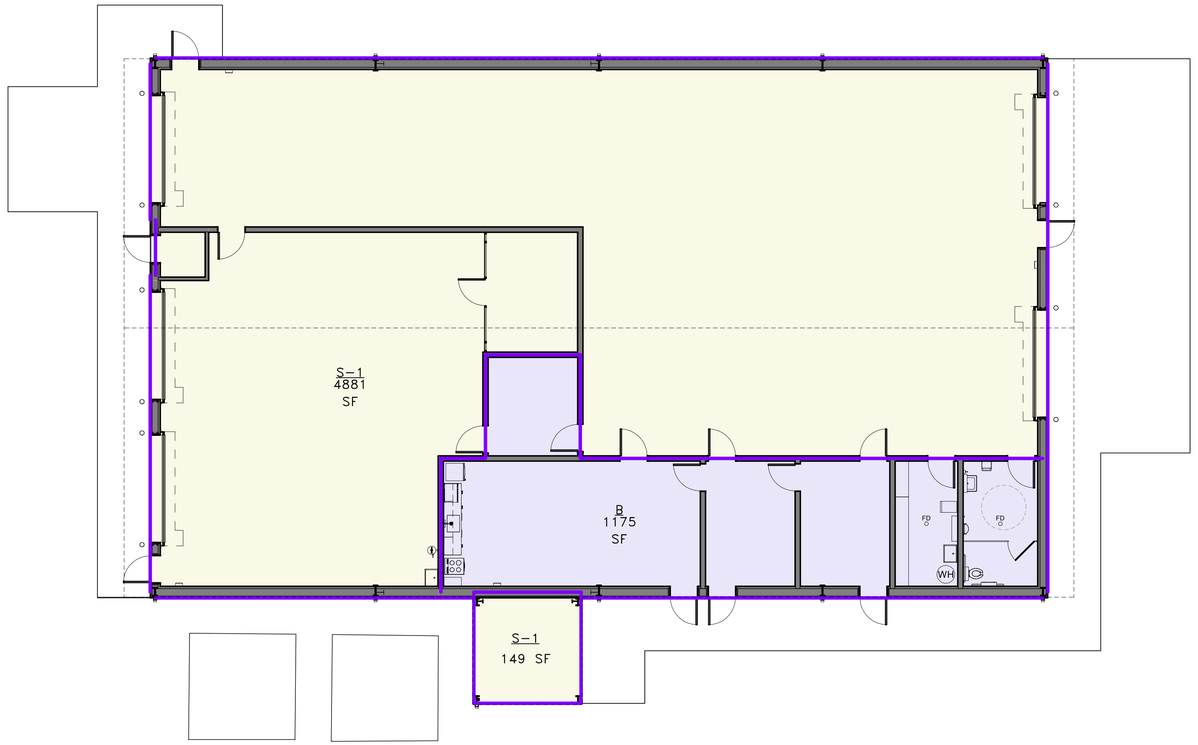
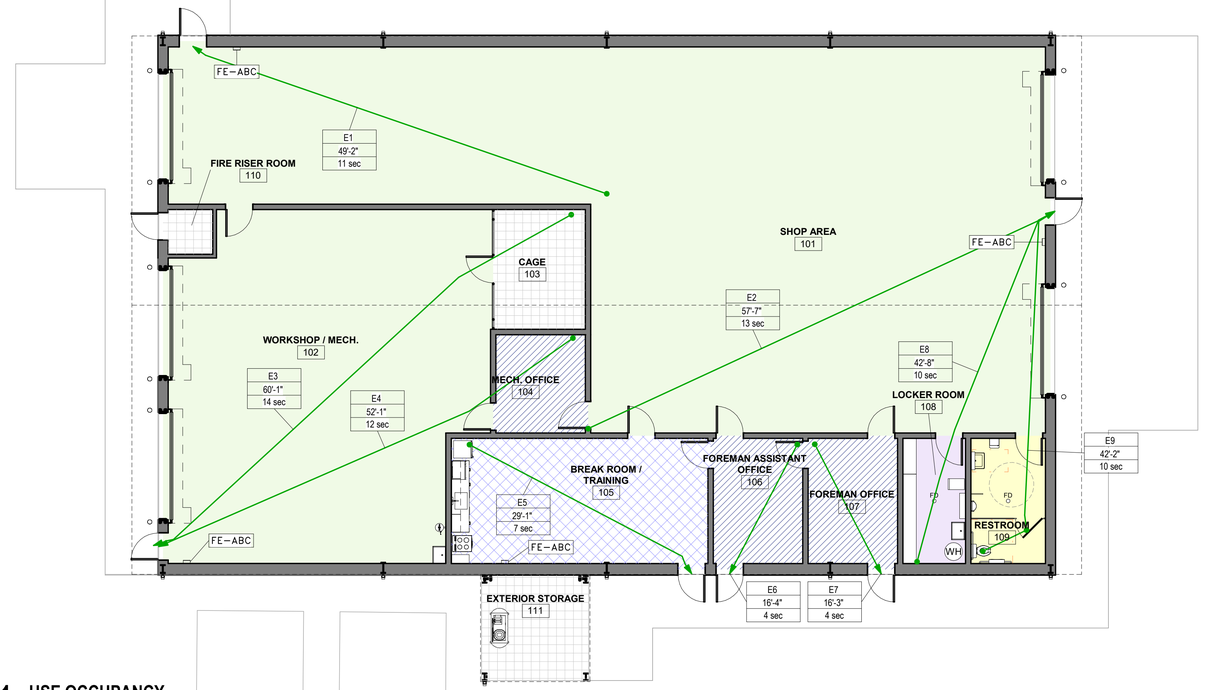


2 OCCUPANCY CLASSIFICATION

1/8" = 1'-0"



1 USE OCCUPANCY

1/8" = 1'-0"

FUNCTION OF SPACE LEGEND

- ACCESSORY STORAGE AREAS, MECHANICAL EQUIPMENT ROOM
- ASSEMBLY W/O FIXED SEATS - UNCONCENTRATED (TABLES & CHAIRS)
- BUSINESS AREAS
- LOCKER ROOMS
- N/A
- WAREHOUSES

OCCUPANCY LOAD (INDOORS)

ROOM NO.	ROOM NAME	ROOM AREA	CIRCULATION AREA	OCCUPANCY LOAD FACTOR	OCCUPANT LOAD
ACCESSORY STORAGE AREAS, MECHANICAL EQUIPMENT ROOM					
103	CAGE	138 SF	0 SF		
110	FIRE RISER ROOM	25 SF			
		163 SF			0
ASSEMBLY W/O FIXED SEATS - UNCONCENTRATED (TABLES & CHAIRS)					
105	BREAK ROOM / TRAINING	402 SF	0 SF		
		402 SF			0
BUSINESS AREAS					
104	MECH. OFFICE	110 SF	0 SF		
106	FOREMAN ASSISTANT OFFICE	140 SF	0 SF		
107	FOREMAN OFFICE	140 SF	0 SF		
		390 SF			0
LOCKER ROOMS					
108	LOCKER ROOM	98 SF			
		98 SF			0
WAREHOUSES					
101	SHOP AREA	3,030 SF	0 SF		
102	WORKSHOP / MECH.	1,330 SF	0 SF		
		4,360 SF			0
OCCUPANCY TOTALS		5,413 SF			0

OCCUPANCY LOAD (OUTDOORS)

ROOM NO.	ROOM NAME	ROOM AREA	CIRCULATION AREA	OCCUPANCY LOAD FACTOR	OCCUPANT LOAD
ACCESSORY STORAGE AREAS, MECHANICAL EQUIPMENT ROOM					
111	EXTERIOR STORAGE	142 SF	0 SF		
		142 SF			0
OCCUPANCY TOTALS		142 SF			0

GROSS BUILDING AREA PER OCCUPANCY TYPE (INDOORS)

LEVEL	AREA SIZE	NOTES
BUSINESS GROUP B		
GROUND LEVEL	1175 SF	
	1175 SF	
MODERATE-HAZARD STORAGE, GROUP S-1		
GROUND LEVEL	4881 SF	
	4881 SF	
TOTAL GROSS AREA	6055 SF	

GROSS BUILDING AREA PER OCCUPANCY TYPE (OUTDOORS)

LEVEL	AREA SIZE	NOTES
MODERATE-HAZARD STORAGE, GROUP S-1		
GROUND LEVEL	149 SF	
	149 SF	
TOTAL GROSS AREA	149 SF	

EGRESS TRAVEL DISTANCE SCHEDULE

ROOM	TRAVEL LINE	LENGTH
GROUND LEVEL		
SHOP AREA 101	E1	49' - 2"
	E2	57' - 7"
CAGE 103	E3	60' - 1"
MECH. OFFICE 104	E4	52' - 1"
BREAK ROOM / TRAINING 105	E5	29' - 1"
FOREMAN ASSISTANT OFFICE 106	E6	16' - 4"
FOREMAN OFFICE 107	E7	16' - 3"
LOCKER ROOM 108	E8	42' - 8"
RESTROOM 109	E9	42' - 2"

FIRE EXTINGUISHER SCHEDULE

TAG	CLASS	SIZE	COUNT	COMMENTS
101				
FE-ABC	ABC	10 LBS	1	
FE-ABC	ABC	10 LBS	1	
			2	
102				
FE-ABC	ABC	10 LBS	1	
			1	
105				
FE-ABC	ABC	10 LBS	1	
			1	
TOTAL: 4			4	

CODE REVIEW SUMMARY

APPLICABLE BUILDING CODES
2006 INTERNATIONAL BUILDING CODE
2015 INTERNATIONAL ENERGY CONSERVATION CODE
2006 UNIFORM FIRE CODE
2012 TEXAS ACCESSIBILITY STANDARDS

ALLOWABLE HEIGHT AND AREA
ALLOWABLE HEIGHT: 35'
ALLOWABLE # OF STORIES: 2.5 stories
ALLOWABLE AREA PER FLOOR (sf): 92,000 sf

CONSTRUCTION TYPE
TYPE II - B (SPRINKLED)

OCCUPANCY GROUP CLASSIFICATION
BUSINESS (B) - STORAGE (S-1) ASSOCIATED WITH GROUP S OCCUPANCIES (303.1.3)

EXIT ACCESS TRAVEL DISTANCE (TABLE 1017.2)
S-1 : 250 FEET WITH SPRINKLER
B : 300 FEET WITH SPRINKLER

ACTUAL HEIGHT AND FLOORS
ACTUAL # OF FLOORS: 1
ACTUAL HEIGHT: 21'-3" (Highest Point)

MINIMUM NUMBER OF EXITS FOR OCCUPANT LOAD PER TABLE 1006.3.1
1-500 OCCUPANTS 2
501-1,000 3
MORE THAN 1,000 4

TOTAL EXITS PROVIDED: 6

FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)
TABLE 601

BUILDING ELEMENT	TYPE II-B
STRUCTURAL FRAME	0
BEARING WALLS	
EXTERIOR	0
INTERIOR	0
NONBEARING WALLS	
EXTERIOR	0
INTERIOR	0
FLOOR/CEILING CONSTRUCTION	0
ROOF CONSTRUCTION	0

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CODE STUDY

SHEET
A006

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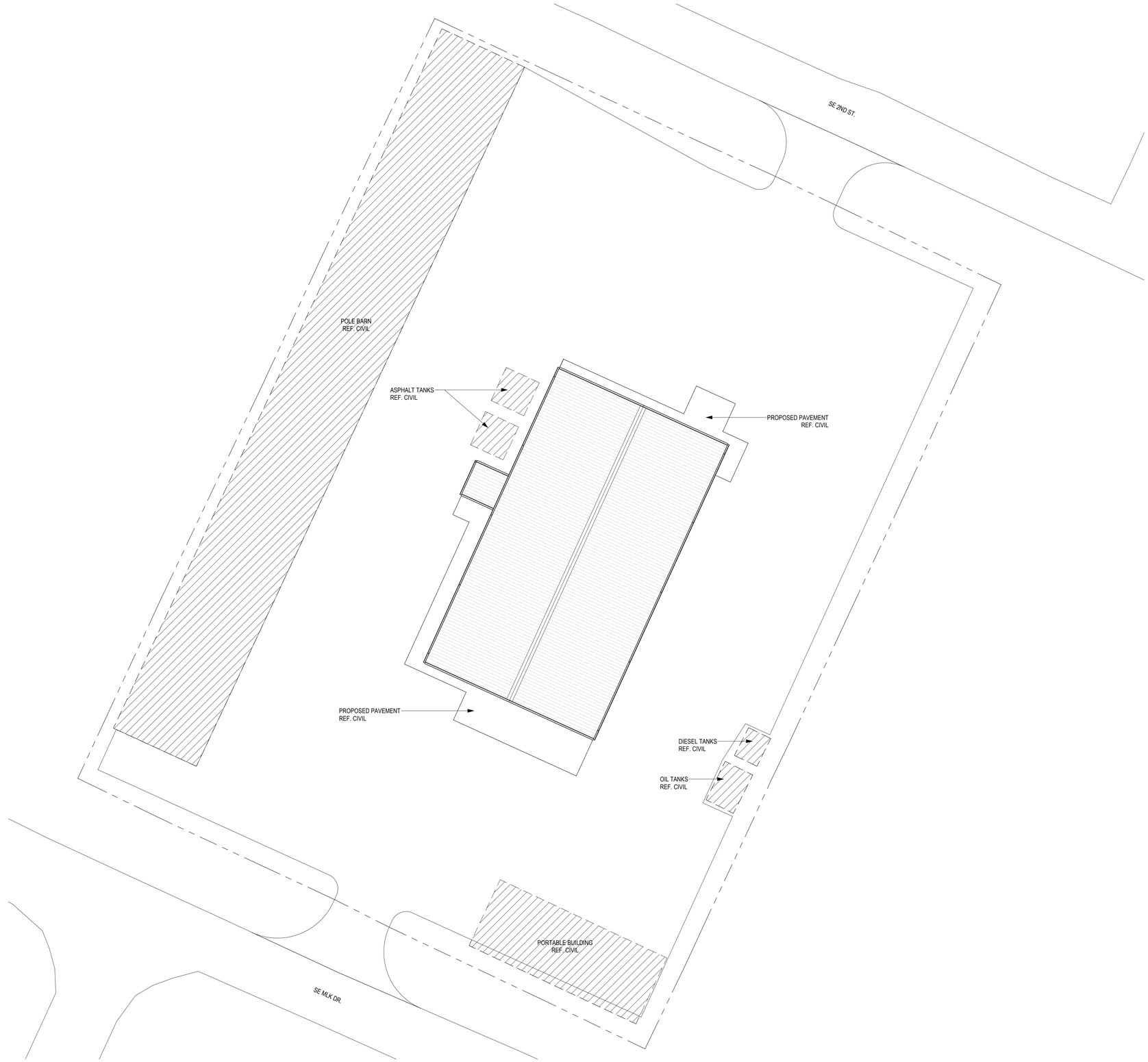

1 **ARCHITECTURAL SITE PLAN**
1/16" = 1'-0"

GENERAL NOTES - ARCHITECTURAL...	
1	INFORMATION SHOWN ON THIS SITE PLAN IS SUPPLEMENTARY TO SITE PLANS BY OTHERS, REFER TO CIVIL AND MEP SITE PLANS FOR ADDITIONAL SITE WORK AND INFORMATION.
2	VERIFY EXISTING SITE CONDITIONS AND REPORT ANY DISCREPANICES BETWEEN ACTUAL FIELD CONDITIONS AND THESE PLANS PRIOR TO COMMENCING WORK.
3	ALL NEW SIDEWALKS TO HAVE MAX 1:20 GRADE WITH CROSS SLOPE TO DRAIN AT 1/4" PER FOOT. BROOM FINISH UNLESS OTHERWISE NOTED.
4	ALL ACCESSIBLE PARKING AREAS, ACCESSIBLE LOADING ZONE, AND THE CROSS SLOPES OF SIDEWALKS ON ACCESSIBLE ROUTE TO MAINTAIN MAX 1:50 SLOPE
5	PROVIDE PAINTED CURB FOR FIRE LANE STRIPING IN ACCORDANCE WITH CITY/COUNTY FIRE STANDARDS.
6	ALL CURB RAMPS SHALL HAVE, FOR THE FULL WIDTH AND DEPTH OF THE RAMP, A LIGHT REFLECTIVE COLOR AND TEXTURE THAT SIGNIFICANTLY CONTRASTS WITH ADJOINING PEDESTRAIN ROUTES.

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ARCHITECTURAL SITE PLAN

SHEET
A007

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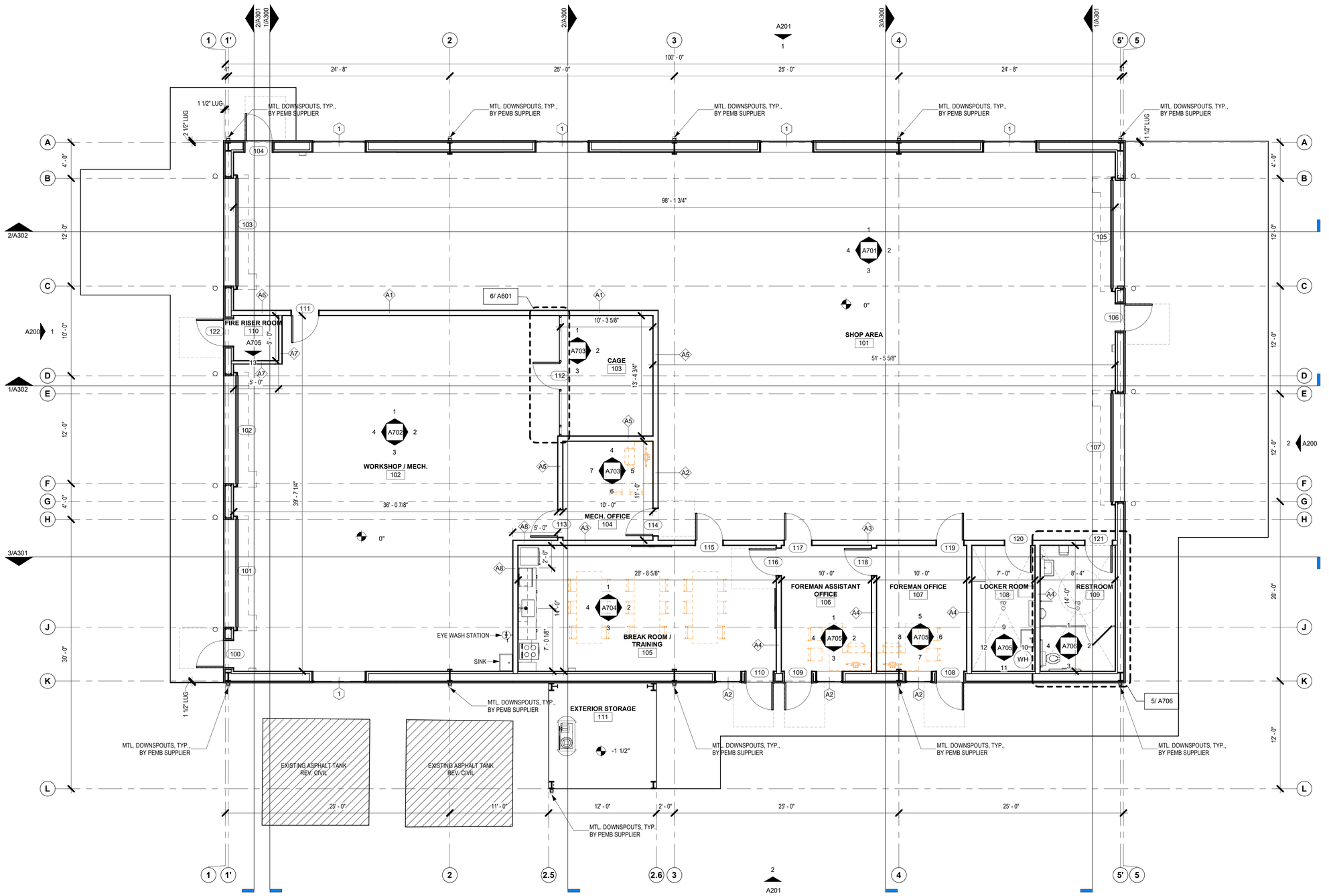
GENERAL NOTES - FLOOR PLAN	
1	ALL DIMENSIONS ARE TO STUD DIMENSIONS, UNLESS OTHERWISE NOTED.
2	REFER TO SHEET A002 FOR ACCESSIBLE DOOR CLEARANCES, FIXTURE MOUNTING REQUIREMENTS AND CLEARANCES.
3	TYPICAL DOOR LOCATION 4" FROM CORNER OF ROOM TO HINGE, UNLESS OTHERWISE NOTED.
4	REFERENCE ENLARGED FLOOR PLANS FOR ADDITIONAL TAGS IN ENLARGED CALLOUTS.



1 FLOOR PLAN

3/16" = 1'-0"

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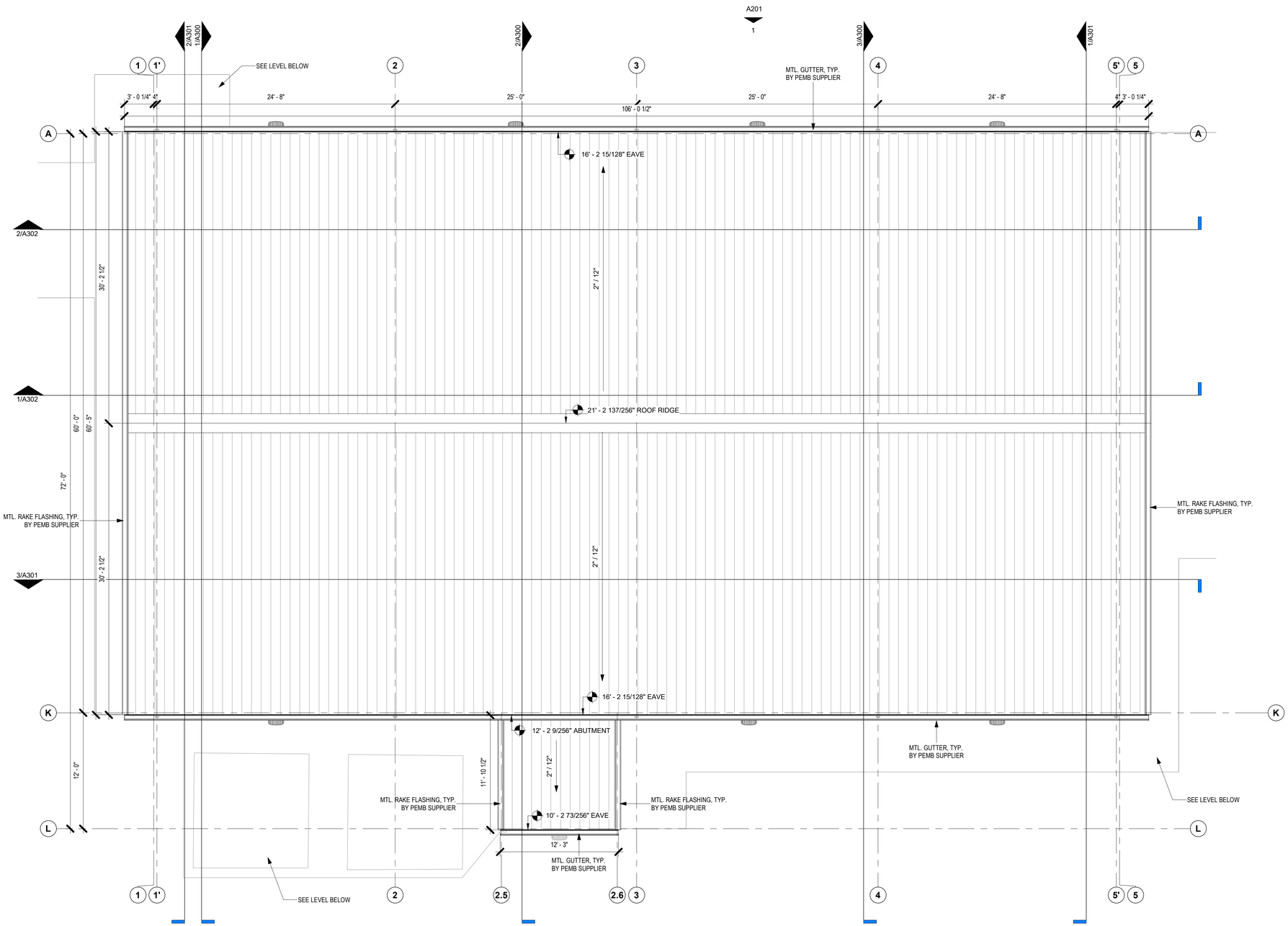
FLOOR PLAN

SHEET
A101

NOTE: REFER TO MEP DRAWINGS FOR ROOF PENETRATIONS



1 ROOF PLAN

3/16" = 1'-0"

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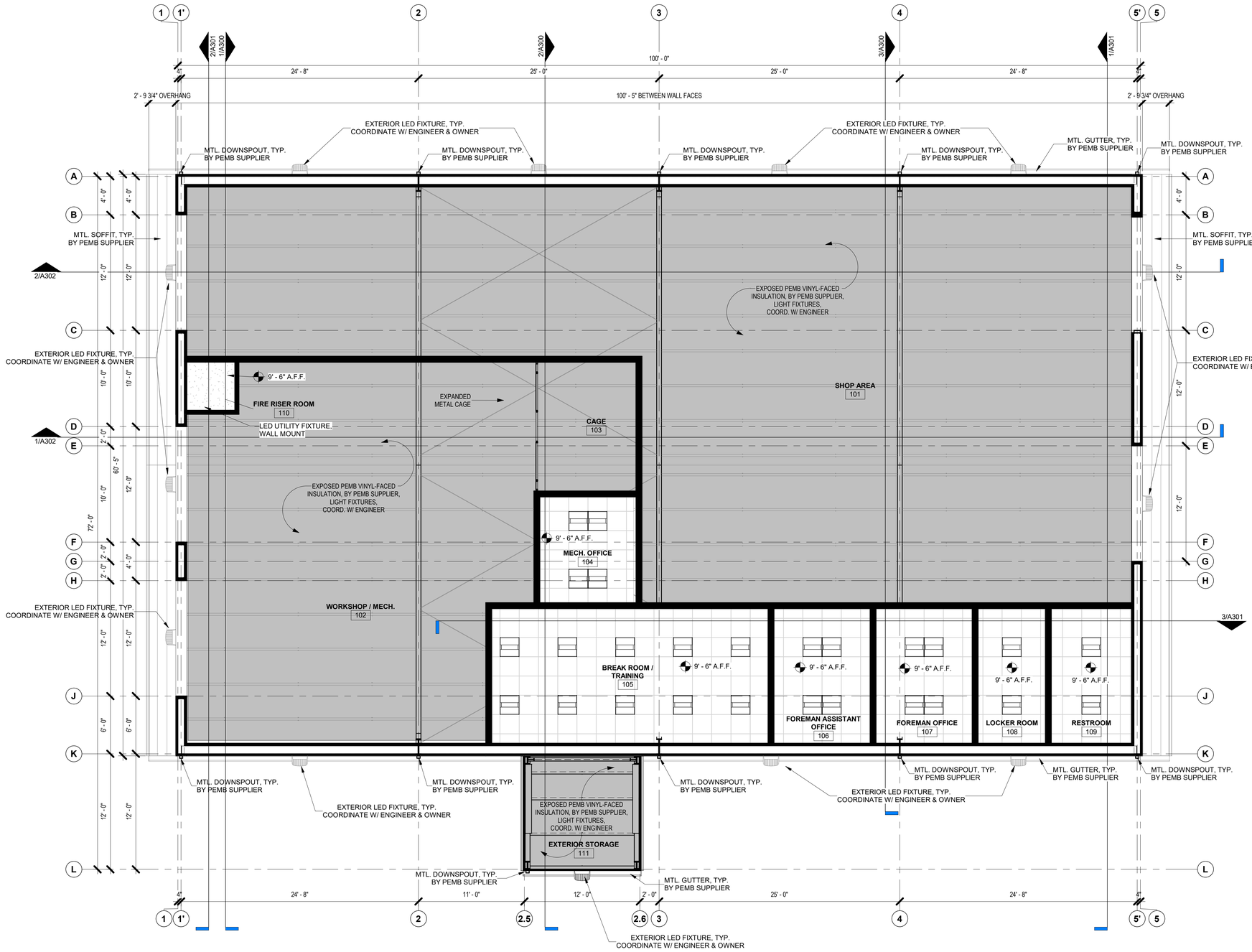
ROOF PLAN

SHEET
A102



1 REFLECTED CEILING PLAN

3/16" = 1'-0"

REFLECTED CEILING PLAN LEGEND

- 2x2 ACOUSTICAL CEILING TILE (ACP-1)
- GYPSUM BOARD CEILING (GYP)
- EXTERIOR SOFFIT (STAINED AND SEALED 1X6 SHIPLAP PROFILE SINKER CYPRESS-MATCH EXISTING CLASSROOM BUILDING)
- EXPOSED ROOF DECK
- 2x4 FIXTURE
- 2x2 FIXTURE

COORDINATE LIGHTING FIXTURE LOCATIONS WITH ELECTRICAL LIGHTING PLAN.

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REFLECTED CEILING PLAN

SHEET
A103

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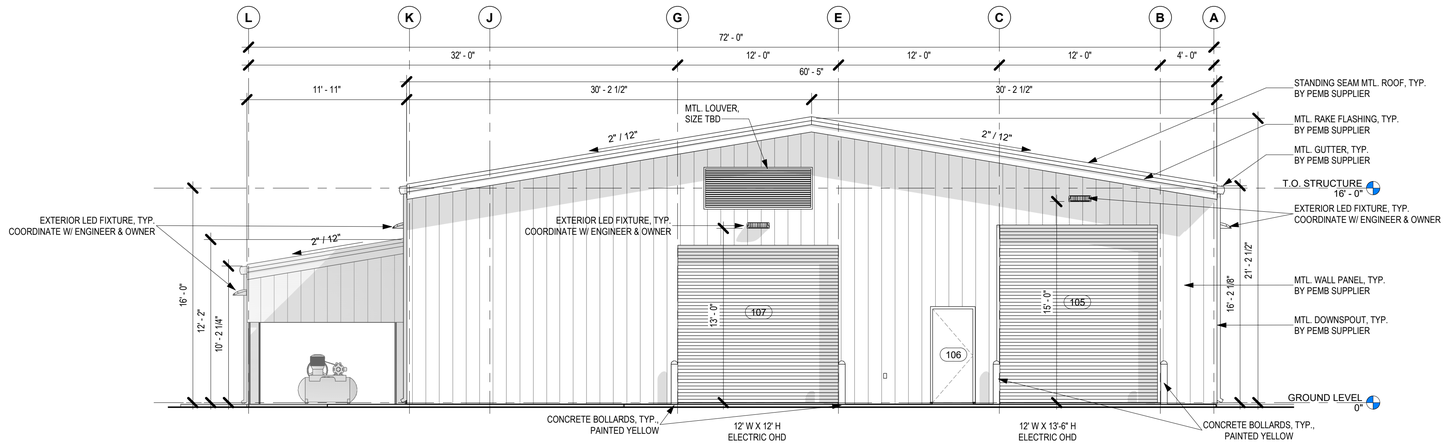
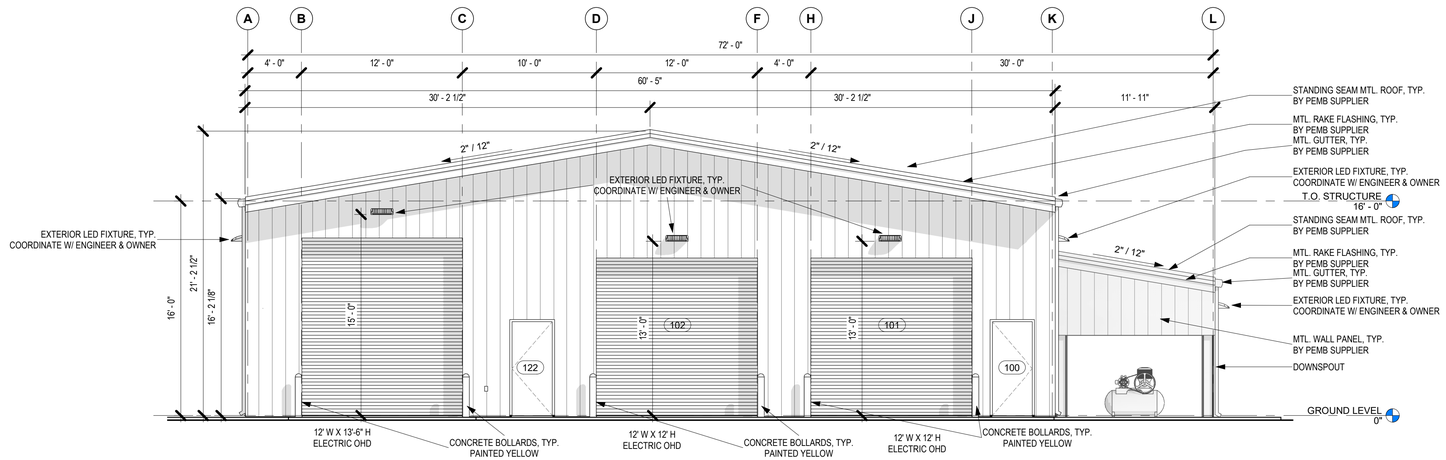
GENERAL NOTES - EXTERIOR...	
1	DOWNSPOUT LOCATIONS TO BE COORDINATED WITH PEMB
2	



2 EXTERIOR ELEVATION - TRUE SOUTH

3/16" = 1'-0"



1 EXTERIOR ELEVATION - TRUE NORTH

3/16" = 1'-0"

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EXTERIOR ELEVATIONS

SHEET A200

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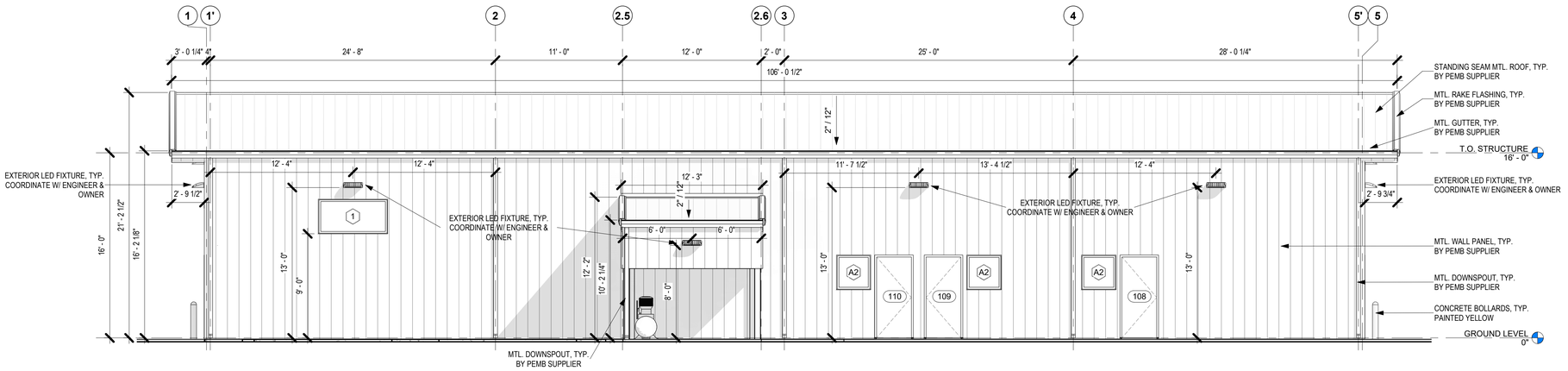
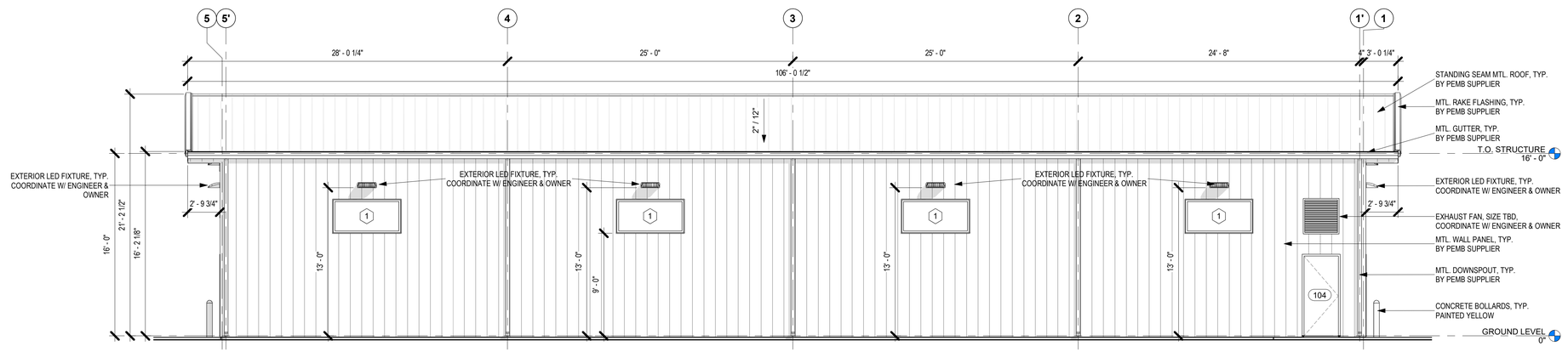
GENERAL NOTES - EXTERIOR...	
1	DOWNSPOUT LOCATIONS TO BE COORDINATED WITH PEMB
2	



2 EXTERIOR ELEVATION - TRUE WEST

3/16" = 1'-0"



1 EXTERIOR ELEVATION - TURE EAST

3/16" = 1'-0"

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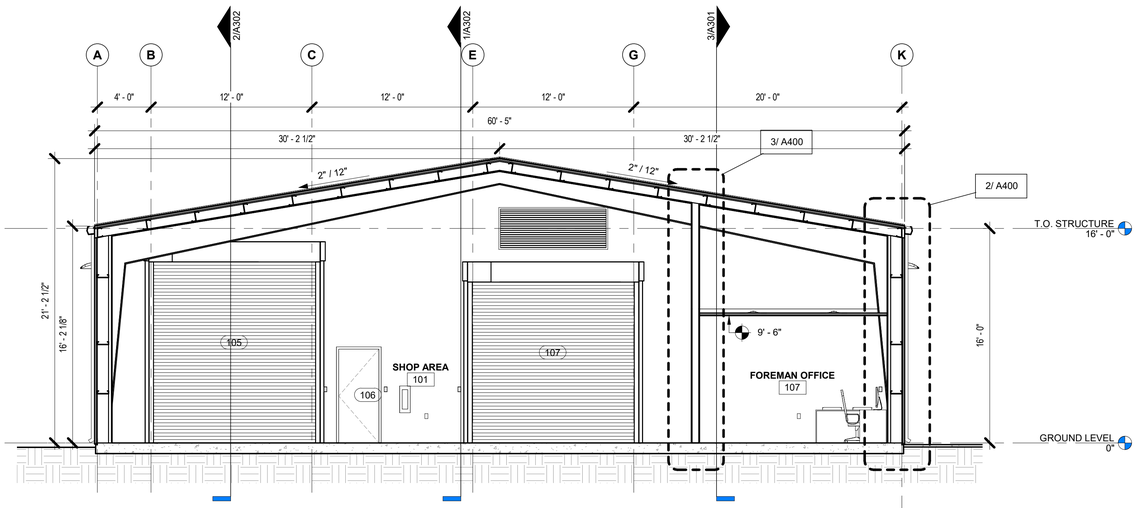
EXTERIOR ELEVATIONS

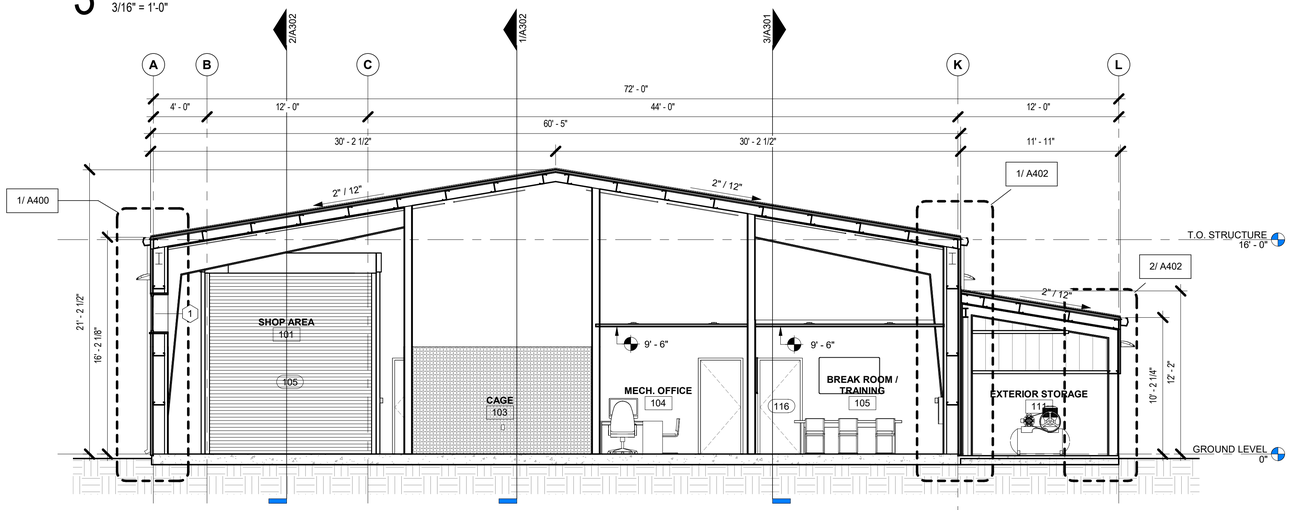
SHEET

A201



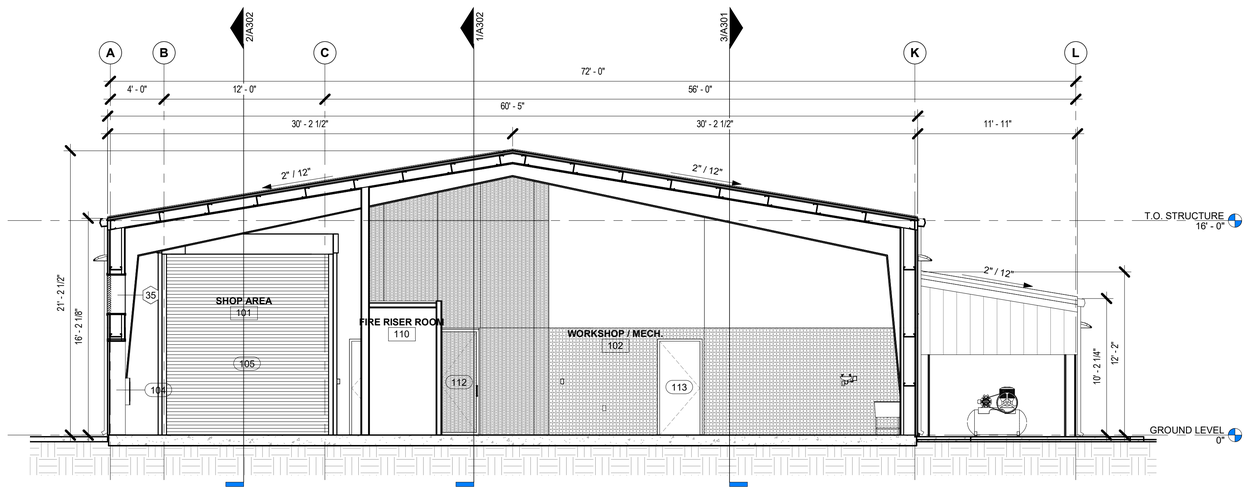
3 BUILDING SECTION - TRUE SOUTH 1.3

3/16" = 1'-0"



2 BUILDING SECTION - TRUE SOUTH 1.2

3/16" = 1'-0"



1 BUILDING SECTION - TRUE SOUTH 1.1

3/16" = 1'-0"

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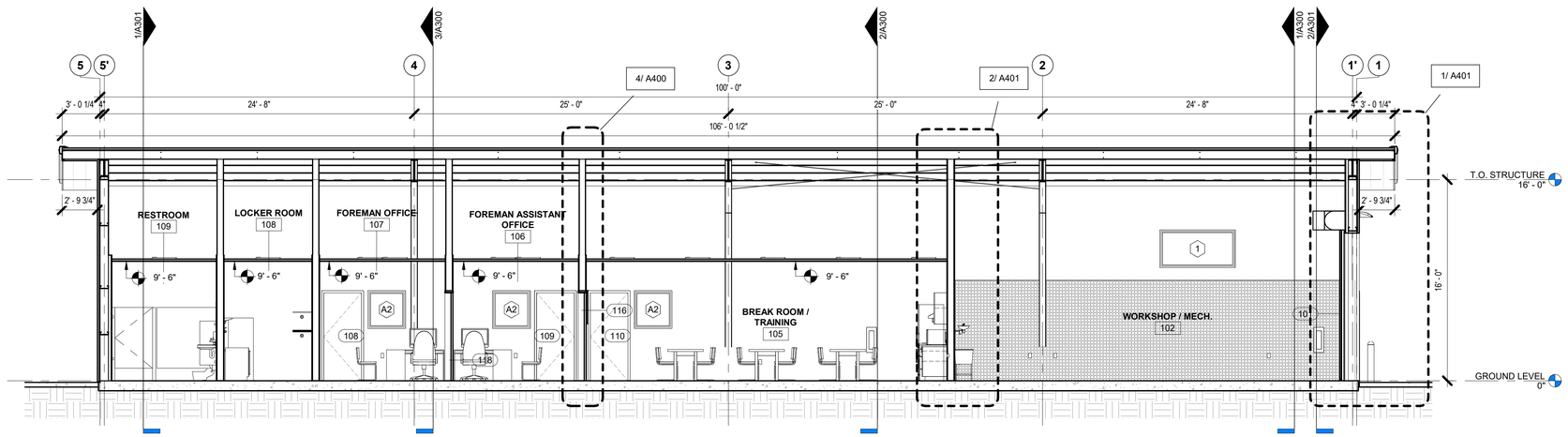
PRECINCT 2 ROAD & BRIDGE FACILITY
911 SE Martin Luther King Blvd.
Smithville, TX 78957

PROJECT NUMBER:	202415
PROJECT PHASE:	CONSTRUCTION DOCUMENTS
DRAWN BY:	CBA
CHECKED BY:	CBA
ISSUE DATE:	03.03.2025

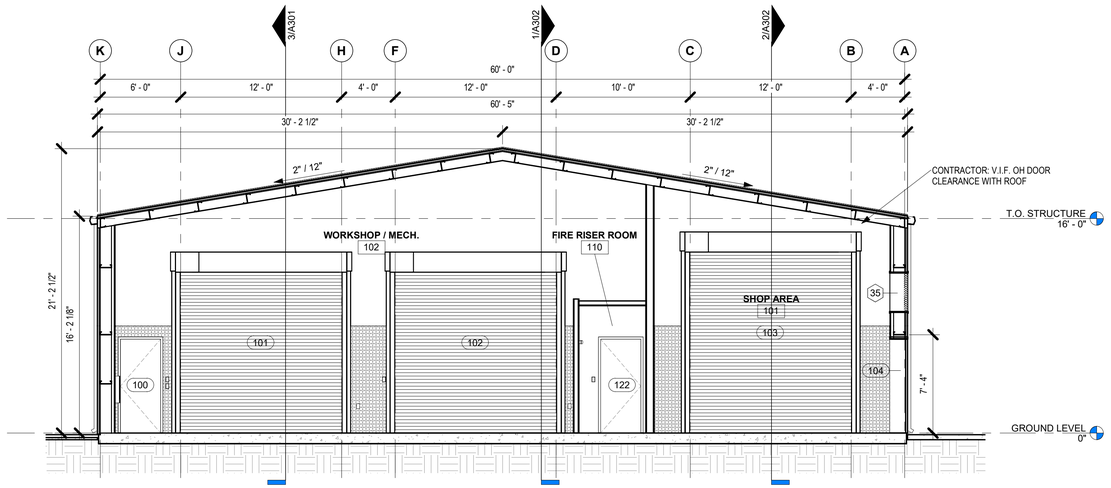
BUILDING SECTIONS

SHEET
A300



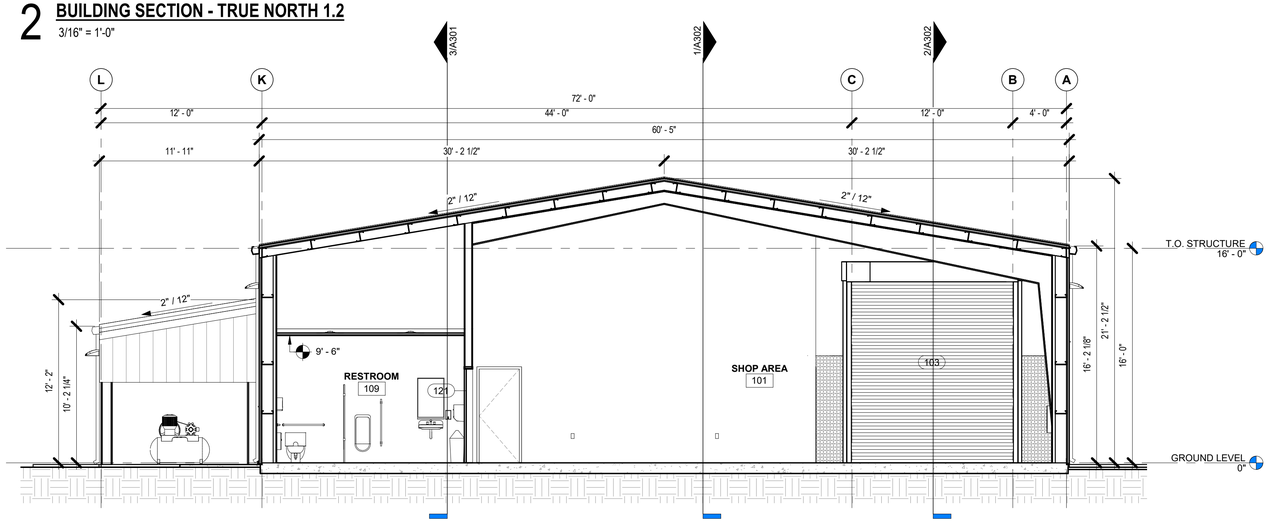
3 BUILDING SECTION - TRUE WEST 1.1

3/16" = 1'-0"



2 BUILDING SECTION - TRUE NORTH 1.2

3/16" = 1'-0"



1 BUILDING SECTION - TRUE NORTH 1.1

3/16" = 1'-0"

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REGISTERED ARCHITECT BEAMAN 29889 STATE OF TEXAS

03/03/2025

REVISIONS

NO.	DATE	DESCRIPTION	BY

BASTROP COUNTY

PRECINCT 2 ROAD & BRIDGE FACILITY

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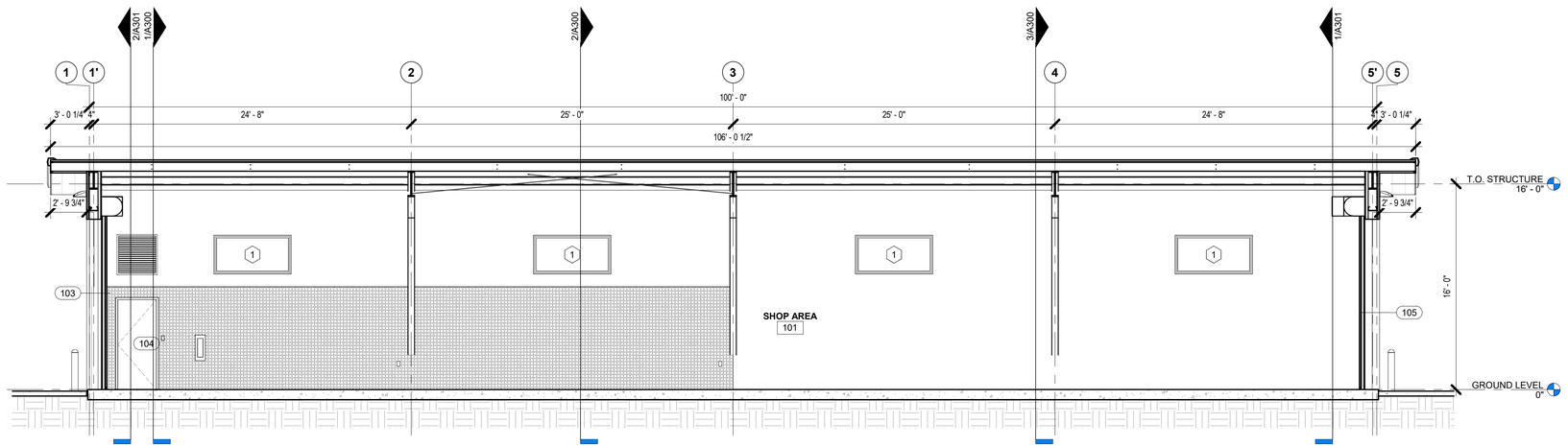
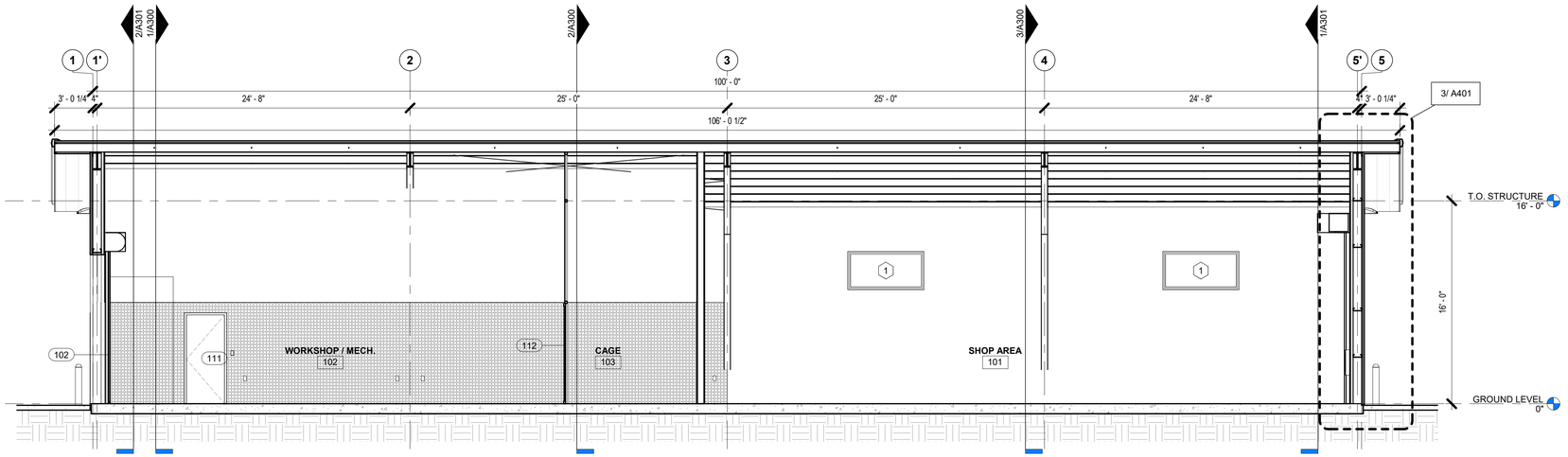
BUILDING SECTIONS

SHEET
A301



2 BUILDING SECTION - TRUE EAST 1.2

3/16" = 1'-0"



1 BUILDING SECTION - TRUE EAST 1.1

3/16" = 1'-0"

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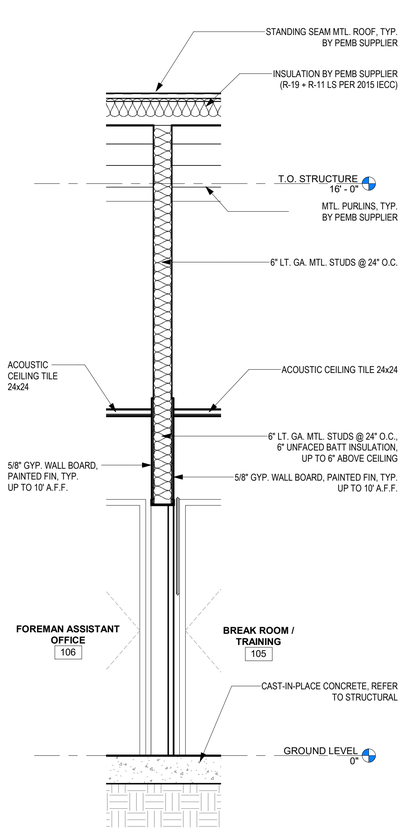
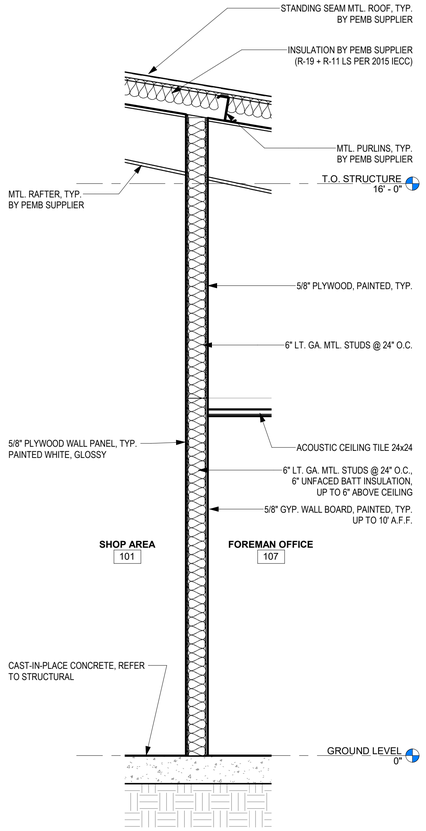
BUILDING SECTIONS

SHEET
A302



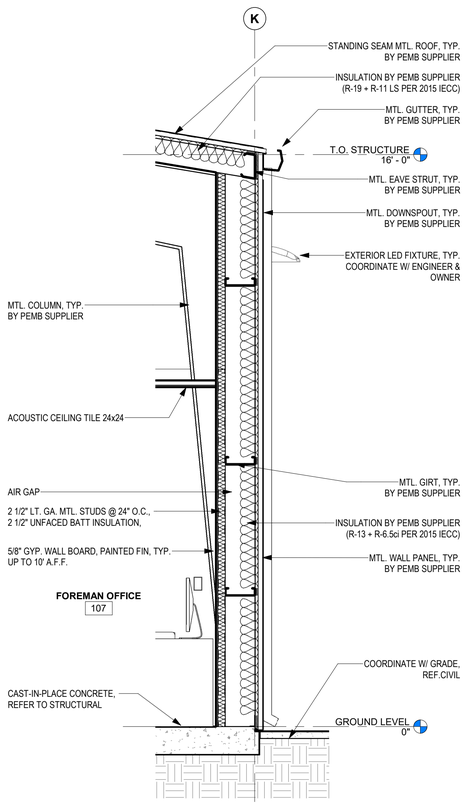
4 WALL SECTION - FOREMAN & FOREMAN ASSISTANT OFFICE (TRUE WEST)

1/2" = 1'-0"



3 WALL SECTION - SHOP AREA & FOREMAN OFFICE (TRUE SOUTH)

1/2" = 1'-0"



2 WALL SECTION - FOREMAN OFFICE & EXTERIOR (TRUE SOUTH)

1/2" = 1'-0"

1 WALL SECTION - SHOP AREA & EXTERIOR (TRUE SOUTH)

1/2" = 1'-0"

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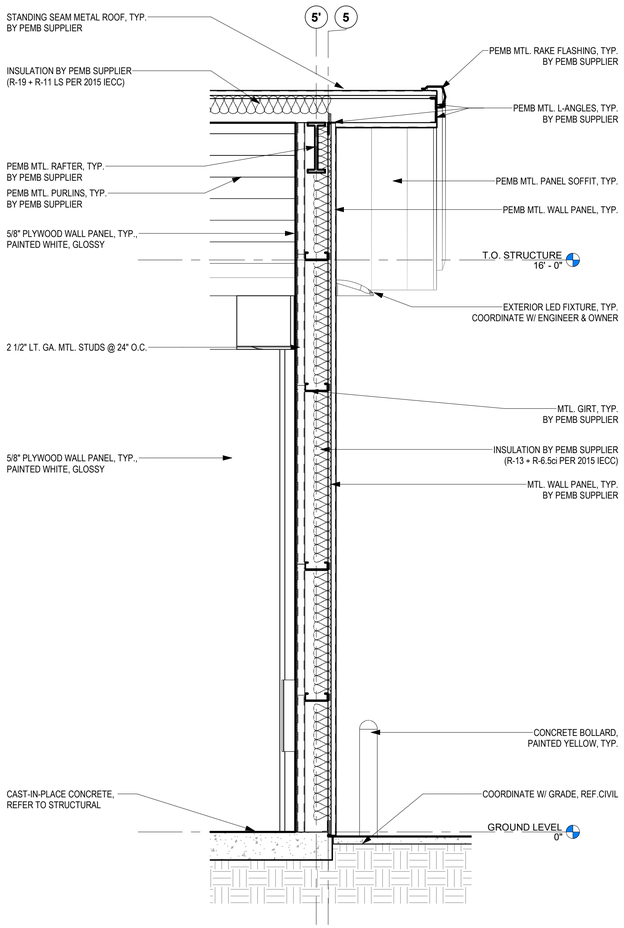
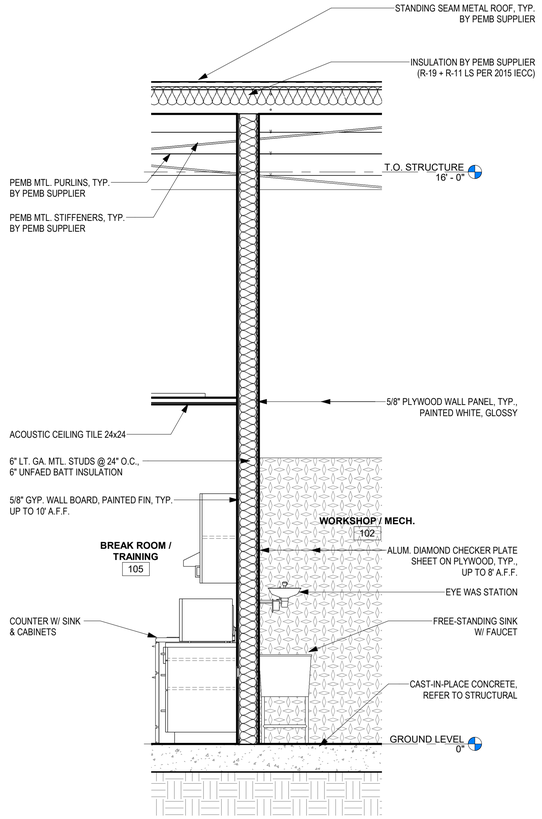
WALL SECTIONS

SHEET
A400



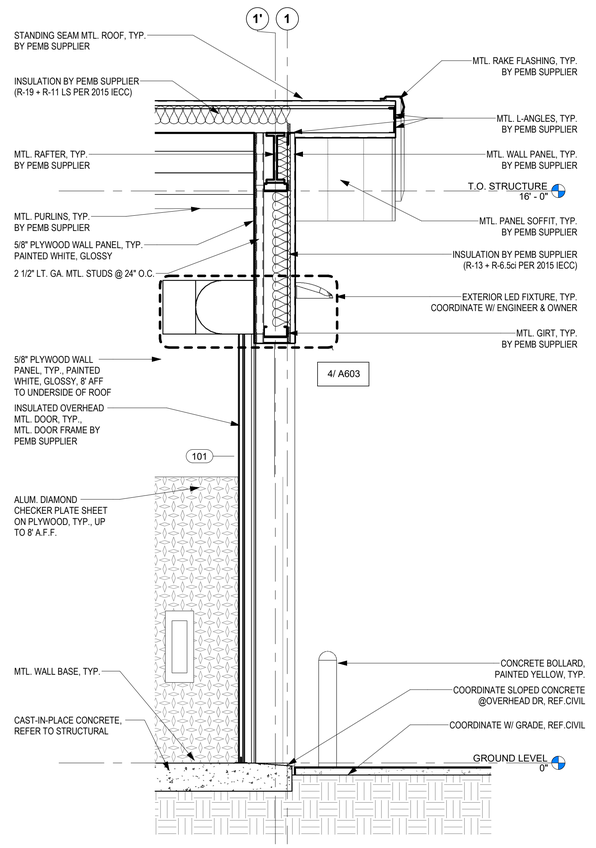
3 WALL SECTION - SHOP AREA & EXTERIOR (TRUE EAST)

1/2" = 1'-0"



2 WALL SECTION - BREAKROOM & WORKSHOP (TRUE WEST)

1/2" = 1'-0"



1 WALL SECTION - WORKSHOP & EXTERIOR @ OVERHEAD DOOR (TRUE WEST)

1/2" = 1'-0"

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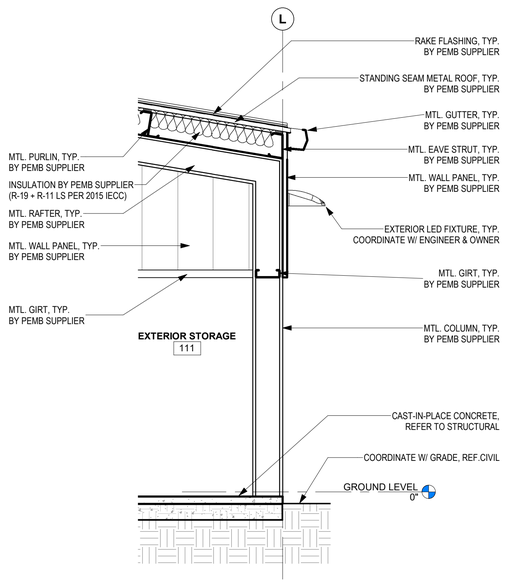
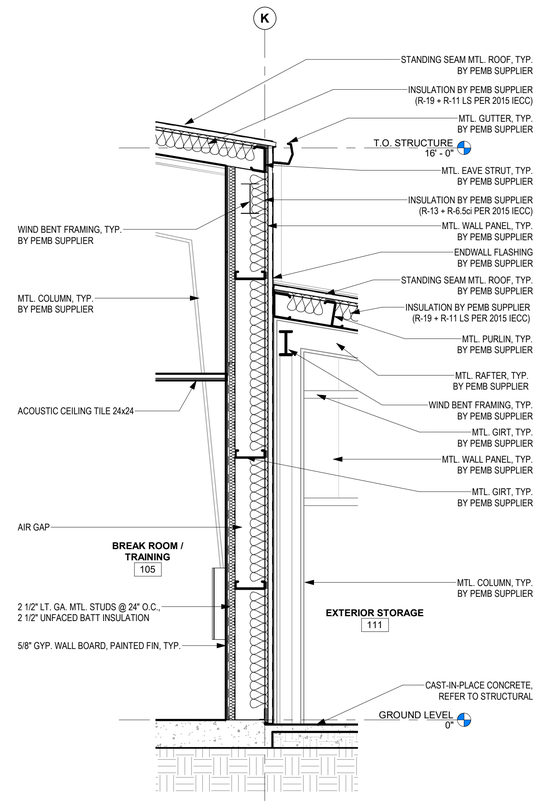
WALL SECTIONS

SHEET
A401



2 WALL SECTION - EXTERIOR STORAGE (TRUE SOUTH)

1/2" = 1'-0"



1 WALL SECTION - BREAKROOM & EXTERIOR STORAGE (TRUE SOUTH)

1/2" = 1'-0"

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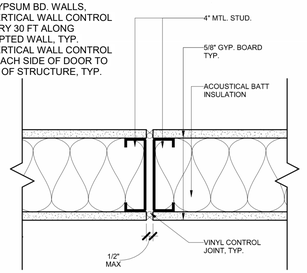
WALL SECTIONS

SHEET
A402

ROOM FINISH MATERIAL LIST

ABREV.	DESCRIPTION
FLOOR	
C1	EPOXY FLOORING W/ ANTI-SLIP ADDITIVE
T1	TILE - PORCELAIN
LVT	LUXURY VINYL TILE
BASE	
RB1	RESILIENT BASE, 4" STANDARD COVE BY ROPPE
TB1	TILE BASE, TO MATCH T1
S1	SEALANT, CLEAR
WALLS	
PT1	GYPSUM BOARD, PAINTED, LOW TEXTURE, SEMI-GLOSS FINISH
PT2	GYPSUM BOARD, PAINTED, LOW TEXTURE, EGGSHELL FINISH
PT3	PLYWOOD, PAINTED, LOW TEXTURE, GLOSSY FINISH, WHITE
PY1	PLYWOOD W/ ALUM. SHEET METAL (GREY) UP TO 8' AFF
T2	TILE
T3	TILE
TRIM	SCHLUTER METAL TRIM – COLOR, & SIZE: TBD
CEILING	
ACP1	2x2 SUSPENDED ACOUSTICAL CEILING TILE & GRID
EXP	EXPOSED CEILING, VINYL-FACED INSULATION
EXP2	EXPOSED TO UNDERSIDE OF MTL ROOF

NOTE: AT GYPSUM BD. WALLS, PROVIDE VERTICAL WALL CONTROL JOINTS EVERY 30 FT ALONG UNINTERRUPTED WALL, TYP. PROVIDE VERTICAL WALL CONTROL JOINTS AT EACH SIDE OF DOOR TO UNDERSIDE OF STRUCTURE, TYP.



GYP. BD. WALL CONTROL JOINT, TYP.

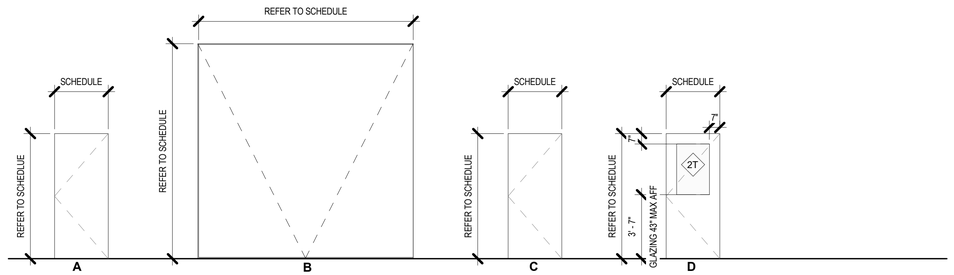
NOTE: LOCATIONS PER TRUE NORTH

ROOM FINISH SCHEDULE

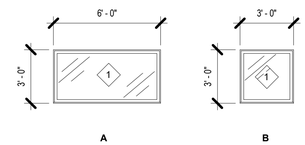
ROOM NUMBER	ROOM NAME	AREA	FLOOR	BASE	WALL FINISH NORTH	WALL FINISH SOUTH	WALL FINISH EAST	WALL FINISH WEST	CEILING	MILLWORK	COUNTERTOPS	NOTES
101	SHOP AREA	3030 SF	C1	S1	PY1/PT3	PT3	PY1/PT3	PY1/PT3	EXP			REF. INTERIOR ELEVATIONS, EXTERIOR SIGNAGE
102	WORKSHOP / MECH.	1330 SF	C1	S1	PY1/PT3	PY1/PT3	PY/PT3	PY1/PT3	EXP			EXTERIOR/INTERIOR ROOM SIGANGE
103	CAGE	138 SF	C1	S1		PY1/PT3	PY1/PT3	PY1/PT3	EXP			NORTH WALL REF DTL 5 & 6/A601
104	MECH. OFFICE	110 SF	LVT	RB	PT3	PT3	PT3	PT3	ACP			INTERIOR ROOM SIGNAGE
105	BREAK ROOM / TRAINING	402 SF	LVT	RB	PT2	PT2	PT2	PT2	ACP			EXTERIOR/INTERIOR ROOM SIGANGE
106	FOREMAN ASSISTANT OFFICE	140 SF	LVT	RB	PT2	PT2	PT2	PT2	ACP			EXTERIOR/INTERIOR ROOM SIGANGE
107	FOREMAN OFFICE	140 SF	LVT	RB	PT2	PT2	PT2	PT2	ACP			EXTERIOR/INTERIOR ROOM SIGANGE
108	LOCKER ROOM	98 SF	T1	RB	PT1	PT1/T2	PT1	PT1	ACP			INTERIOR ROOM SIGNAGE
109	RESTROOM	117 SF	T1	TB	PT1/T2	PT1/T2	PT1/T2	PT1/T2	ACP			INTERIOR ROOM SIGNAGE
110	FIRE RISER ROOM	25 SF	C1	RB	PT1	PT1	PT1	PT1	EXP			EXTERIOR SIGNAGE
111	EXTERIOR STORAGE	142 SF							EXP2			

DOOR SCHEDULE

LOCATION DOOR #	ROOM NAME	EXT.	INT.	SGL/PR /OH	DOOR WIDTH	DOOR HEIGHT	DOOR THICKNESS	DOOR MAT'L.	DOOR TYPE	FRAME MAT'L.	FRAME TYPE	DETAIL HEAD	DETAIL JAMB	DETAIL SILL	FIRE RATING	HARDWARE SET	REMARKS
GROUND LEVEL																	
100	WORKSHOP / MECH.	√		SGL	3' - 0"	7' - 0"	1 3/4"	PEMB	A	PEMB	E1			4/A601		PEMB	BY PEMB SUPPLIER
101	WORKSHOP / MECH.	√		OH	12' - 0"	12' - 0"		GS	B	STL						HW01	REF 4/A603
102	WORKSHOP / MECH.	√		OH	12' - 0"	12' - 0"		GS	B	STL						HW01	REF 4/A603
103	SHOP AREA			OH	12' - 0"	13' - 6"		GS	B	STL							
104	SHOP AREA	√		SGL	3' - 0"	7' - 0"	1 3/4"	PEMB	A	PEMB	E1			4/A601		PEMB	BY PEMB SUPPLIER
105	SHOP AREA	√		OH	12' - 0"	13' - 6"		GS	B	STL						HW02	OHD OPENING -12'W X 13'6"H & 4/A603
106	SHOP AREA	√		SGL	3' - 0"	7' - 0"	1 3/4"	PEMB	A	PEMB	E1			4/A601		PEMB	BY PEMB SUPPLIER
107	SHOP AREA	√		OH	12' - 0"	12' - 0"		GS	B	STL						HW01	REF 4/A603
108	FOREMAN OFFICE	√		SGL	3' - 0"	7' - 0"	1 3/4"	PEMB	A	PEMB	E1			3/A601		PEMB	BY PEMB SUPPLIER
109	FOREMAN ASSISTANT OFFICE	√		SGL	3' - 0"	7' - 0"	1 3/4"	PEMB	A	PEMB	E1			3/A601		PEMB	BY PEMB SUPPLIER
110	BREAK ROOM / TRAINING	√		SGL	3' - 0"	7' - 0"	1 3/4"	PEMB	A	PEMB	E1			3/A601		PEMB	BY PEMB SUPPLIER
111	WORKSHOP / MECH.		√	SGL	3' - 0"	7' - 0"	1 3/4"	I.MTL	A	AL		1/A601	2/A601	4/A601		PEMB	
112	CAGE		√	SGL	3' - 0"	7' - 10 13/16"	1 3/4"	HM	E	AL	I3					HW03	REF TO DTLS 5&6/A601
113	MECH. OFFICE		√	SGL	3' - 0"	7' - 0"	1 3/4"	I.MTL	A	AL		1/A601	2/A601	3/A601		HW04	
114	MECH. OFFICE			SGL	3' - 0"	7' - 0"	1 3/4"	WD	D	AL							
115	BREAK ROOM / TRAINING		√	SGL	3' - 0"	7' - 0"	1 3/4"	WD	D	AL		1/A601	2/A601	3/A601		HW05	PLAM FINISH
116	BREAK ROOM / TRAINING		√	SGL	3' - 0"	7' - 0"	1 3/4"	WD	D	AL		1/A601	2/A601	3/A601		HW05	PLAM FINISH
117	FOREMAN ASSISTANT OFFICE		√	SGL	3' - 0"	7' - 0"	1 3/4"	WD	D	AL		1/A601	2/A601	3/A601		HW06	PLAM FINISH
118	FOREMAN ASSISTANT OFFICE		√	SGL	3' - 0"	7' - 0"	1 3/4"	WD	D	AL		1/A601	2/A601	3/A601		HW06	PLAM FINISH
119	FOREMAN OFFICE		√	SGL	3' - 0"	7' - 0"	1 3/4"	WD	D	AL		1/A601	2/A601	3/A601		HW06	PLAM FINISH
120	LOCKER ROOM		√	SGL	3' - 0"	7' - 0"	1 3/4"	WD	C	AL		1/A601	2/A601	3/A601		HW07	PLAM FINISH
121	RESTROOM		√	SGL	3' - 0"	7' - 0"	1 3/4"	WD	C	AL		1/A601	2/A601	3/A601		HW08	PLAM FINISH
122	FIRE RISER ROOM	√		SGL	3' - 0"	7' - 0"	1 3/4"	PEMB	A	PEMB	E1			4/A601		HW09	BY PEMB SUPPLIER



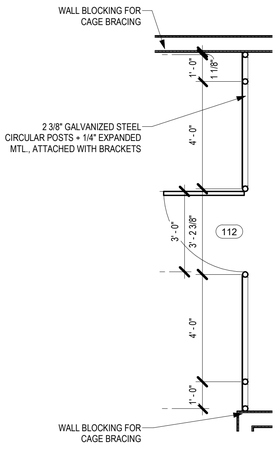
DOOR TYPES



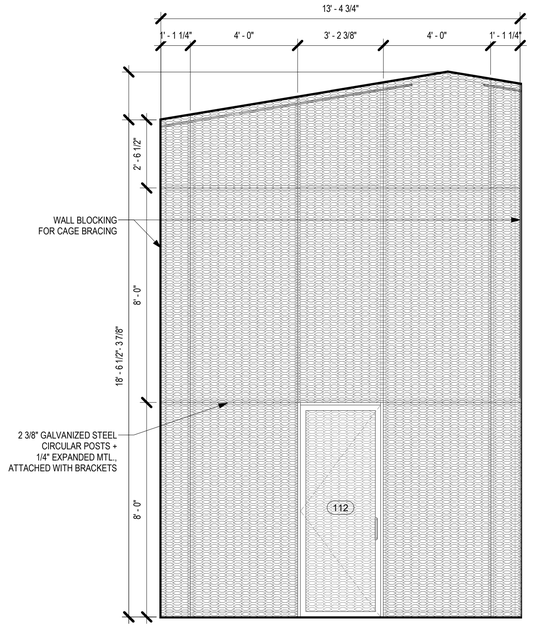
WINDOW TYPES

1 1" INSULATED LOW-E GLASS W/ GREEN/BLUE TINT

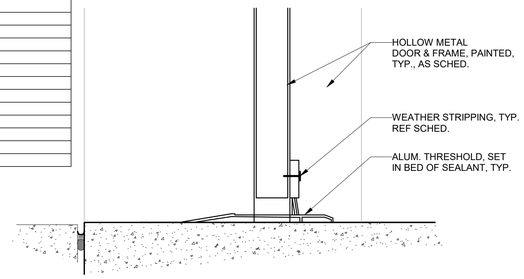
GLAZING TYPES



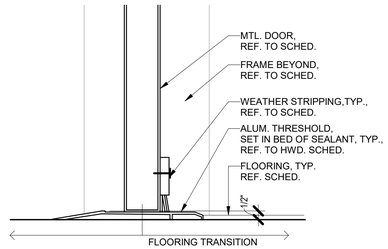
6 CAGE - FLOOR PLAN
3/8" = 1'-0"



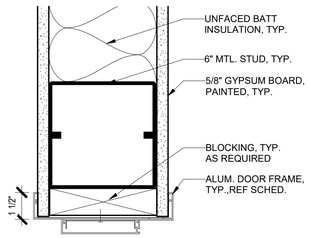
5 CAGE - ELEVATION
3/8" = 1'-0"



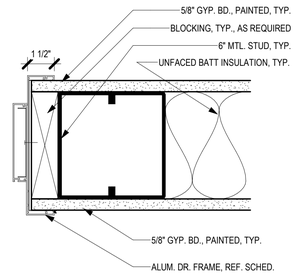
4 HM EXTERIOR SLAB DETAIL
3" = 1'-0"



3 INTERIOR DOOR SILL DETAIL
3" = 1'-0"



1 INTERIOR ALUMINUM FRAME HEAD DETAIL
3" = 1'-0"



2 INTERIOR ALUMINUM FRAME JAMB DETAIL
3" = 1'-0"

GENERAL NOTES - ROOM FINISH

1	PAINT (PT) COLORS SELECTION PER WALL WILL BE ASSIGNED DURING CONSTRUCTION VIA THE SUBMITTAL PROCESS.
2	TILE (T-) SELECTION WILL BE ASSIGNED DURING CONSTRUCTION VIA THE SUBMITTAL PROCESS.
3	ALL TRANSITIONS TO OCCUR UNDER DOOR, UNLESS OTHERWISE NOTED.
4	ALL FINISH WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE FINISH STANDARD CODES, MANUALS, AND RULES OF ITS KIND. FINISH WORK NOT PERFORMED PER ITS STANDARDS OF ITS KIND SHALL BE REPLACED AND/OR ADJUSTED TO MEET THE STANDARDS AT NO ADDITIONAL COST.

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SCHEDULES, DOOR & FRAME ELEVATIONS

SHEET
A601

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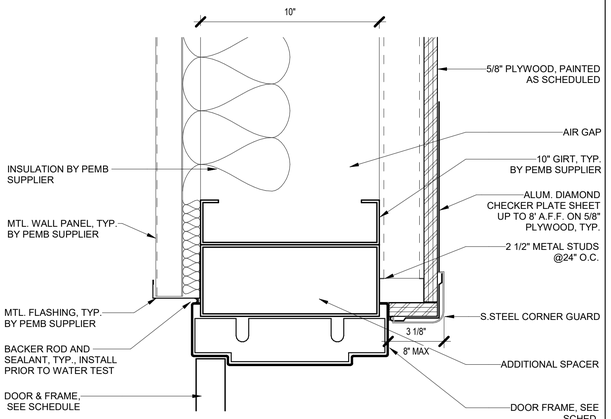
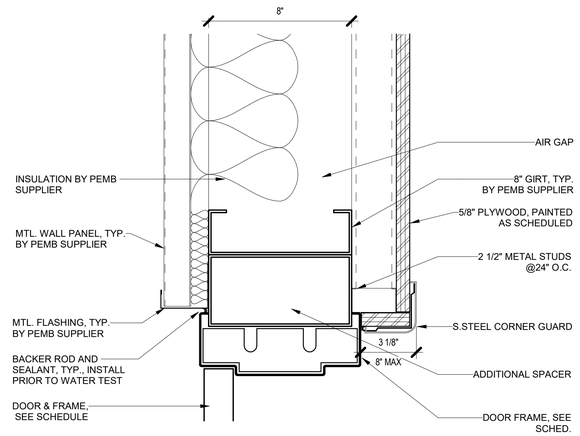


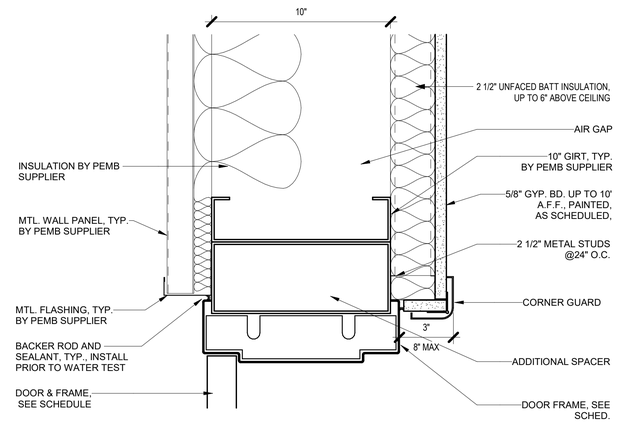
7 EXTERIOR MTL DOOR HEAD @DR 104

3" = 1'-0"



8 EXTERIOR MTL DOOR HEAD @DR 106, 122

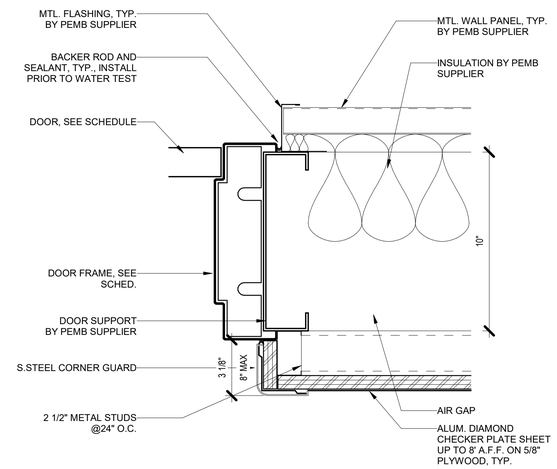
3" = 1'-0"



9 EXTERIOR MTL DOOR HEAD @DR 108,109,110,122

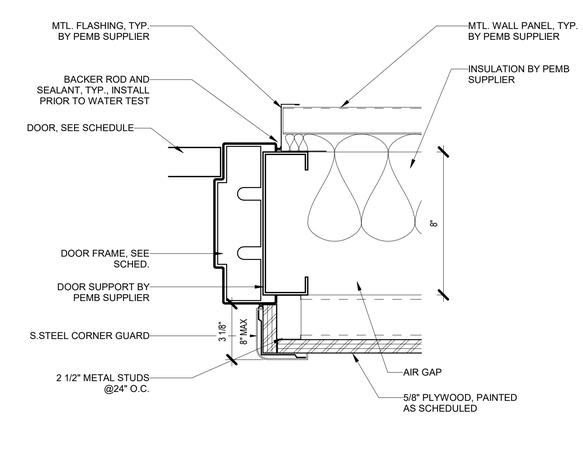
3" = 1'-0"

NOTE: ALL EXTERIOR SWINGING DOORS PROVIDED BY PEMB SUPPLIER. METAL STUDS SHOWN IN DETAIL ARE VISUAL



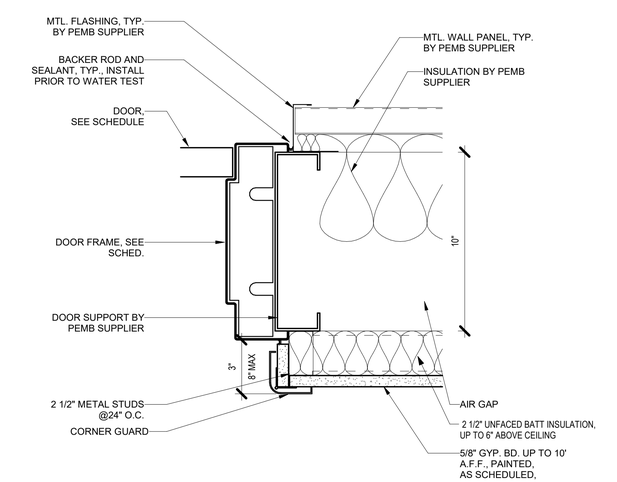
4 EXTERIOR MTL DOOR JAMB @DR 104

3" = 1'-0"



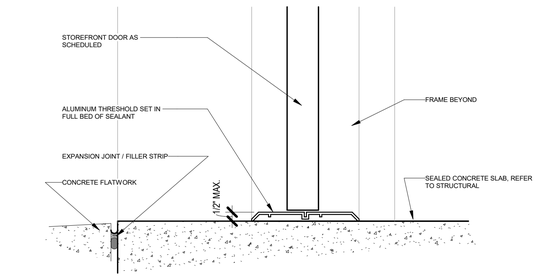
5 EXTERIOR MTL DOOR JAMB @DR 106, 122

3" = 1'-0"



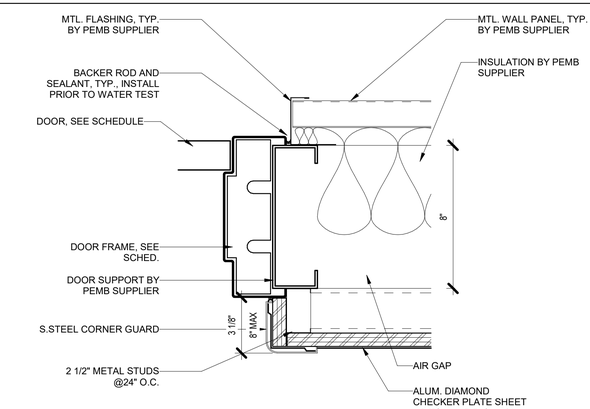
6 EXTERIOR MTL DOOR JAMB @DR 108,109.110,122

3" = 1'-0"



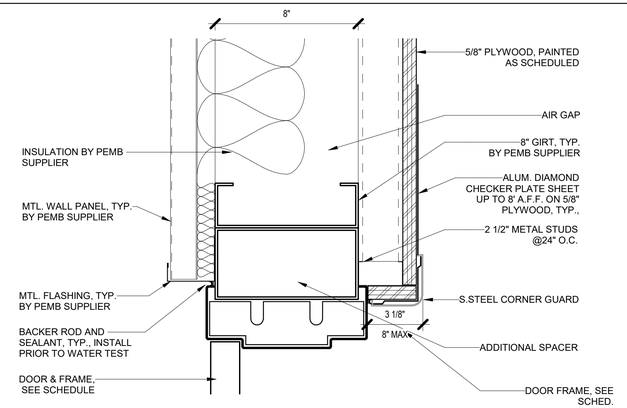
1 DOOR SLAB @WALKWAY

3" = 1'-0"



2 EXTERIOR MTL DOOR JAMB @DR 100

3" = 1'-0"



3 EXTERIOR MTL DOOR HEAD @DR 100

3" = 1'-0"

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REGISTERED ARCHITECT BEAMAN 29889 STATE OF TEXAS

03/03/2025

REVISIONS		
NO.	DATE	DESCRIPTION BY

BASTROP COUNTY

PRECINCT 2 ROAD & BRIDGE FACILITY

911 SE Martin Luther King Blvd, Smithville, TX 78957

PROJECT NUMBER:	202415
PROJECT PHASE:	CONSTRUCTION DOCUMENTS
DRAWN BY:	CBA
CHECKED BY:	CBA
ISSUE DATE:	03.03.2025

EXTERIOR DOOR DETAILS

SHEET
A602

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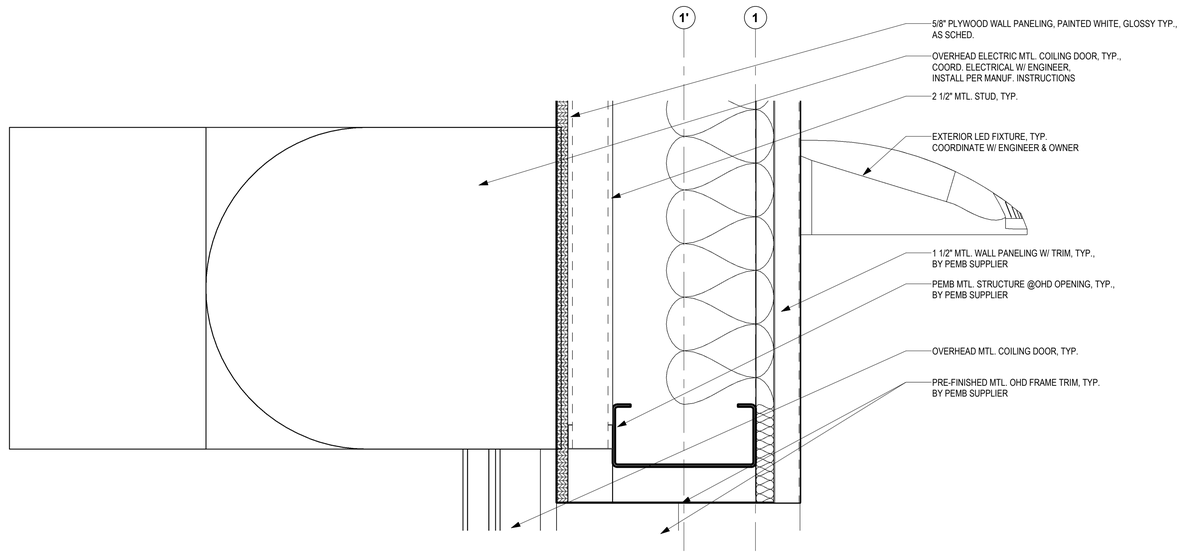
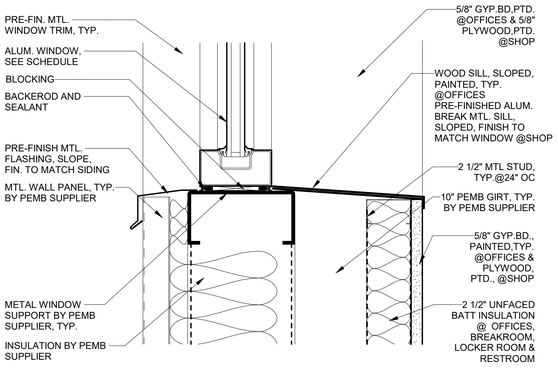


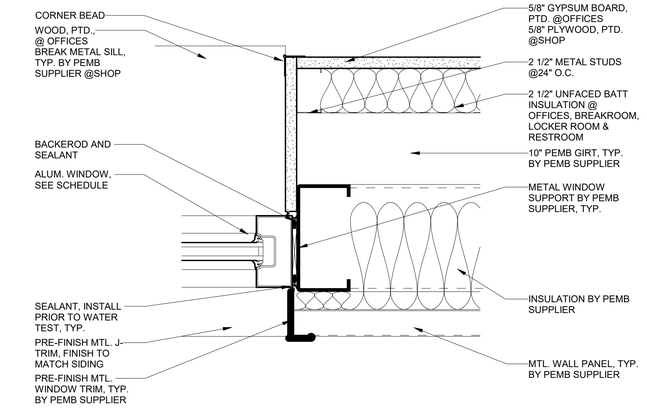
4 COILING OVERHEAD DOOR DETAIL

3" = 1'-0"



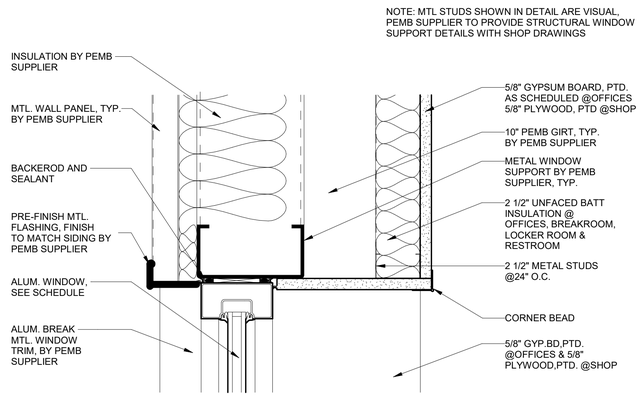
1 WINDOW SILL @OFFICES & SHOP

3" = 1'-0"



2 WINDOW JAMB @OFFICES & SHOP

3" = 1'-0"



3 WINDOW HEAD @OFFICES & SHOP

3" = 1'-0"

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REGISTERED ARCHITECT BEAMAN 8889 STATE OF TEXAS

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EXTERIOR WINDOW & OH DOOR DETAILS

SHEET
A603

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ACOUSTIC NOTES:

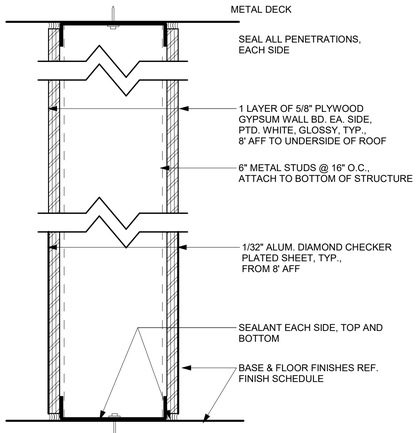
1. USE ACOUSTIC SEALANT (FIRE STOP CAULKING) AT TOP AND BOTTOM OF STUD WALLS.
2. USE ACOUSTIC SEALANT AROUND ALL PENETRATIONS IN GYPSUM BOARD WALLS.
3. STAGGER GYPSUM BOARD JOINTS.
4. PROVIDE AT LEAST ONE STUD BETWEEN PLUGS, SWITCHES, J-BOXES, ETC. THAT BACK AGAINST EACH OTHER.
5. EXTEND GYPSUM BOARD TO BOTTOM OF ROOF OR FLOOR DECK ON ALL WALLS NOTED AS ACOUSTIC PARTITIONS.

GYPSUM BOARD NOTES:

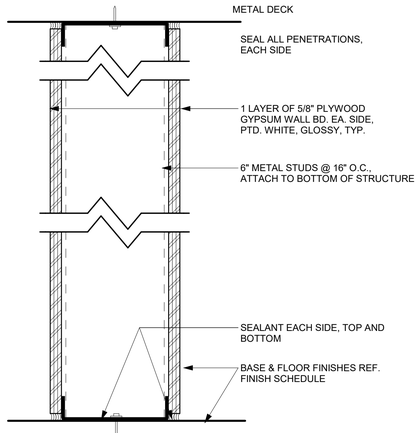
1. PLACE INTERIOR CONTROL JOINTS IN THE FOLLOWING LOCATIONS:
   A. WHERE PARTITIONS, FURRINGS, OR COLUMN FIREPROOFING ABUT A STRUCTURAL ELEMENT (EXCEPT FLOOR) OR DISSIMILAR WALL OR CEILING.
   B. WHERE CEILINGS OR SOFFITS ABUT A STRUCTURAL ELEMENT, DISSIMILAR WALL OR PARTITION, OR OTHER VERTICAL PENETRATION.
   C. WHERE CONSTRUCTION CHANGES WITHIN A PLANE OF A PARTITION OR CEILING.
   D. WHERE CEILING DIMENSIONS EXCEED 50' IN EITHER DIRECTION WITH PERIMETER RELIEF. 30' WITHOUT PERIMETER RELIEF.
   E. WHERE PARTITIONS OR FURRINGS EXCEED 30'.
   F. WHERE EXPANSION OR CONTROL JOINTS OCCUR ON EXTERIOR WALLS.
   G. AT BOTH SIDES OF DOOR HEADS.
   H. WHERE SHOWN ON DRAWINGS.
2. PLACE CORNER BEADS AT ALL EXTERNAL CORNERS USING THE LONGEST PRACTICAL LENGTH.
3. PLACE EDGE TRIM WHERE GYPSUM BOARD ABUTS DISSIMILAR MATERIALS.
4. GYPSUM WALL BOARD MUST BE SUPPORTED WITH STUD FRAMING OR BLOCKING ON BOTH SIDES OF CONTROL JOINTS.
5. ANY INTERIOR OR EXTERIOR GYMPUSM WALL BOARD SURFACE IN A ROOM WITH NO CEILING OR WITH A CEILING GREATER THAN 10 FEET HIGH SHALL HAVE HORIZONTAL CONTROL JOINTS AT THE TOPS OF GYPSUM BOARD PANELS OR AS SHOWN ON THE INTERIOR ELEVAIONS.

GENERAL NOTES:

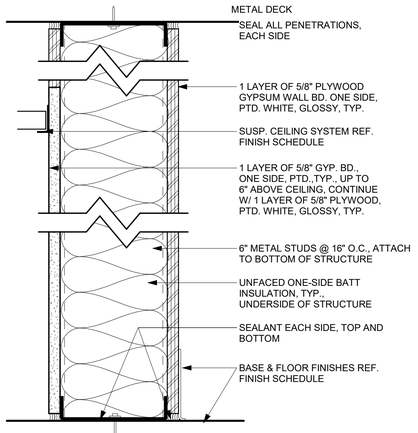
1. "METAL DECK", "STRUCTURE", OR "EXISTING WALL" INDICATED FOR EACH PARTITION IS DIAGRAMMATIC ONLY AND DOES NOT INDICATE EXACT CONSTRUCTION CONDITIONS OR GEOMETRY.
2. INSULATION: HEAD CONDITIONS AT FLOOR/ROOF DECK
   A. FIRE RATED PARTITIONS SHALL USE MINERAL WOOL INSULATION.
   B. NON-RATED PARTITIONS REQUIRING SOUND ATTENUATION SHALL USE SOUND ATTENUATION BLANKETS.
   C. PROVIDE FULL THICKNESS INSULATION INSIDE ALL STUD BOX BEAMS AND HEADERS.
3. REFER TO SPECIFICATIONS FOR MINIMUM STUD THICKNESS, MAXIMUM SPACING, AND ALLOWABLE LIMITING HEIGHTS DEFLECTION CRITERIA FOR GYPSUM BOARD ASSEMBLIES.
4. FOR PARTITIONS INDICATED TO RECEIVE SOUND ATTENUATION BLANKETS, EXTEND TO FULL HEIGHT OF PARTITION UNLESS OTHERWISE INDICATED. FLOOR TRACK TO BE SET IN A CONTINUOUS BED OF SEALANT.



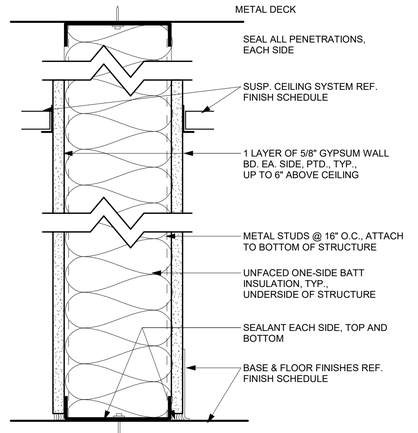
A1 NON-RATED SEPARATION
WALL W/ 6" STUDS



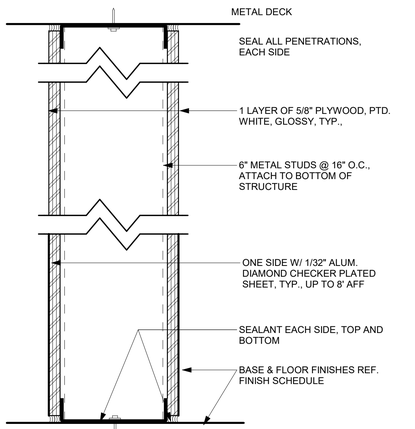
A2 NON-RATED SEPARATION
WALL W/ 6" STUDS



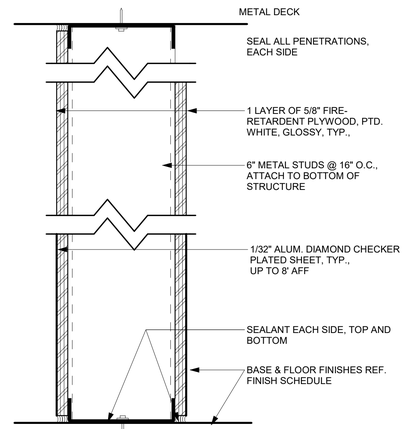
A3 NON-RATED SEPARATION
WALL W/ 6" STUDS



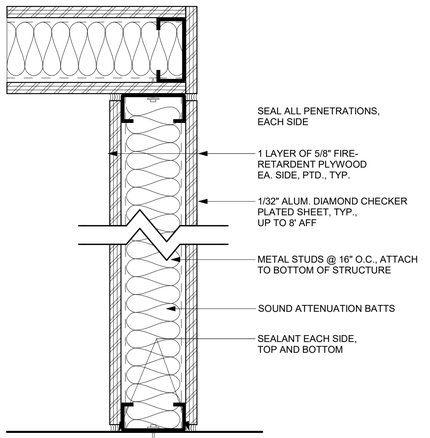
A4 NON-RATED SEPARATION
WALL W/ 6" STUDS



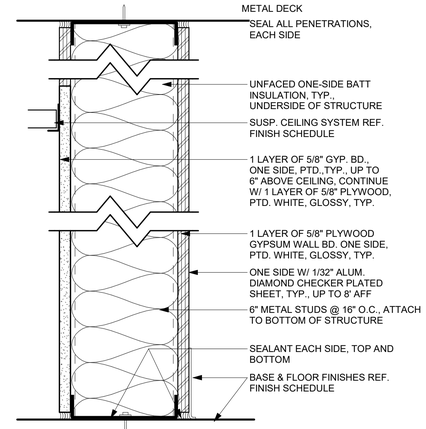
A5 NON-RATED SEPARATION
WALL W/ 6" STUDS



A6 NON-RATED SEPARATION
WALL W/ 6" STUDS



A7 1 HR FIRE-RATED SEPARATION
WALL W/ 3 5/8" STUDS



A8 NON-RATED SEPARATION
WALL W/ 6" STUDS

INTERIOR PARTITION TYPES - METAL STUDS

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STATE OF TEXAS
8889

03/03/2025

REVISIONS		
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BASTROP COUNTY
PRECINCT 2 ROAD & BRIDGE FACILITY
911 SE Martin Luther King Blvd,
Smithville, TX 78957

PROJECT NUMBER:	202415
PROJECT PHASE:	CONSTRUCTION DOCUMENTS
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PARTITION TYPES

SHEET
A604

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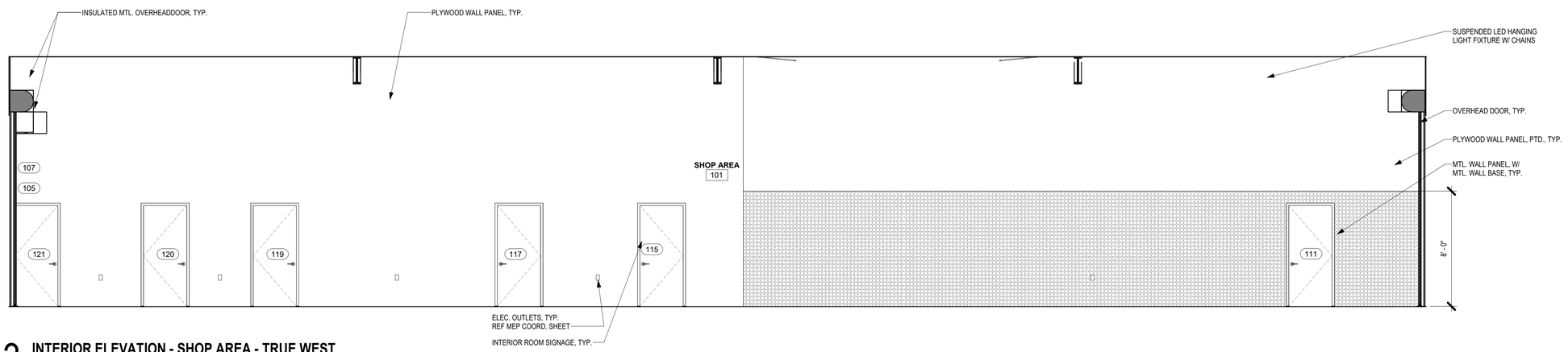
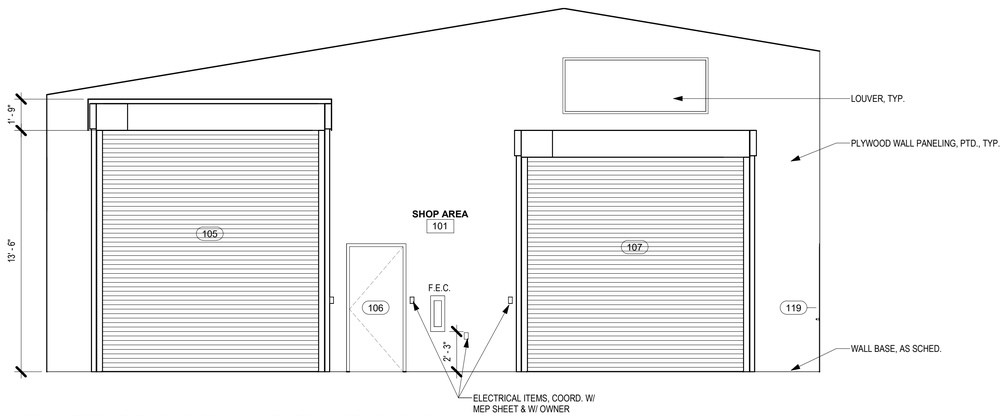
NOTE: COORDINATE ALL ELECTRICAL & PLUMBING WITH MEP COORDINATION SHEET, W/ OWNER & ENGINEERS



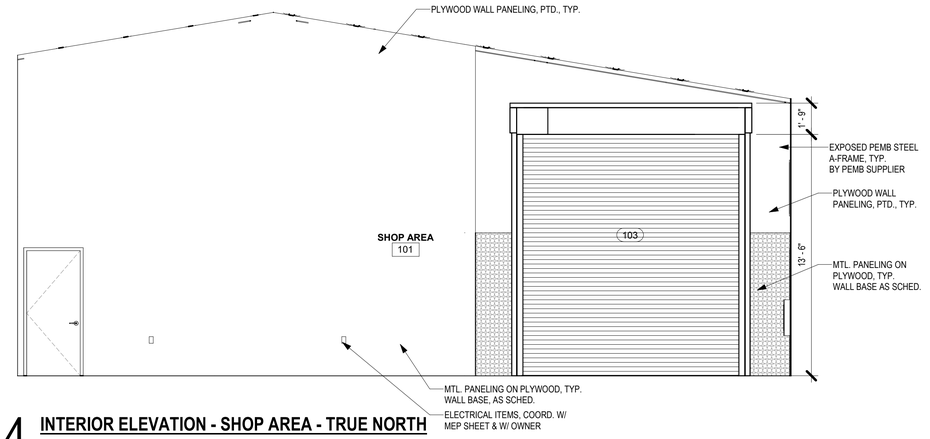
3 INTERIOR ELEVATION - SHOP AREA - TRUE WEST

1/4" = 1'-0"



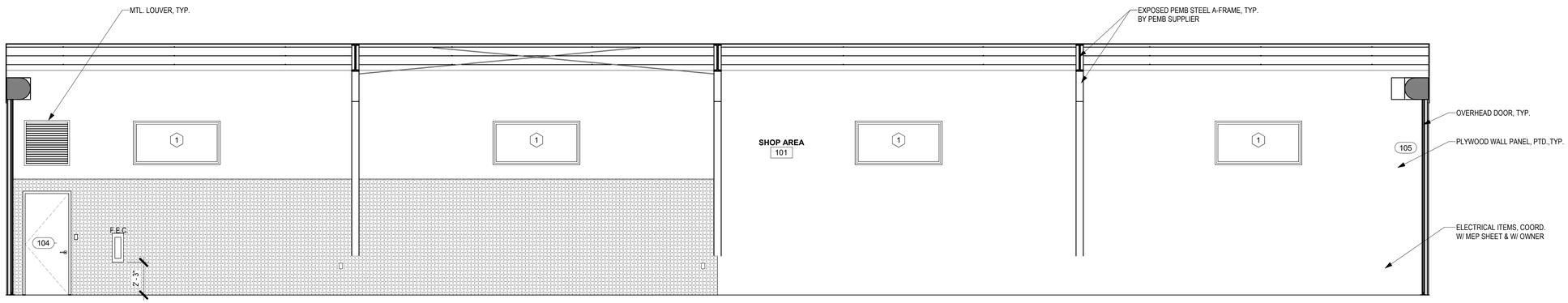
2 INTERIOR ELEVATION - SHOP AREA - TRUE SOUTH

1/4" = 1'-0"



4 INTERIOR ELEVATION - SHOP AREA - TRUE NORTH

1/4" = 1'-0"



1 INTERIOR ELEVATION - SHOP AREA - TRUE EAST

1/4" = 1'-0"

GENERAL NOTES - INTERIOR...

1	REFER TO SHEET A002 & A003 FOR ACCESSIBLE DOOR CLEARANCES, FIXTURE MOUNTING REQUIREMENTS AND CLEARANCES.
2	MILLWORK CABINETS ARE PLASTIC LAMINATE ON EXPOSED AND SEMI-EXPOSED SURFACES, RESILIENT BASE AT STANDARD 4" TOE KICK ONLY; AND MELAMINE ON INTERIORS, U.N.O.
3	TOE KICKS TO RECEIVE SCHED. WALL BASE IN STANDARD INSTANCES. EXCEPTIONS: TOE KICK TO BE PLAM TO MATCH BASE CABINET WHERE KICK IS GREATER THAN 4 INCHES, LOCATED IN RESTROOM OR WHEN OTHERWISE NOTED.

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REGISTERED ARCHITECT BEAMAN 8889 STATE OF TEXAS
03/03/2025

REVISIONS

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PRECINCT 2 ROAD & BRIDGE FACILITY
911 SE Martin Luther King Blvd, Smithville, TX 78957

PROJECT NUMBER:	202415
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INTERIOR ELEVATIONS - SHOP AREA

SHEET
A701

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NOTE: COORDINATE ALL ELECTRICAL & PLUMBING WITH MEP COORDINATION SHEET, W/ OWNER & ENGINEERS

GENERAL NOTES - INTERIOR...	
1	REFER TO SHEET A002 & A003 FOR ACCESSIBLE DOOR CLEARANCES, FIXTURE MOUNTING REQUIREMENTS AND CLEARANCES.
2	MILLWORK CABINETS ARE PLASTIC LAMINATE ON EXPOSED AND SEMI-EXPOSED SURFACES, RESILIENT BASE AT STANDARD 4" TOE KICK ONLY; AND MELAMINE ON INTERIORS, U.N.O.
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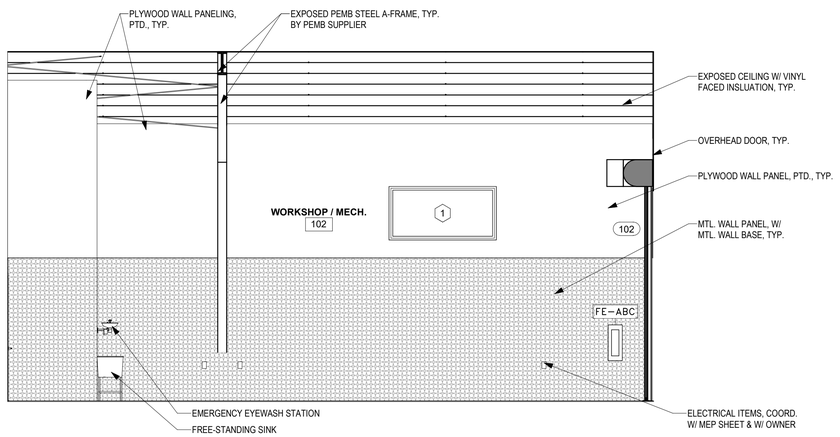
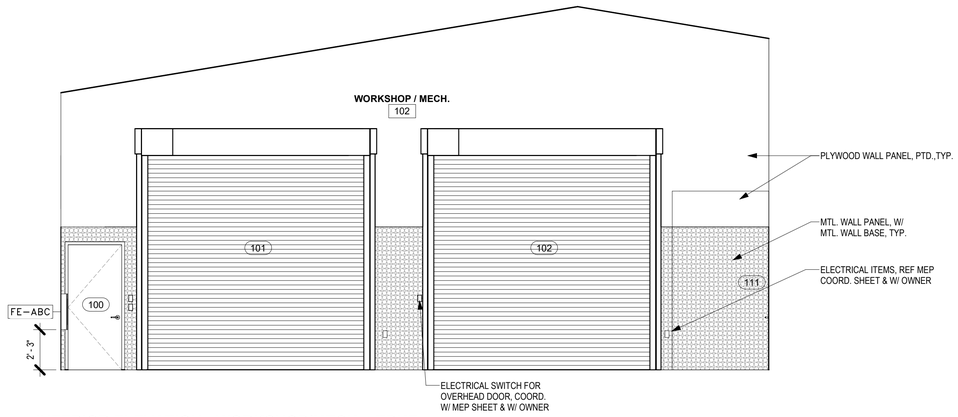


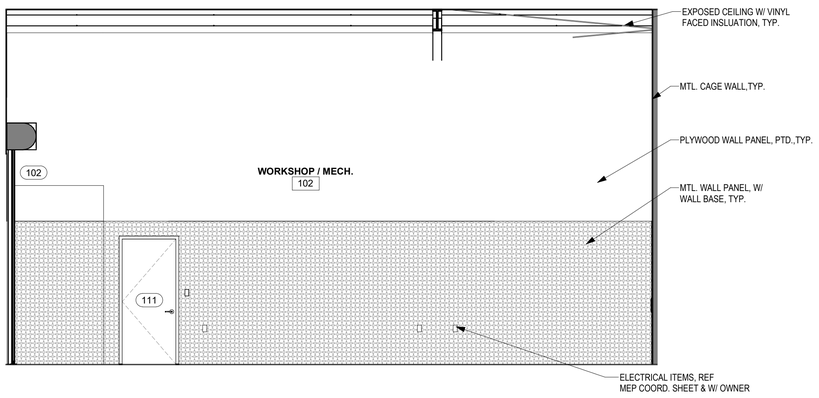
3 INTERIOR ELEVATION - WORKSHOP/MECH. - TRUE WEST

1/4" = 1'-0"



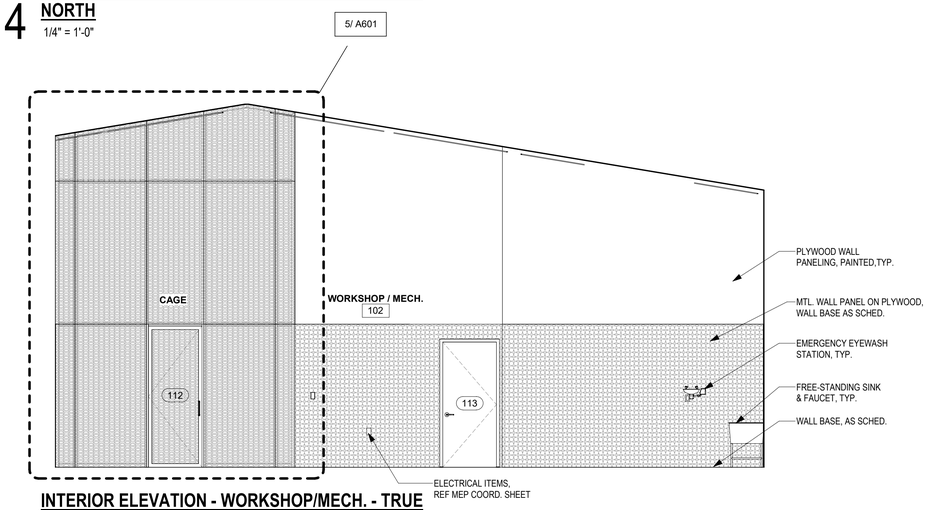
4 INTERIOR ELEVATION - WORKSHOP/MECH. - TRUE NORTH

1/4" = 1'-0"



1 INTERIOR ELEVATION - WORKSHOP/MECH. - TRUE EAST

1/4" = 1'-0"



2 INTERIOR ELEVATION - WORKSHOP/MECH. - TRUE SOUTH

1/4" = 1'-0"

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REGISTERED ARCHITECT BEAMAN 8889 STATE OF TEXAS

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911 SE Martin Luther King Blvd.
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DRAWN BY:	Author
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ISSUE DATE:	03.03.2025

INTERIOR ELEVATIONS - WORKSHOP/MECH.

SHEET
A702

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NOTE: COORDINATE ALL ELECTRICAL & PLUMBING WITH MEP COORDINATION SHEET, W/ OWNER & ENGINEERS

GENERAL NOTES - INTERIOR...	
1	REFER TO SHEET A002 & A003 FOR ACCESSIBLE DOOR CLEARANCES, FIXTURE MOUNTING REQUIREMENTS AND CLEARANCES.
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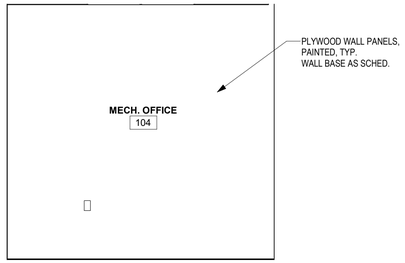
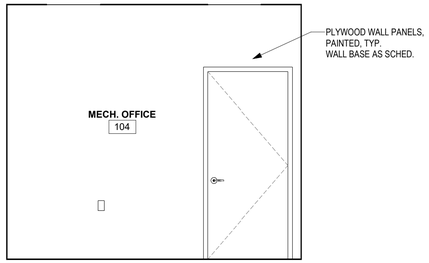
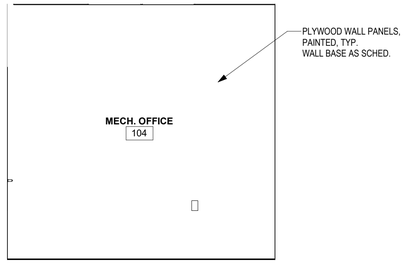


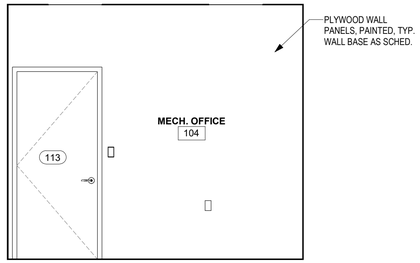
4 **INTERIOR ELEVATION - MECH. OFFICE - TRUE EAST**
3/8" = 1'-0"



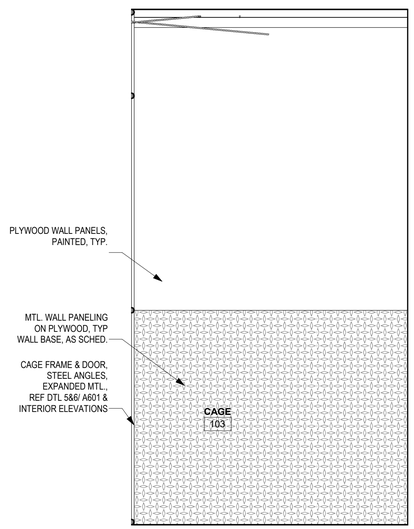
5 **INTERIOR ELEVATION - MECH. OFFICE - TRUE SOUTH**
3/8" = 1'-0"



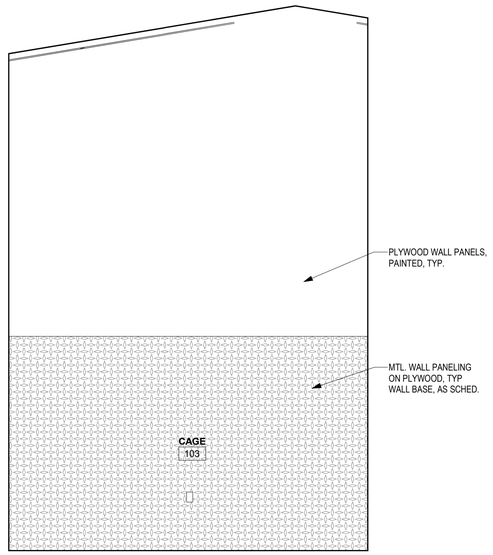
6 **INTERIOR ELEVATION - MECH. OFFICE - TRUE WEST**
3/8" = 1'-0"



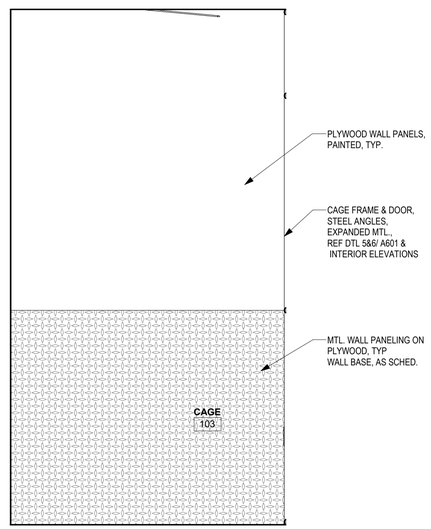
7 **INTERIOR ELEVATION - MECH. OFFICE - TRUE NORTH**
3/8" = 1'-0"



1 **INTERIOR ELEVATION - CAGE - TRUE EAST**
3/8" = 1'-0"



2 **INTERIOR ELEVATION - CAGE - TRUE SOUTH**
3/8" = 1'-0"



3 **INTERIOR ELEVATION - CAGE - TRUE WEST**
3/8" = 1'-0"

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DRAWN BY:	Author
CHECKED BY:	Checker
ISSUE DATE:	03.03.2025

INTERIOR ELEVATIONS

SHEET
A703

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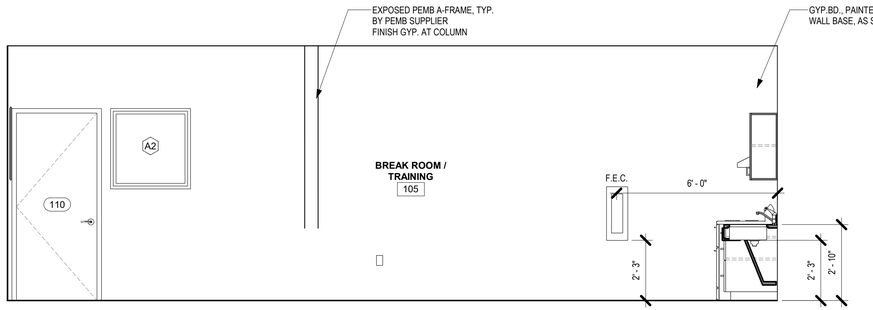
NOTE: COORDINATE ALL ELECTRICAL & PLUMBING WITH MEP COORDINATION SHEET, W/ OWNER & ENGINEERS

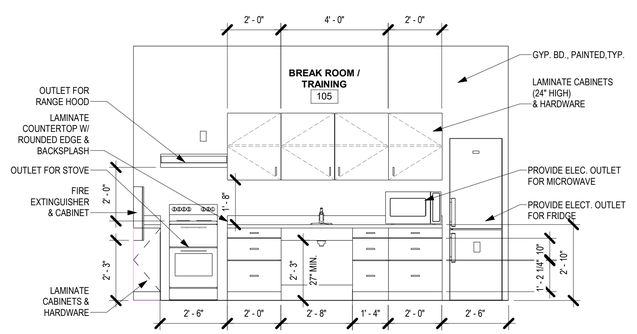
GENERAL NOTES - INTERIOR...	
1	REFER TO SHEET A002 & A003 FOR ACCESSIBLE DOOR CLEARANCES, FIXTURE MOUNTING REQUIREMENTS AND CLEARANCES.
2	MILLWORK CABINETS ARE PLASTIC LAMINATE ON EXPOSED AND SEMI-EXPOSED SURFACES, RESILIENT BASE AT STANDARD 4" TOE KICK ONLY; AND MELAMINE ON INTERIORS, U.N.O.
3	TOE KICKS TO RECEIVE SCHED. WALL BASE IN STANDARD INSTANCES. EXCEPTIONS: TOE KICK TO BE PLAM TO MATCH BASE CABINET WHERE KICK IS GREATER THAN 4 INCHES, LOCATED IN RESTROOM OR WHEN OTHERWISE NOTED.



3 INTERIOR ELEVATION - BREAKROOM - TRUE WEST

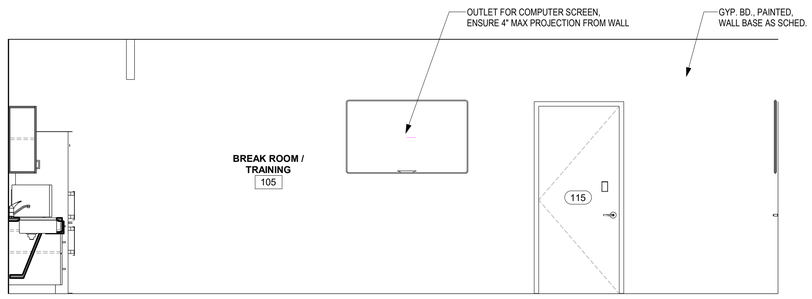
3/8" = 1'-0"

NOTE: REFER TO MILLWORK DETAILS 6-9/ A705



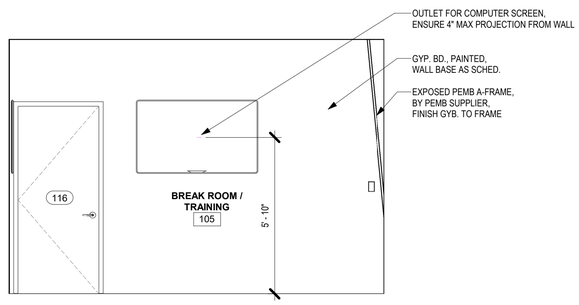
4 INTERIOR ELEVATION - BREAKROOM - TRUE NORTH

3/8" = 1'-0"



1 INTERIOR ELEVATION - BREAKROOM - TRUE EAST

3/8" = 1'-0"



2 INTERIOR ELEVATION - BREAKROOM - TRUE SOUTH

3/8" = 1'-0"

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REGISTERED ARCHITECT
BEAMAN
STATE OF TEXAS
8889

03/03/2025

REVISIONS		
NO.	DATE	DESCRIPTION BY

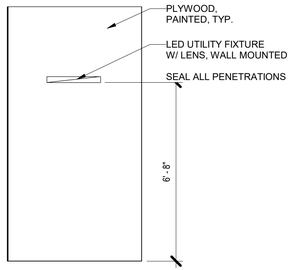
BASTROP COUNTY
PRECINCT 2 ROAD & BRIDGE FACILITY
911 SE Martin Luther King Blvd,
Smithville, TX 78957

PROJECT NUMBER:	202415
PROJECT PHASE:	CONSTRUCTION DOCUMENTS
DRAWN BY:	Author
CHECKED BY:	Checker
ISSUE DATE:	03.03.2025

INTERIOR ELEVATIONS

SHEET
A704

PLOTTED: 3/3/2025 2:36:05 PM



13 INTERIOR ELEVATION - RISER ROOM - TRUE WEST
3/8" = 1'-0"

NOTE: COORDINATE ALL ELECTRICAL & PLUMBING WITH MEP COORDINATION SHEET, W/ OWNER & ENGINEERS

GENERAL NOTES - INTERIOR...

1	REFER TO SHEET A002 & A003 FOR ACCESSIBLE DOOR CLEARANCES, FIXTURE MOUNTING REQUIREMENTS AND CLEARANCES.
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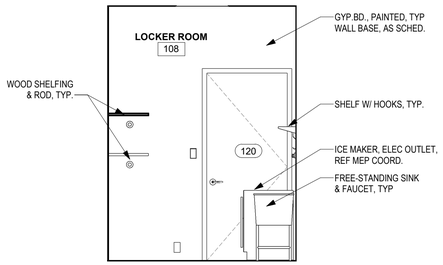
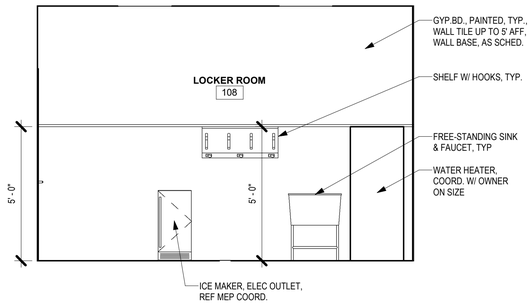


9 INTERIOR ELEVATION - LOCKER RM - TRUE EAST
3/8" = 1'-0"



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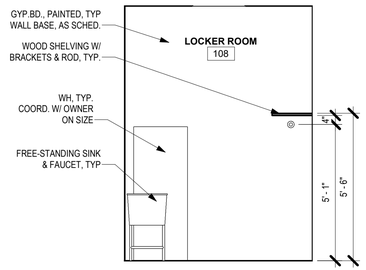
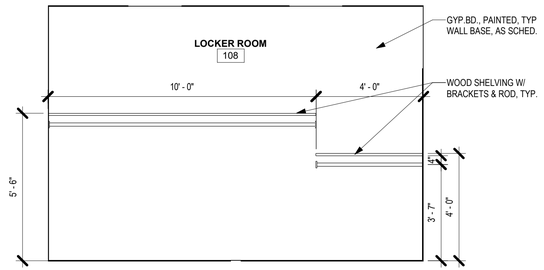
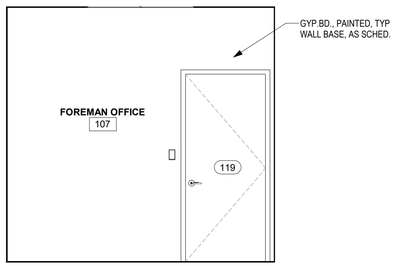
3/8" = 1'-0"



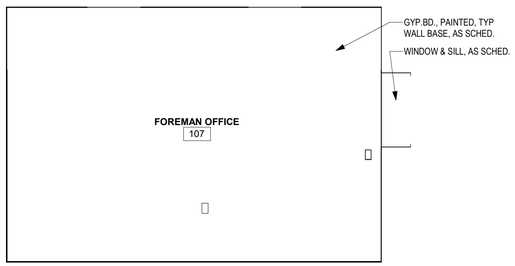
11 INTERIOR ELEVATION - LOCKER RM - TRUE WEST
3/8" = 1'-0"



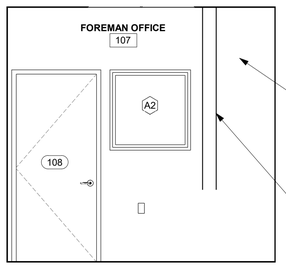
12 INTERIOR ELEVATION - LOCKER RM - TRUE NORTH
3/8" = 1'-0"



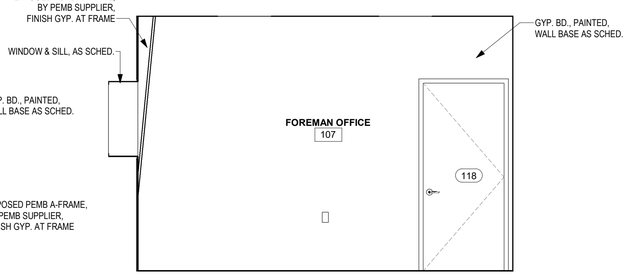
5 INTERIOR ELEVATION - FOREMAN OFFICE - TRUE EAST
3/8" = 1'-0"



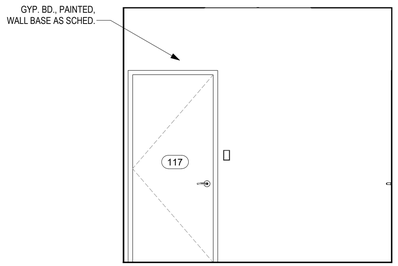
6 INTERIOR ELEVATION - FOREMAN OFFICE - TRUE SOUTH
3/8" = 1'-0"



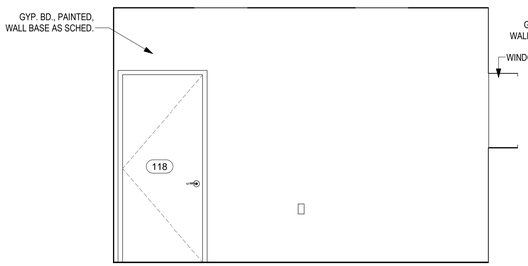
7 INTERIOR ELEVATION - FOREMAN OFFICE - TRUE WEST
3/8" = 1'-0"



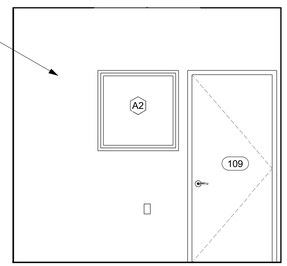
8 INTERIOR ELEVATION - FOREMAN OFFICE - TRUE NORTH
3/8" = 1'-0"



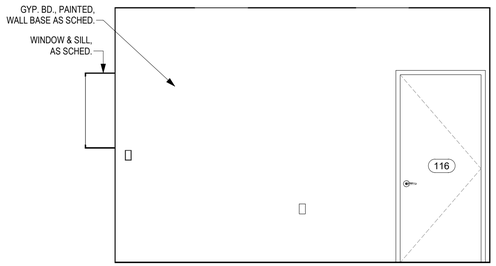
1 INTERIOR ELEVATION - FOREMAN ASSISTANT - TRUE EAST
3/8" = 1'-0"



2 INTERIOR ELEVATION - FOREMAN ASSISTANT - TRUE SOUTH
3/8" = 1'-0"



3 INTERIOR ELEVATION - FOREMAN ASSISTANT - TRUE WEST
3/8" = 1'-0"



4 INTERIOR ELEVATION - FOREMAN ASSISTANT - TRUE NORTH
3/8" = 1'-0"

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REGISTERED ARCHITECT BEAMAN 29 STATE OF TEXAS 8889
03/03/2025

REVISIONS

NO.	DATE	DESCRIPTION	BY

BASTROP COUNTY
PRECINCT 2 ROAD & BRIDGE FACILITY
911 SE Martin Luther King Blvd, Smithville, TX 78957

PROJECT NUMBER:	202415
PROJECT PHASE:	CONSTRUCTION DOCUMENTS
DRAWN BY:	Author
CHECKED BY:	Checker
ISSUE DATE:	03.03.2025

INTERIOR ELEVATIONS

SHEET
A705

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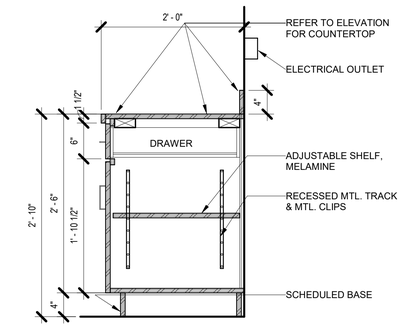
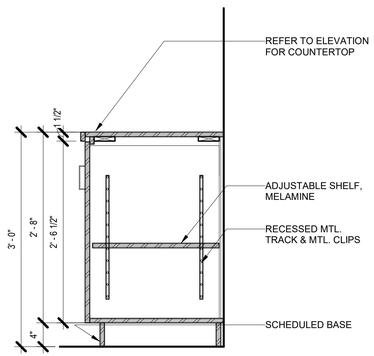
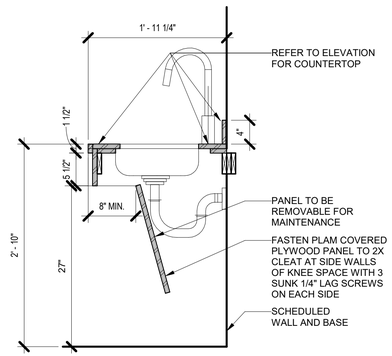


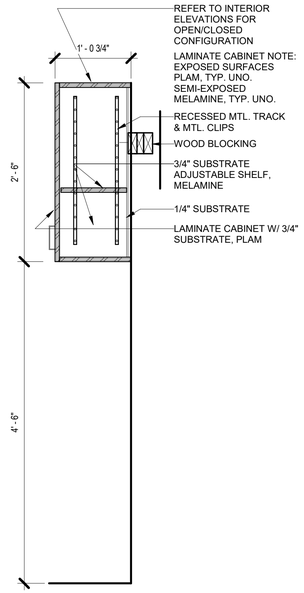
6 BASE CABINET WITH DRAWER DETAIL
1" = 1'-0"



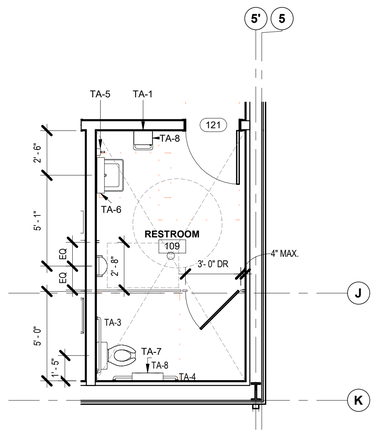
7 BASE CABINET WITH DETAIL
1" = 1'-0"



8 UNDERMOUNT SINK DETAIL
1" = 1'-0"



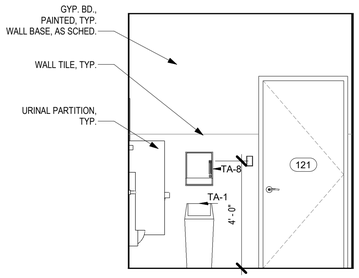
9 UPPER CABINET DETAIL
1" = 1'-0"



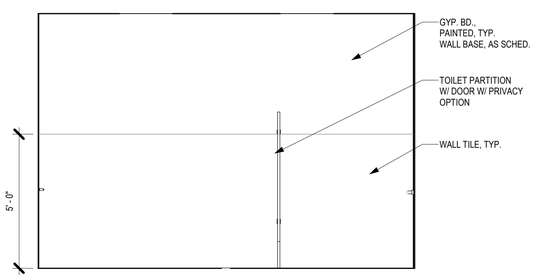
5 ENLARGED RESTROOM PLAN - TOILET ACCESSORIES
1/4" = 1'-0"

TOILET ACCESSORIES SCHEDULE

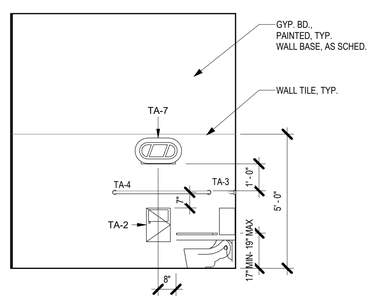
ITEM #	DESCRIPTION	PRODUCT/ MODEL
TA-1	WASTE RECEPTACLE	ULINE 2445 BLACK 16X16X36 23 GAL
TA-2	SANITARY NAPKIN DISPOSAL	ULINE S.STEEL H3454
TA-3	36" GRAB BAR - ADULT	ULINE H6484
TA-4	42" GRAB BAR - ADULT	ULINE H6485
TA-5	WALL-MOUNTED SOAP DISPENSER-LIQUID	ULINE GOJO H1175
TA-6	FRAMED MIRROR	ULINE H9524 24X36X3/4"
TA-7	DUAL TOILET PAPER DISPENSER	ULINE H5114 S.STEEL
TA-8	HAND TOWEL ROLL DISPENSER	SEE SPEC.



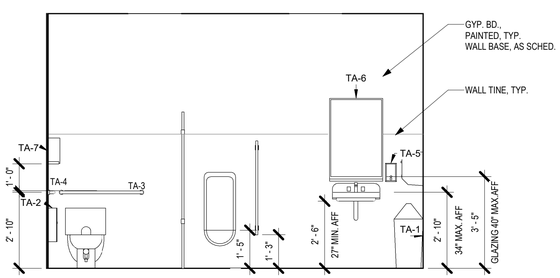
1 INTERIOR ELEVATION - RESTROOM - TRUE EAST
3/8" = 1'-0"



2 INTERIOR ELEVATION - RESTROOM - TRUE SOUTH
3/8" = 1'-0"



3 INTERIOR ELEVATION - RESTROOM - TRUE WEST
3/8" = 1'-0"



4 INTERIOR ELEVATION - RESTROOM - TRUE NORTH
3/8" = 1'-0"

GENERAL NOTES - INTERIOR...

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REGISTERED ARCHITECT BEAMAN 8889 STATE OF TEXAS
03/03/2025

REVISIONS

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911 SE Martin Luther King Blvd, Smithville, TX 78957

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INTERIOR ELEVATIONS & MILLWORK SECTIONS

SHEET
A706

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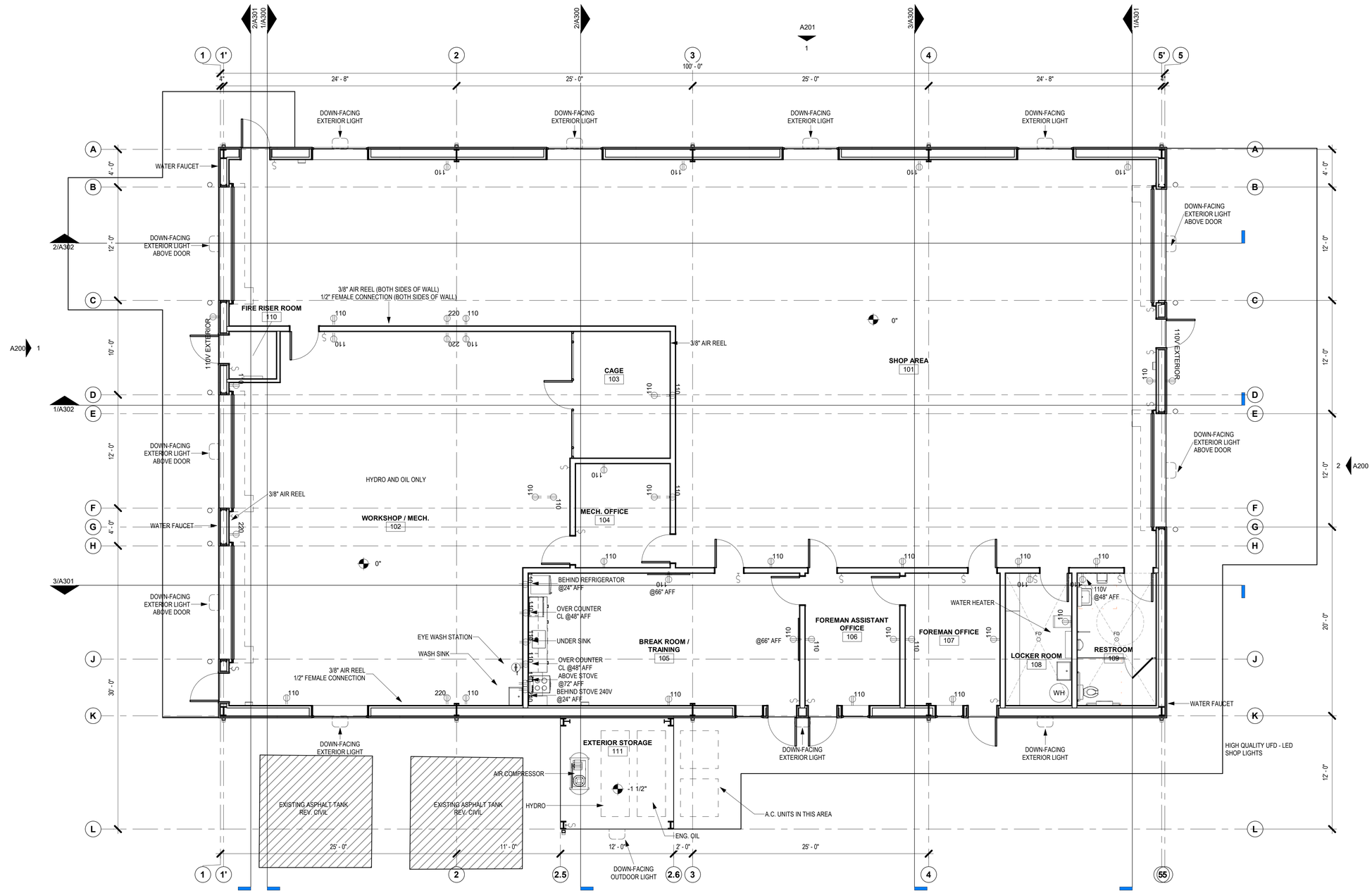

1 FLOOR PLAN - MEP COORDINATION

3/16" = 1'-0"

2
A201

USE FOR REFERENCE ONLY

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03/03/2025

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Smithville, TX 78957

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MEP COORDINATION

SHEET

MEP01

BASTROP COUNTY

PRECINCT 2 ROAD AND BRIDGE FACILITY

911 SE MARTIN LUTHER KING BLVD,
SMITHVILLE, TX 78957

PROJECT NARRATIVE:

THE SCOPE OF THIS PROJECT IS THE MECHANICAL, ELECTRICAL AND PLUMBING DESIGN FOR A REPLACEMENT OFFICE/SHOP BUILDING. THE EXISTING BUILDING WILL BE DEMOLISHED PRIOR TO THE START OF THIS PROJECT.

DRAWING INDEX:

C0.0	COVER SHEET
MEP1	MEP SITE AND ROOF PLAN
M1.1	MECHANICAL GENERAL NOTES AND LEGENDS
M2.1	MECHANICAL SCHEDULES
M4.1	MECHANICAL FLOOR PLAN
M9.1	MECHANICAL DETAILS
M9.2	MECHANICAL DETAILS
E1.1	ELECTRICAL GENERAL NOTES, LEGENDS, AND SCHEDULES
E2.1	SINGLE LINE DIAGRAM
E2.2	PANEL SCHEDULES
E2.3	ELECTRICAL SCHEDULES
E4.2	POWER PLAN
E5.2	LIGHTING PLAN
E6.0	ELECTRICAL DETAILS
E8.0	FIRE ALARM NOTES
P1.1	PLUMBING GENERAL NOTES AND LEGENDS
P2.1	PLUMBING SCHEDULES
P4.1	SANITARY AND VENT INSTALLATION PLAN
P4.2	DOMESTIC WATER INSTALLATION PLAN
P9.1	PLUMBING DETAILS
FP1.1	FIRE PROTECTION GENERAL NOTES, LEGENDS, & SCHEDULES

TOTAL SHEET COUNT: 21

BASTROP COUNTY
1041 LOVERS LANE
BASTROP COUNTY, TEXAS 78602

ENGINEER OF RECORD:

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203 Norton St., #170
San Antonio, TX 78211
(210) 924-6222

STATE OF TEXAS
THOMAS PAUL ARTHUR OTTEN
91932
LICENSED
PROFESSIONAL ENGINEER
04/04/2025

PRICINCT 2 ROAD AND BRIDGE FACILITY
BASTROP COUNTY
911 SE MARTIN LUTHER KING BLVD
SMITHVILLE TX, 78957

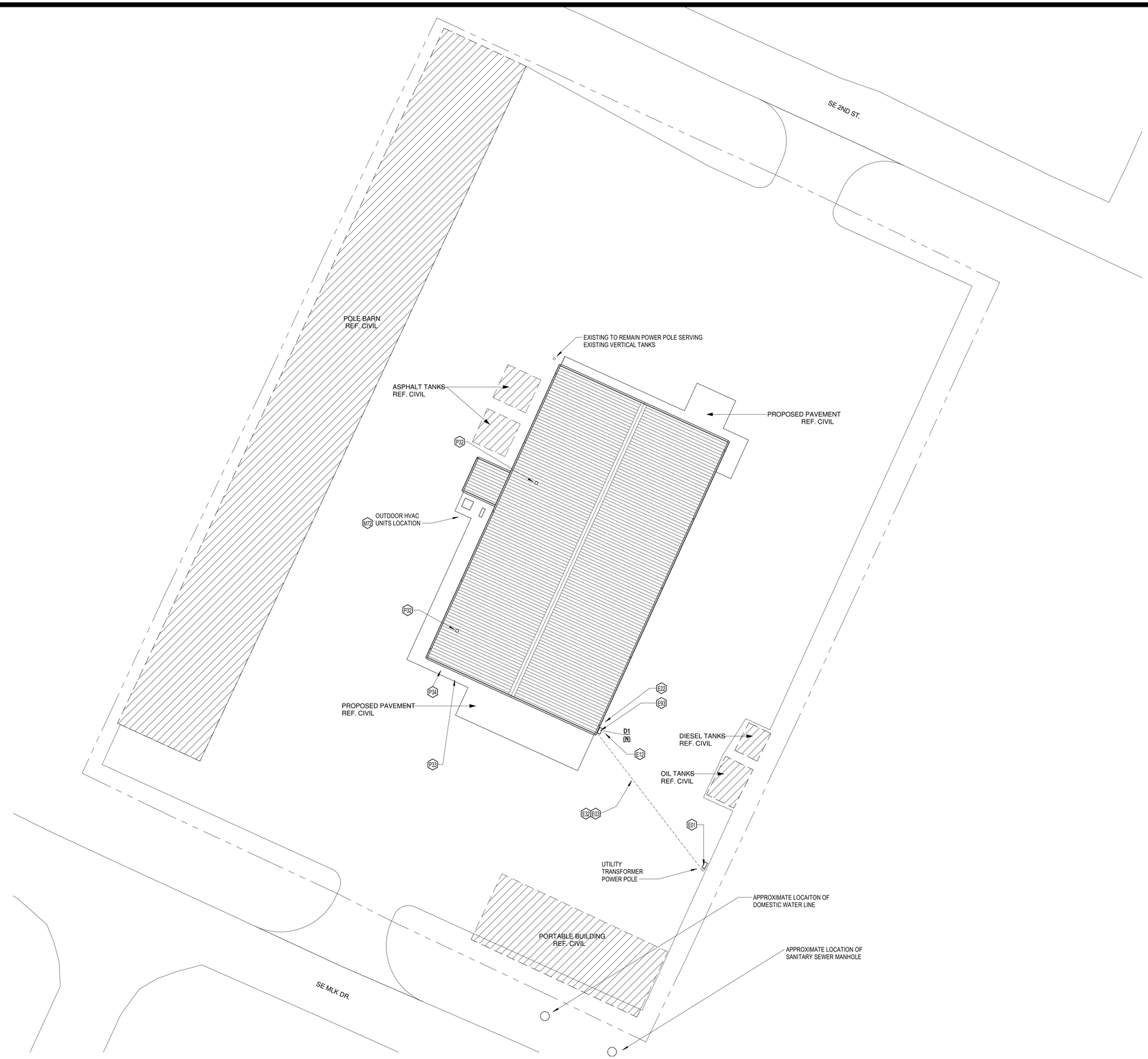
COVER SHEET

SHEET TITLE:

REVISIONS:

NO.	DATE

Job No:	T2414
Drawn by:	TO
Checked by:	TS/SK/EB
Sheet No.	C0.0
Date:	APRIL 2025



1 Site and Roof Plan
1/16" = 1'-0"

GENERAL ELECTRICAL NOTES

1. REFER TO SHEET E1.1 FOR GENERAL NOTES AND LEGENDS.
2. COORDINATE WITH OTHER TRADES (MECH, CONTROLS, PLUMBING, AND FIRE ALARM) FOR DEMOLITION AND NEW WORK, INCLUDING ANY ADDITIONAL CONDUIT/POWER REQUIREMENTS.
3. SNAP SWITCHES USED AS DISCONNECTS SHALL BE AC GENERAL USE SNAP SWITCHES PER NEC 2020 404.14(A)(3)
4. FOR ELECTRICAL EQUIPMENT BEING ADDED, THE CONTRACTOR SHALL:
   A. RECORD THE CIRCUIT NUMBER AND BREAKER RATING OF EQUIPMENT.
   B. REPORT IN TABULAR FORM (UNIT #, CIRCUIT #(s), AND V/A/P,) TO ENGINEER AND OWNER FOR O&M RECORDS. LABEL EQUIPMENT FOR DISCONNECT SWITCHES WITH EQUIPMENT VOLTAGE, AMPERAGE, PHASE AND CIRCUIT NUMBER.
5. BEFORE ROUGHING IN OUTLET AND SWITCH LOCATIONS, CONTRACTOR TO COORDINATE WITH ARCHITECT'S FURNITURE LAYOUT, AND PRESENT SHOP DRAWING FOR ARCHITECT AND OWNER APPROVAL. SHOP DRAWING SHALL INDICATE VERTICAL AND HORIZONTAL WALL LOCATION OF ALL OUTLETS AND SWITCHES.
6. PROVIDE OUTLET RECEPTACLES FOR EQUIPMENT AS PER EQUIPMENT MANUFACTURER'S RECOMMENDATION. OWNER TO PROVIDE CUT SHEETS FOR ALL EQUIPMENT REQUIRING SPECIAL RECEPTACLES.

ELECTRICAL NEW WORK KEYED NOTES

E01 THE FOLLOWING ARE OWNER PROVIDED AND INSTALLED BY UTILITY. NEW ELECTRICAL SERVICE INCLUDING POWER POLE AND METER, SECONDARY CONDUIT FROM TRANSFORMER, TRANSFORMER, GROUNDING ELECTRODES AT TRANSFORMER, AND METERING EQUIPMENT ENCLOSURES. COORDINATE WITH ELECTRICAL UTILITY WHEN CONNECTING TO NEW ELECTRIC SERVICE.

E03 BURY NEW CONDUITS A MINIMUM OF 36" BELOW GRADE.

E12 APPROXIMATE LOCATION OF GROUND ROD. SEE SINGLE LINE DIAGRAM ON SHEET E2.1 FOR MORE DETAILS.

E22 LOCATION OF OWNER PROVIDED DATA ENTRANCE TO BUILDING FROM BELOW GROUND.

E32 COORDINATE ROUTING OF BURIED CONDUIT WITH FOUNDATION, CIVIL AND PLUMBING CONTRACTORS.

E93 MOUNT DISCONNECT ON OUTSIDE OF BUILDING.

GENERAL MECHANICAL NOTES

1. REFER TO SHEET M1.1 FOR GENERAL NOTES AND LEGENDS.
2. PERFORM ALL WORK IN ACCORDANCE WITH LOCAL CODES.
3. ALL PENETRATIONS OF THE ROOF SHALL BE SHIELDED AND SEALED IN COMPLIANCE WITH REQUIREMENTS OF THE ROOF MFGR AND OWNER'S ROOFING SPECIALIST.
4. FIRE SEAL ALL PENETRATIONS OF FIRE RATED CONSTRUCTION TO PRESERVE THE FIRE RATING. CONFIRM WALL RATINGS WITH OWNER. FOR BIDDING, ASSUME THAT CORRIDOR WALLS ARE RATED ONE HOUR.
5. TESTING, ADJUSTING, AND BALANCING (TAB) WORK FOR HVAC SYSTEMS WITHIN THE SCOPE OF WORK IS REQUIRED FOR PROJECT ACCEPTANCE. REFERENCE SPECIFICATIONS.
6. ALL DUCTWORK SHALL BE SHEET METAL CONSTRUCTED & SUPPORTED IN ACCORDANCE WITH THE LATEST EDITION OF SHEET METAL & AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION, INC. (SMACNA) STANDARD "HVAC DUCT CONSTRUCTION STANDARDS, METAL & FLEXIBLE".
7. DETAILED DIMENSIONED SHOP DRAWINGS SHALL BE PREPARED AND SUBMITTED (MANDATORY REQUIREMENT) BY CONTRACTOR FOR REVIEW AND APPROVAL BY ENGINEER AND OWNER.

MECHANICAL NEW WORK KEYED NOTES

M72 APPROXIMATE LOCATION OF NEW HVAC OUTDOOR UNITS.

GENERAL PLUMBING NOTES

1. REFER TO SHEET P1.1 FOR GENERAL NOTES AND LEGENDS.

PLUMBING NEW WORK KEYED NOTES

P32 APPROXIMATE LOCATION OF PLUMBING VENTS. COORDINATE WITH ROOFING MANUFACTURER FOR PROPER INSTALLATION FOR METAL ROOF.

P33 APPROXIMATE LOCATION OF DOMESTIC WATER LINE. COORDINATE WITH CIVIL.

P34 APPROXIMATE LOCATION OF WASTE LINE. COORDINATE WITH CIVIL.

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MEP SITE AND ROOF PLAN

SHEET TITLE:

REVISIONS:

NO.	DATE

Job No:	T2414
Drawn by:	TO
Checked by:	TS/SK/EB
Sheet No.	MEP1
Date:	APRIL 2025

MECHANICAL ABBREVIATIONS

A		
	A/C	AIR CONDITIONING
	ACCU	AIR COOLED CONDENSOR UNIT
	AD	ACCESS DOOR
	AFF	ABOVE FINISHED FLOOR
	AFC	ABOVE FINISHED CEILING
	AFG	ABOVE FINISHED GRADE
	AHU	AIR HANDLING UNIT
	AI	ANALOG IN
	AO	ANALOG OUT
	AP	ACCESS PANEL
	AS	AIR SEPARATOR
	APPROX	APPROXIMATE
	AUX	AUXILARY
B		
	BAS	BUILDING AUTOMATION SYSTEM
	BACNET	BACNET CONTROL PROTOCOL
	BFF	BELOW FINISHED FLOOR
	BFG	BELOW FINISHED GRADE
	BFS	BELOW FINISHED SLAB
	BFG	BELOW FINISHED GRADE
	BFP	BACKFLOW PREVENTER
	BLDG	BUILDING
	BLR	BOILER
	BOD	BOTTOM OF DUCT
	BTU	BRITISH THERMAL UNIT
	BTUH	BRITISH THERMAL UNIT PER HOUR
C		
	CD	COLD DECK OR CONDENSATE DRAIN
	CFH	CUBIC FEET PER HOUR
	CFM	CUBIC FEET PER MINUTE
	CH	CHILLER
	CHW	CHILLED WATER
	CHWP	CHILLED WATER PUMP
	CHWR	CHILLED WATER RETURN
	CHWS	CHILLED WATER SUPPLY
	CI	CAST IRON
	CLG	CEILING
	COD	CENTER OF DUCT
	CO	CLEANOUT
	COND	CONDENSATE
	CP	CIRCULATING PUMP
	CT	COOLING TOWER OR CURRENT TRANSFORMER
	CTRL	CONTROL
	CU	COPPER
	CV	CONSTANT VOLUME
	CW	CONDENSER WATER
	CWP	CONDENSER WATER PUMP
	CWR	CONDENSER WATER RETURN
	CWS	CONDENSER WATER SUPPLY
D		
	DA	DISCHARGE AIR
	DB	DRY BULB
	DCW	DOMESTIC COLD WATER
	DDC	DIRECT DIGITAL CONTROL
	DHW	DOMESTIC HOT WATER
	DI	DUCTILE IRON
	DIA	DIAMETER
	DN	DOWN
	DO	DISCRETE OUT, DIGITAL OUT
	DP	DIFFERENTIAL PRESSURE
	DTB	DROP TO BELOW
	DX	DIRECT EXPANSION
E		
	EA	EACH, OR EXHAUST AIR
	EAT	ENTERING AIR TEMPERATURE
	EDH	ELECTRIC DUCT HEATER
	EF	EXHAUST FAN
	EMS	ENERGY MANAGEMENT SYSTEM
	ERV	ENERGY RECOVERY VENTILATOR
	ETR	EXISTING TO REMAIN
	EVAP	EVAPORATOR
	EWT	ENTERING WATER TEMPERATURE
	EWH	ELECTRIC WATER HEATER
	EXH	EXHAUST
	EXT	EXTERNAL
F		
	FCU	FAN COIL UNIT
	FD	FIRE DAMPER/FLOOR DRAIN
	FH	FIRE HYDRANT
	FLR	FLOOR
	FPM	FEET PER MINUTE
	FPTU	FAN POWERED TERMINAL UNIT
	FS	FLOOR SINK
	FSD	FIRE/SMOKE DAMPER
	FT	FEET/FOOT
G		
	GAL	GALLONS
	GC	GENERAL/PRIME CONTRACTOR
	GEN	GENERAL
	GPH	GALLONS PER HOUR
	GPM	GALLONS PER MINUTE
H		
	HHW	HEATING HOT WATER
	HP	HORSEPOWER
	HR	HOUR
	HRU	HEAT RECOVERY UNIT
	HRV	HEAT RECOVERY VENTILATOR
	HTG	HEATING
	HUM	HUMIDITY
	HW	HOT WATER
	HWR	HOT WATER RETURN
	HWS	HOT WATER SUPPLY
	HX	HEAT EXCHANGER
	HZ	HERTZ
I		
	IN	INCHES
	IOM OR I.O.M	INSTALLATION & OPERATION MANUAL
K		
	K	KILO
	KW	KILOWATTS
L		
	LAN	LOCAL AREA NETWORK
	LAT	LEAVING AIR TEMPERATURE
	LBS	POUNDS
	LON	LONWORKS CONTROL PROTOCOL
	LTG	LIGHTING
	LWT	LEAVING WATER TEMPERATURE
M		
	MA	MIXED AIR
	MAU	MAKE-UP AIR UNIT
	MAX	MAXIMUM
	MBH	THOUSAND BTU'S PER HR.
	MIN	MINIMUM
	MZ	MULTI-ZONE
N		
	NA	NOT APPLICABLE
	NC	NORMALLY CLOSED
	NG	NATURAL GAS
	NO	NORMALLY OPEN
O		
	OA	OUTSIDE AIR
	OAH	OUTSIDE AIR HUMIDITY
	OAT	OUTSIDE AIR TEMPERATURE
	OBD	OPPOSED BLADE DAMPER
	OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
P		
	PD	PRESSURE DROP
	PPG	PIPING
	PSI	POUNDS PER SQUARE INCH
	PWM	PULSE WIDTH MODULATION
Q		
	QTY	QUANTITY
R		
	RA	RETURN AIR
	RAT	RETURN AIR TEMPERATURE
	REF	REFERENCE
	RF	RELIEF FAN OR RETURN FAN
	RFB	RISE FROM BELOW
	RH	RELATIVE HUMIDITY
	RM	ROOM
	RPZA	REDUCED PRESSURE ZONE ASSEMBLY
	RTA	RISE TO ABOVE
	RTU	ROOF TOP UNIT
S		
	SA	SUPPLY AIR
	SD	SMOKE DETECTOR, OR SINGLE DUCT
	SF	SUPPLY FAN
	SP	STATIC PRESSURE
	STPT	SETPOINT
	S/S	START/STOP
	SW	SANITARY WASTE
	SZ	SINGLE ZONE
T		
	TEMP	TEMPERATURE
	TU	TERMINAL UNIT
	TYP	TYPICAL
U		
	UH	UNIT HEATER
	UON	UNLESS OTHERWISE NOTED
	UV	UNIT VENTILATOR
V		
	V	VENT/VOLTS
	VAC	VOLTS ALTERNATING CURRENT
	VAV	VARIABLE AIR VOLUME
	VFD	VARIABLE FREQUENCY DRIVE
	VRF	VARIABLE REFRIGERANT FLOW
	VTR	VENT THRU ROOF
W		
	W	WATTS
	W/	WITH
	WB	WET BULB
	WG	WATER GAUGE
	WP	WEATHERPROOF
X		
	XT	EXPANSION TANK
Z		
	ZN	ZONE

AIR DISTRIBUTION LEGEND

- SUPPLY AIR DIFFUSER
- RETURN GRILLE/REGISTER
- EXHAUST GRILLE/REGISTER
- SUPPLY DIFFUSER W/ FLEX DUCT
- ROUND SUPPLY DIFFUSER
- SIDEWALL SUPPLY, RETURN OR EXHAUST GRILLE THRU WALL
- SLOT DIFFUSER
- DIFFUSER TAG (S1 / CFM / L"xW")
- DUCT SIZE TAG W/D (12"/12")
- DUCT HEATER
- RECTANGULAR ACCESS DOOR (SIDE VIEW) (AD)
- RECTANGULAR ACCESS DOOR (TOP VIEW) (AD)
- CIRCULAR ACCESS DOOR (TOP VIEW) (AD)
- PARRALLEL BLADE CONTROL DAMPER
- MOTORIZED CONTROL DAMPER
- MANUAL BALANCING DAMPER
- MANUAL BALANCING DAMPER
- FIRE SMOKE DAMPER (FSD-X; X = RATING 1 = 1 HR)
- BACK DRAFT (GRAVITY) DAMPER
- BAROMETRIC PRESSURE RELIEF DAMPER
- 90 DEGREE RADIAL ELBOW
- 45 DEGREE RADIAL ELBOW
- 90 DEGREE DUCT ELBOW WITH TURNING VANES
- RECTANGULAR DUCT TEE
- ROUND DUCT TEE
- DUCT END CAP
- RECTANGULAR TO ROUND TRANSITION (12"/12" 12"ø)
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- 45 DEGREE BOOT TAP WITH BALANCING DAMPER
- DUCT 16" WIDE & 12" DEEP. (16"/12")
- RECTANGULAR ELBOW UP
- RECTANGULAR ELBOW DOWN
- RECTANGULAR DUCT RISE
- RECTANGULAR DUCT DROP
- ROUND DUCT RISE
- ROUND DUCT DROP
- NEW DUCTWORK
- EXISTING DUCTWORK
- DEMOLISHED DUCTWORK

HYDRONIC PIPING LEGEND

SINGLE LINE	DESCRIPTION	SINGLE LINE	DESCRIPTION
	ELBOW DOWN		HOSE BIBB W/ FREEZE PROTECTION
	ELBOW UP		VALVE IN VERTICAL
	TEE DOWN		VALVE IN VERTICAL
	45° OFFSET		GENERIC ISOLATION VALVE (FILL INDICATES NORMALLY CLOSED)
	PIPE CONTINUATION		GENERIC ISOLATION VALVE (FILL INDICATES NORMALLY CLOSED)
	END CAP OR PLUG		GATE VALVE
	REDUCER		VALVE IN BOX
	UNION		2-WAY CONTROL VALVE
	THREADED UNION		3-WAY CONTROL VALVE
	FLANGED UNION		THERMOSTATIC MIXING VALVE
	PIPE SLEEVE		3-WAY VALE
	COMBINATION WYE & 1/8 BEND		CHECK VALVE
	DOUBLE-WYE & 1/8 BEND		BALL VALVE (FILLED CENTER INDICATES NORMALLY CLOSED)
	SINGLE WYE		BUTTERFLY VALVE (FILLED CENTER INDICATES NORMALLY CLOSED)
	VENT STACK WYE		BALANCING VALVE
	IN-LINE CLEAN OUT		PLUG VALVE
	WALL CLEAN OUT		RELIEF (X=TYPE) T = TEMPERATURE P=PRESSURE T&P= TEMPERATURE & PRESSURE
	FLOOR CLEAN OUT GRADE CLEAN OUT		SAFETY RELIEF VALVE
	TWO-WAY CLEAN OUT		PRESSURE REDUCING VALVE
	FLOOR DRAIN		PRESSURE REGULATOR (X=TYPE: G=GAS/A=AIR/W=WATER)
	BTU METER		PRESSURE REGULATING VALVE
	FLOW SWITCH		BACKFLOW PREVENTION ASSEMBLY
	AUTO AIR VENT		WYE STRAINER W/ BLOW OFF
	AIR VENT		PUMP
	BAS SENSOR IN WELL (X=TYPE) T = TEMPERATURE P=PRESSURE DP= DIFFERENTIAL PRESSURE		
	FIXTURE VALVE		

GENERAL LEGEND

- POINT OF CONNECTION NEW TO EXISTING OR DISCONNECTION DEMO FROM EXISTING. MAY NOT BE INDICATED AT ALL SUCH POINTS. CROSS REF W/ LINE-WEIGHT AND STYLE CONVENTIONS AT RIGHT.
- 1 REVISION CLOUD & MARKER
- DETAIL REFERENCE (3 / M1)
- BOUNDARY MARKS
- SHEET REFERENCE
- BREAK MARK
- PHOTO OR AXON VIEW REFERENCE (3 / M1)
- APPROX. AXONOMETRIC VIEWING LOCATION & DIRECTION
- SHEET REFERENCE

- (1) NEW WORK KEYED NOTE
- (1) DEMOLITION KEYED NOTE
- (1) DETAIL KEYED NOTE
- (1) MISC. KEYED NOTE
- AREA " " / AREA " " MATCHLINE
- (N) - NEW WORK
- (X) - DEMOLITION
- (R) - RELOCATE/REINSTALL
- (E) - EXISTING, REMAINS

NOTE: PHASING NOTATIONS, e.g. (N), (E), etc. MAY NOT NECESSARILY BE INDICATED ON ALL ITEMS. CROSS REF WITH LINE-WEIGHT AND STYLE CONVENTIONS ABOVE.

DUCTWORK CONNECTION SCHEDULE

CFM RANGE	FLEXIBLE DUCT DIAMETER (IN.)	RECTANGULAR DUCT RUNOUT (IN.)
UP TO 120	6"	8" x 8"
121 TO 230	8"	8" x 10"
231 TO 350	10"	8" x 12"
351 TO 525	12"	10" x 14"

DUCTWORK CONNECTION SCHEDULE NOTES:

1. MAXIMUM LENGTH OF FLEX DUCT NOT TO EXCEED 5 FEET.
2. RECTANGULAR RUN OUT DIMENSIONS ARE FOR REFERENCE ONLY, DIMENSIONS MAY BE ADJUSTED TO PROVIDE EQUIVALENT AREA AS REQUIRED.
3. REF: GENERAL AND KEYED NOTES.

GENERAL MECHANICAL NOTES

1. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, AND FEDERAL CODES & STANDARDS. CRAFTSMANSHIP AND MATERIAL SHALL BE OF THE FINEST QUALITY.
2. REFER TO SPECIFICATION DIVISION 23 FOR ADDITIONAL INFORMATION REGARDING THE PROJECT. THE DRAWINGS AND THE SPECIFICATIONS ARE BOTH INCLUDED IN THE CONTRACT DOCUMENTS.
3. ALL DUCTWORK SHALL BE CONSTRUCTED & SUPPORTED IN ACCORDANCE WITH THE LATEST EDITION OF SHEET METAL & AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION, INC. STANDARD "HVAC DUCT CONSTRUCTION STANDARDS, METAL & FLEXIBLE".
4. UNLESS NOTED OTHERWISE, ALL CAPACITIES INDICATED ARE AT SITE CONDITIONS. ALL EQUIPMENT SHALL BE ADJUSTED, MODIFIED, AND ORDERED TO ACCOMMODATE SITE CONDITIONS.
5. THE CONTRACTOR SHALL REVIEW THE CONTRACT DOCUMENTS FULLY PRIOR TO THE SUBMITTAL PHASE OF THE PROJECT. CONFLICTS WITHIN AND BETWEEN THE CONTRACT DOCUMENTS SHALL BE NOTED IN WRITING TO THE ENGINEER PRIOR TO SUBMITTING DATA SHEETS FOR REVIEW.
6. IT IS THE INTENT OF THE DRAWINGS TO SHOW A COMPLETE DESIGN IN EVERY RESPECT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR A COMPLETE AND FULLY FUNCTIONAL INSTALLATION. THE PRIME CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING THE WORK BETWEEN SUBCONTRACTORS TO ASSURE THAT THE INSTALLATION WILL BE COMPLETE WITHOUT ADDITIONAL COST TO THE CONTRACT.
7. BRANCH DUCTS SERVING DIFFUSERS SHALL BE THE SAME SIZE AS THE DIFFUSER NECK UNLESS NOTED OTHERWISE.
8. THE MAX. ALLOWABLE FLEXIBLE DUCT LENGTH IS 5'-0". ADDITIONAL LENGTHS SHALL BE COMPENSATED BY ROUND SHEET METAL DUCTWORK OF EQUAL SIZE, UNLESS SPECIFICALLY NOTED OTHERWISE ON PLANS.
9. SLOPE ALL CONDENSATE DRAINAGE TOWARDS THE DISCHARGE AT 1/8" DROP PER 12" HORIZONTAL RUN WHEREVER POSSIBLE, BUT IN NO CASE LESS THAN A MIN. OF 1/16" DROP PER 12" HORIZONTAL RUN, UNLESS NOTED OTHERWISE.
10. MOUNT ALL CONTROLS INTENTED FOR GENERAL OCCUPANT USE, SUCH AS SWITCHES AND THERMOSTATS, IN ACCORDANCE WITH AMERICANS WITH DISABILITIES ACT STANDARDS OF 48" A.F.F. FRONT REACH AND 54" A.F.F. SIDE REACH. UNLESS NOTED OTHERWISE. CONTROLS WITH RESTRICTED ACCESS SHALL BE MOUNTED 60" A.F.F., REFERENCE ARCHITECTURAL PLANS FOR EXACT MOUNTING HEIGHTS OR CONFIRM WITH OWNER.
11. MAINTAIN MIN. CLEARANCES IN FRONT OF ALL CONTROL AND ELECTRIC PANELS ON EQUIPMENT SUCH AS FANS, AIR TERMINAL UNITS, ETC. IN ACCORDANCE WITH THE FOLLOWING: 120/208V = 36", 277/480V = 48". WHERE FACTORY MOUNTED PANELS DO NOT ALLOW ADEQUATE CLEARANCE, COORDINATE WITH ELECTRICAL CONTRACTOR TO RELOCATE & REMOUNT AS REQUIRED. ALL FACTORY WARRANTEES SHALL BE MAINTAINED.
12. MOUNT ALL INSTRUMENTS AND GAGES TO ALLOW OBSERVATION OF READINGS FROM THE FLOOR LEVEL.
13. BE AWARE OF UNDERGROUND UTILITIES IN THE AREA.
14. PROVIDE VALVE HANDLE EXTENSIONS AS REQUIRED TO ACCOMMODATE INSULATION. VALVE HANDLE ACTUATION SHALL NOT DISTURB INSULATION.
15. BOTH THE SUBCONTRACTOR FOREMAN AND PRIME CONTRACTOR FOREMAN SHALL VISUALLY INSPECT THE QUALITY & COMPLETENESS OF INSTALLATION PRIOR TO REQUESTING A FIELD OBSERVATION BY THE ENGINEER. PROVIDE A MIN. OF 24 HOUR WRITTEN NOTICE TO THE ENGINEER PRIOR TO ANY FIELD OBSERVATION REQUIREMENTS.
16. COORDINATE THE INSTALLATION OF DUCTWORK & CEILING DIFFUSERS WITH THE STRUCTURE, LIGHTS, & CEILING GRID. WHERE THE ALTERATION OF DUCT SIZES ARE NECESSARY, MAINTAIN CROSS-SECTIONAL FREE AIR AREAS. IF RATIO OF LARGE/SMALL DUCT DIMENSIONS INCREASES BY 50% OR MORE, OBTAIN ENGINEER'S APPROVAL BEFORE FABRICATION.
17. INSTALL EQUIPMENT TO MINIMIZE SOUND OR NOISE TRANSMISSION TO OCCUPIED SPACES.
18. ALL EQUIPMENT, FIXTURES, PIPING, AND DUCTWORK SHALL BE INSTALLED PARALLEL TO BUILDING LINES U.O.N.
19. ALL VALVE & DAMPER ACTUATORS AND INSTRUMENT SETTING DEVICES SHALL BE INSTALLED TO ALLOW ADJUSTMENT WHILE VISIBLE TO THE PERSON MAKING ADJUSTMENTS.
20. SCHEDULING SHALL BE CLOSELY COORDINATED WITH THE OWNER, & NO WORK SHALL PROCEED WITHOUT AN OWNER APPROVED SCHEDULE. WORK SHALL BE DONE SO AS TO MINIMIZE DISRUPTIONS TO BLDG. ACTIVITIES. SCHEDULE ALL SHUTDOWNS AT LEAST 48 HOURS IN ADVANCE WITH OWNER IN WRITING. REFER TO SPECIFICATIONS FOR AREAS REQUIRING SPECIAL ACCESS, SCHEDULING, AND/OR SECURITY.
21. CONTRACTOR SHALL COORDINATE WITH OTHER TRADES. CONFLICTS SHALL BE BROUGHT TO THE ATTENTION OF THE PRIME CONTRACTOR, ARCHITECT/ENGINEER AND AS NECESSARY, THE OWNER.
22. TEST, ADJUST AND BALANCE HVAC SYSTEMS AFTER INSTALLATION.
23. TURN OVER ALL EQUIPMENT & MATERIAL, OPERATING AND MAINTENANCE (O&M) MANUALS TO OWNER WITHIN 30 DAYS AFTER INSTALLATION IS COMPLETE.
24. KEEP DUCTWORK AND PIPING INTERIORS CLEAN AND FREE OF DEBRIS THROUGHOUT THE PROJECT. CAP ALL PIPING & DUCTWORK EXPOSED TO THE ELEMENTS DURING THE DURATION OF CONSTRUCTION.
25. EQUIPMENT OR MATERIAL SUBSTITUTED AS APPROVED EQUAL TO THAT SHOWN ON THE PLANS & SPECIFICATIONS SHALL BE COMPATIBLE IN EVERY RESPECT. ANY CHANGES OR MODIFICATIONS REQUIRED TO ACCOMMODATE THE SUBSTITUTE ITEMS SHALL BE MADE BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.
26. IMPORTANT: ALL HVAC AIR DUCT DIMENSIONS ARE INSIDE FREE AIR DIMENSIONS. ALL DUCTWORK SHALL BE INSTALLED IN ACCORDANCE WITH THE STANDARDS DESCRIBED IN THE LATEST EDITION OF ASHRAE, SMACNA, & LOCAL CODES.
27. ALL EXTERNAL INSULATION SHALL BE A MIN. OF 2" THICK UNLESS OTHERWISE NOTED. REFERENCE DIV. 23 SPECIFICATIONS FOR DENSITY, VAPOR BARRIER, SEALANT AND OTHER REQUIREMENTS. INSULATION MUST MEET OR EXCEED CURRENT APPLICABLE ENERGY CODE REQUIREMENTS.
28. USE TURNING VANES AT TEES AND ELBOWS AS REQUIRED. PROVIDE VOLUME DAMPERS ON ALL RETURN AIR & OUTSIDE AIR DUCTS TO THE UNIT. PROVIDED THERE IS ADEQUATE SPACE, SUPPLY AIR MAY USE A 1.5 TIMES RADIUS ELBOW IN LIEU OF TURNING VANES.
29. FIELD VERIFY ALL DIMENSIONS AND CONDITIONS IN THE FIELD. VERIFY AT JOB SITE EXACT LOCATION OF STRUCTURAL MEMBRANE & FIREWALL LOCATION. PROVIDE FIREPROOFING AND INSTALL FIRE/SMOKE DAMPERS AS REQUIRED.
30. ALL AHU'S SHALL SHUT DOWN WHEN A FIRE IS DETECTED. SYSTEMS WITH 2000 CFM OR GREATER SUPPLY AIR (BASED ON SUM OF ALL UNITS SERVING A COMMON SPACE OR SHARING ANY SUPPLY OR RETURN DUCTS) SHALL HAVE SMOKE DETECTORS IN THE SUPPLY DUCT(S) PER NFPA 72. COORDINATE ALL REQUIREMENTS WITH THE FIRE ALARM CONTRACTOR AS REQUIRED.
31. WHERE EXISTING SPRAY-APPLIED FIRE RESISTIVE MATERIAL (SFRM) ON BUILDING STRUCTURE IS DISTURBED TO RECEIVE HANGERS, FASTENERS, ETC. UNDER THE PROJECT, PATCH WITH APPROVED LISTED HAND-APPLIED PATCH PRODUCT TO MAINTAIN FIRE RESISTIVE RATING.
32. VERIFY THE EXACT LOCATION OF ALL STRUCTURAL MEMBERS AT THE JOB SITE, TO LOCATE EQUIPMENT AND DUCTWORK. VERIFY THE LOCATION OF OUTDOOR EQUIPMENT AS REQUIRED. MAINTAIN CLEARANCE AS REQUIRED FOR ROUTINE MAINTENANCE & EQUIPMENT CHANGE OUT.
33. MECHANICAL CONTRACTOR SHALL FURNISH AND INSTALL FIRE/SMOKE DAMPER(S) AS INDICATED. THE FIRE ALARM CONTRACTOR SHALL CONNECT THE DAMPER TO THE FIRE ALARM SYSTEM. THE FIRE ALARM CONTRACTOR SHALL FURNISH THE DUCT MOUNTED SMOKE DETECTOR, THE MECHANICAL CONTRACTOR SHALL INSTALL THE DUCT MOUNTED SMOKE DETECTOR & THE FIRE ALARM CONTRACTOR SHALL CONNECT THE DETECTOR TO THE FIRE ALARM SYSTEM. ALL ELECTRICAL POWER WIRING TO BE INSTALLED BY ELECTRICAL CONTRACTOR.
34. ALL CABLING ABOVE CEILINGS (CONTROLS, DATA, SPECIAL SYSTEMS) SHALL BE SUPPORTED WITH ACCEPTABLE DEVICES SUCH AS J-HOOKS OR BRACES TO PREVENT LOOSE WIRING FROM FALLING ON THE CEILING GRID.
35. UNLESS OTHERWISE NOTED, INTERNALLY LINE TEN FEET OF ALL DUCTWORK TO/FROM AHU's W/ 1" THICK ANTIMICROBIAL COATED MINERAL FIBER OR APPROVED EQUAL MATERIAL. USE LINER THAT IS EROSION AND MOLD RESISTANT, AS SPECIFIED. DUCT LINER TO MEET THE FOLLOWING MINIMUM STANDARDS: ASTM C1071, NFPA 90A, NFPA 90B, GREENGUARD CHILDREN AND SCHOOLS.

GENERAL DEMOLITION NOTES

1. FIELD VERIFY ALL EXISTING CONDITIONS, INCLUDING EQUIPMENT AND UTILITY SERVICE LOCATIONS, PRIOR TO START OF ANY WORK. VISIT JOB SITE PRIOR TO BIDDING TO VERIFY EXISTING CONDITIONS. NOTIFY GC AND ENGINEER IMMEDIATELY IF ANY DISCREPANCIES ARE FOUND.
2. PERFORM ALL WORK AND DISPOSAL/RECYCLING IN COMPLIANCE WITH APPLICABLE FEDERAL, STATE, AND LOCAL LAWS, CODES, AND ORDINANCES.
3. KEEP THE CONSTRUCTION AREA CLEAN AT ALL TIMES. RESTORE ANY WORK SPACE TO WIPED-CLEAN STATUS BEFORE SCHEDULED OCCUPANCY BY OWNER.
4. COORDINATE WITH APPROPRIATE TRADES TO DISCONNECT RELATED SERVICES BEFORE DEMOLITION OF ANY ITEM. CLOSE AND TAG OUT WATER AND GAS VALVES. TAG AND LOCK OUT ELECTRICAL POWER. DISABLE AND DOCUMENT STATUS OF FIRE ALARM, SECURITY, AND CONTROL POINTS.
5. WHERE PIPING OR CONDUIT IS REMOVED, REMOVE ALL ANCILLARY SUPPORTS, VALVES, DEVICES AND CONNECTORS NOT TO BE REUSED.
6. OPENINGS IN WALLS, CEILINGS, FLOORS, AND ROOFS WHERE PENETRATING DUCTS, PIPES, ETC. ARE REMOVED BUT NOT REPLACED IN KIND, SHALL BE SHORED AND PATCHED WITH LIKE MATERIALS AND FINISH TO THE SURROUNDING SURFACE.
7. CAP & SEAL ANY PIPES LEFT OPEN-ENDED BY DEMOLITION.
8. REFERENCE HAZARDOUS MATERIAL ABATEMENT SPECIFICATIONS FOR IDENTIFICATION OF HAZARDOUS MATERIALS IN THE PROJECT AREA AND INSTRUCTIONS FOR SCOPE INVOLVED THEREWITH. DO NOT PROCEED WITH ANY WORK THAT MAY DISTURB ASBESTOS OR OTHER IDENTIFIED HAZARDOUS MATERIALS UNTIL ANY REQUIRED ABATEMENT HAS BEEN COMPLETED.

SCOPE DIRECTIVES GENERAL DEFINITIONS

1. "FURNISH" MEANS GENERALLY ONLY TO PURCHASE AND DELIVER A SPECIFIED ITEM TO ANOTHER ENTITY FOR FURTHER INSTALLATION.
2. "INSTALL" MEANS GENERALLY ONLY TO RECEIVE AN ITEM PURCHASED BY OTHERS AND INSTALL AS SPECIFIED.
3. "INSTALL," WHERE USED WITH AND IN CONTRAST TO "CONNECT," GENERALLY MEANS TO PHYSICALLY INSTALL A SPECIFIED ITEM (E.G. IN DUCTWORK OR PIPING), WITH CONNECTION OF SPECIFIED ANCILLARY UTILITIES (E.G. POWER, CONTROLS, ETC.) BY OTHERS.
4. "CONNECT," WHERE USED WITH AND IN CONTRAST TO "INSTALL," GENERALLY MEANS TO TERMINATE SPECIFIED ANCILLARY UTILITIES (E.G. POWER, CONTROLS, ETC.) TO AN ITEM PURCHASED AND PHYSICALLY INSTALLED BY A SEPARATE ENTITY OR ENTITIES.
5. "PROVIDE" MEANS GENERALLY TURNKEY FURNISHMENT AND INSTALLATION OF A SPECIFIED ITEM, PLUS ALL ANCILLARY CONNECTIONS AS REQUIRED.
6. WHERE THE DOCUMENTS DIRECT TO "COORDINATE" WORK WITH ANOTHER TRADE OR PARTY, THE CURRENT TRADE IS NOT NECESSARILY RESPONSIBLE FOR INITIATING SUCH WORK, BUT IS RESPONSIBLE FOR CONFIRMING AND ADVISING OF CROSS-TRADE DIMENSIONAL, CLEARANCE, ROUGH-IN, ELECTRICAL, SUPPORT, ET AL REQUIREMENTS OF SAID WORK PRIOR TO START IN ORDER TO AVOID CONFLICTS IN THE FIELD.
7. WHERE THE DOCUMENTS DIRECT TO "ENGAGE" ANOTHER TRADE OR PARTY FOR A GIVEN SCOPE OF WORK, THE CURRENT TRADE IS GENERALLY RESPONSIBLE FOR INITIATING AND ENSURING COMPLETION OF SAID WORK, EVEN IF NOT DIRECTLY PERFORMING IT, UNLESS OTHERWISE ARRANGED WITH THE GC/PRIME.
8. WHERE WORK IS NOTED TO BE "BY OTHERS", "BY GC/PRIME CONTRACTOR", OR "BY DIV-X/X CONTRACTOR" (WHERE 'X' IS SOME SEPARATE TRADE), SAID WORK IS SO NOTED FOR COORDINATION PURPOSES AND TO ALERT THE PRIME CONTRACTOR THERETO. SAID WORK MAY OR MAY NOT BE FURTHER DEFINED ELSEWHERE IN THE DOCUMENTS. UNLESS SAID WORK IS SPECIFICALLY NOTED TO BE "NOT IN CONTRACT (N.I.C.)", "UNDER SEPARATE CONTRACT" OR "BY OWNER", THE PRIME CONTRACTOR IS ULTIMATELY RESPONSIBLE FOR ASSIGNING AND COMPLETING THE WORK PER APPLICABLE CODES, THE PLANS AND SPECIFICATIONS, AND INDUSTRY STANDARDS ACCORDING TO THEIR OWN MEANS AND METHODS.

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MECHANICAL GENERAL NOTES AND LEGENDS

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Job No:	T2414
Drawn by:	TO
Checked by:	TS/SK/EB
Sheet No.	M1.1
Date:	APRIL 2025

SPLIT-DX INDOOR FAN COIL UNIT (FCU) SCHEDULE

UNIT MARK	TYPE	LOCATION	SUPPLY CFM	OA	SUPPLY FAN E.S.P. "WG	SUPPLY FAN HP (QTY)	DX COOLING COIL CAPACITY (MBH) TOTAL	DX COOLING COIL CAPACITY (MBH) SENS	E.D.B. (°F)	E.W.B. (°F)	L.D.B. (°F)	L.W.B. (°F)	HEAT PUMP PERFORMANCE HEATING AT 47/17 F OUTDOOR (°F)	HEAT PUMP PERFORMANCE MBH @47°F / COP	HEAT PUMP PERFORMANCE MBH @17°F / COP	AUX ELEC. HTG KW	SINGLE PT. ELECTRICAL VAC / PH	MCA	MOCP	APPROX. WEIGHT (LBs)	BASIS OF DESIGN MODEL (MFGR: TRANE)	FOOT NOTES
FCU-1 (FOREMAN OFFICES, LOCKER ROOM AND RESTROOM)	CONCEILED DUCT	ABOVE OFFICE CEILING	875	209	0.6, SELECTABLE	121 W	30	21	79.8	68.0	57.6	57.5	70 / 70	34 / 3.3	18 / 2.6	-	POWERED BY OUTDOOR			67	PEAD-AA30NL	3, 4, 6
FCU-2-1 (WORKSHOP AREA)	HORIZONTAL	ABOVE OFFICE CEILING	535	535	1.00	278 BHP (1)	37	28	104.0	75.0	55.5	54.6	NA	NA	NA	DUCT MOUNTED	240/60/1	5.3	15	150	BCHE024	1,2,5,6,7,8
FCU-2-2 (WORKSHOP AREA)	HORIZONTAL	ABOVE OFFICE CEILING	535	535	1.00	278 BHP (1)	37	28	104.0	75.0	55.5	54.6	NA	NA	NA	DUCT MOUNTED	240/60/1	5.3	15	150	BCHE024	1,2,5,6,7,8
FCU-3 (BREAK ROOM, MECH OFFICE)	CONCEILED DUCT	ABOVE OFFICE CEILING	875	209	0.6, SELECTABLE	121 W	30	21	79.8	68.0	57.6	57.5	70 / 70	34	18 / 2.6	-	POWERED BY OUTDOOR			67	PEAD-AA30NL	3, 4, 6

FCU SCHEDULE GENERAL NOTES

G1 PROVIDE ITEM SCHEDULED (BASIS OF DESIGN TRANE) OR APPROVED EQUAL BY LENNOX, CARRIER OR LG. EQUIPMENT SUBMITTED AS APPROVED EQUAL VARIANTS TO THE BASIS OF DESIGN SHALL BE EQUAL IN ALL RESPECTS. ALL STRUCTURAL, ELECTRICAL, PIPING, DUCTWORK, CONTROLS, AND ARCHITECTURAL MODIFICATIONS REQUIRED TO ACCOMMODATE SAID VARIANTS SHALL BE INCLUDED IN THE PRIME CONTRACTOR'S BID PRICE.
G2 SYSTEM EFFICIENCY TO MEET OR EXCEED AS NOTED ON CONDENSING UNIT SCHEDULE.
G3 PROVIDE 5-YEAR EXTENDED WARRANTY ON ENTIRE UNIT (PARTS, LABOR, & REFRIGERANT) FROM THE DATE OF PROJECT SUBSTANTIAL COMPLETION.
G4 PROVIDE WITH TXV AND ALL REQUIRED REFRIGERANT ACCESSORIES. REFRIGERANT LINE SIZING AND OIL RETURN TRAPS AS PER MANUFACTURER'S INSTRUCTIONS.
G5 COPPER TUBE COILS WITH ALUMINUM FINS. MAXIMUM 450 FPM COOLING COIL FACE VELOCITY.
G6 THIS NOTE NOT USED.
G7 INDOOR FAN FOR UNITS LESS THAN 6 TONS SHALL HAVE DIRECT DRIVE EC MOTOR.
G8 A DETAILED SHOP DRAWING DEMONSTRATING MAINTENANCE CLEARANCES TO BE APPROVED BY THE ENGINEER PRIOR TO INSTALLATION.
G9 PROVIDE W/ 2" MERV13 EZ FILTER BASE. (TWO SETS, ONE FOR CONSTRUCTION PHASE AND ONE AT JOB ACCEPTANCE BY OWNER)
G10 INDOOR SUMMER CONDITIONS: 74 F DB / 55% RH, INDOOR WINTER CONDITIONS: 69 F DB - UNLESS INDICATED OTHERWISE.
G11 PROVIDE WITH ACCESS PANELS FOR ALL ACCESS, FAN AND FILTER SECTIONS.

FCU SCHEDULE FOOTNOTES

1 SINGLE POINT ELECTRICAL CONNECTION FOR FAN AND HEAT. UNIT SHALL HAVE INTERNAL FLOW SWITCH SAFETY FOR HEAT ELEMENT ENERGIZATION GIVEN REMOTE ENABLE SIGNAL.
2 PROVIDE DUCT MOUNTED ELECTRIC HEATER
3 PROVIDE STAINLESS STEEL DRAIN PAN AND DRAIN PAN OVERFLOW SWITCH.
4 PROVIDE CONDENSATE DRAIN PUMP.
5 UNIT TO HAVE ONBOARD CONTROLLER WITH TOUCHSCREEN EQUAL TO TRANE SYMBIO 600 THAT WILL CONTROL FAN (START-STOP AND STATUS), COOLING STAGES, HEATER STAGES, SPACE TEMPERATURE AND HUMIDITY, MODULATING HOT GAS REHEAT VALVES, WITH REFRIGERANT TEMPERATURE SENSORS AND A2L REFRIGERANT MITIGATION SEQUANCE THAT MONITORS REFRIGERANT SENSORS AND UPON ALARM, STOPS HEAT AND COMPRESSORS AND ENGAGES FAN FOR 5 MINUTES BEFORE RESETTING TO NORMAL MOFE. ONBOARD CONTROLLER SHALL HAVE TOD CONTROLS. SPACE TEMPERATURE SENSOR SHALL HAVE A THUMBWHEEL FOR ADJUSTMENT.
6 PROVIDE PROGRAMMABLE THERMOSTAT SYSTEM.
7 PROVIDE MODULATING HOT GAS REHEAT SYSTEM.
8 PROVIDE ALL NECESSARY FACTORY ADAPTER BOARDS AND CONTROLLERS TO ENABLE UNIT TO CONTROL OUTSIDE AIR DAMPER, HOT GAS REHEAT, FREEEZSTAT, AND CONDENSOR STAGING.

AIR DEVICE SCHEDULE (FOR REFERENCE ONLY)

MARK	TYPE	MATERIAL	MOUNTING	SERVICE	MAKE, SERIES	NOTES
S1	CEILING DIFFUSER	STEEL	LAY-IN or surf.	SUPPLY	TITUS TMS	
S2	SUPPLY GRILL	ALUMINUM	DUCT	SUPPLY	TITUS 272FL	1,2,b
S4	CEILING DIFFUSER	ALUMINUM	DUCT	SUPPLY	TITUS TMS-AA	1,3
S10	DOUBLE DEFLECTION	STEEL	FLUSH, CEILING	SUPPLY	TITUS 272 RL	a,b
R1	CEILING GRILLE	ALUMINUM OR STEEL	LAY-IN	RETURN/TRANSFER	TITUS 50F	
R3	30 DEG DEFLECTION	STEEL	FLUSH, CEILING	RETURN	TITUS 23 RS	a,c
R4	SIDEWALL GRILL	STEEL	DUCT	RETURN	TITUS 25RL	1,2
E1	CEILING GRILLE	ALUMINUM OR STEEL	LAY-IN	EXHAUST	TITUS 50FF	
E2	CEILING GRILLE	ALUMINUM OR STEEL	LAY-IN OR SURF.	EXHAUST	TITUS 50F	

GENERAL NOTES FOR AIR DEVICES:

G1 DEVICE SHALL BE AS SCHEDULED, OR APPROVED EQUAL BY TITUS, METAL*AIRE, OR PRICE.
G2 SEE DRAWINGS FOR QUANITIES AND APPROXIMATE LOCATIONS.
G3 FOR GRILLES WITH NO MARK ON DRAWING, SUBMIT THE OBVIOUS TYPE OR OBTAIN CLARIFICATION.
G4 REFER TO ARCHITECTURAL DRAWINGS OR SCHEDULES TO DETERMINE TYPE OF CEILING. PROVIDE APPROPRIATE TRIM. FOR EXAMPLES, TITUS TYPE 1 FOR SURFACE, TYPE 3 FOR LAY-IN.
G5 UNLESS OTHERWISE NOTED, SELECT DEVICES FOR NC<30 AND FOR NECK VELOCITY < 700 FPM.
G6 SIZE DEVICE FACES AS INDICATED ON DRAWINGS. WHERE FEASIBLE, PROVIDE 24" X 24" FACE PANELS FOR LAY-IN CEILINGS. MODIFY T-BAR CEILING GRID WHERE REQUIRED.
G7 PROVIDE FINISH AS NOTED, OR AS SELECTED BY ARCHITECT FROM AMONG MANUFACTURER'S STANDARD PAINT FINISHES.

NUMBERED NOTES FOR AIR DEVICES:

1 PROVIDE W/ OPPOSED BLADE DAMPER (OBD) ADJUSTABLE THRU FACE.
2 PROVIDE ADJUSTABLE ACCESSORIES FOR INSTALLATION IN EXPOSED ROUND DUCT.
3 ALL-ALUMINUM CONSTRUCTION, WHITE PAINT FINISH.
4 HORIZONTAL FACE BLADES OR BARS.
T1 VAV DIFFUSER WITH INTEGRAL THERMOSTATIC FLOW RATE CONTROL, PLUS AUTOMATIC HEAT-COOL CHANGE-OVER BASED ON SUPPLY AIR TEMPERATURE.
T2 BALANCE AHU & DIFFUSER WITH DIFFUSER SET FOR MAX. COOLING AIRFLOW. SET MINIMUM AIRFLOW IF ONE IS SHOWN ON DRAWING.
a PAINTED STEEL, FLUSH FRAME, RIGID CONSTRUCITON, 3/4" BAR SPACING.
b DOUBLE DEFLECTION WITH LONG FACE BARS.
c FIXED 30 DEG DEFLECTION WITH SHORT FACE BARS.
d WHITE PAINTED ALUMINUM, ZERO DEGREE DEFLECTION WITH SHORT FACE BARS, RIGID CONSTRUCTION, 3/4" BAR SPACING.

SPLIT-DX CONDENSING UNIT (CU) AND HEAT PUMP (HP) SCHEDULE

MARK	MIN. STAGES	REFRIG'T	VAC/PH/HZ	MCA	MOCP	BASIS OF DESIGN (MFGR: TRANE)	MIN. (AHRI) SEER / EER	FOOT-NOTES
HPCU-1	MODULATING	R-454B	230 / 1/ 60	22	35	PUZ-A30NHA7	18.2 SEER2, 9.9 EER2	1,2,4,5
HPCU-3	MODULATING	R-454B	230 / 1/ 60	22	35	PUZ-A30NHA7	18.2 SEER2, 9.9 EER2	1,2,4,5
CU-2-1	1	R-454B	230 / 1/ 60	23	35	5TTR5048A	4.0 ISMRE	2,3,5
CU-2-2	1	R-454B	230 / 1/ 60	23	35	5TTR5048A	4.0 ISMRE	2,3,5

SCHEDULE GENERAL NOTES

G1 PROVIDE ITEM SCHEDULED OR APPROVED EQUAL BY CARRIER, LG, OR LENNOX. EQUIPMENT SUBMITTED AS APPROVED EQUAL VARIANTS TO THE BASIS OF DESIGN SHALL BE EQUAL IN ALL RESPECTS. ALL STRUCTURAL, ELECTRICAL, PIPING, DUCTWORK, CONTROLS, AND ARCHITECTURAL MODIFICATIONS REQUIRED TO ACCOMODATE SAID VARIANTS SHALL BE INCLUDED IN THE PRIME CONTRACTOR'S BID PRICE.
G2 ALL COMPRESSOR MOTORS SHALL BE INTERNALLY ISOLATED.
G3 PROVIDE 5-YEAR COMPREHENSIVE WARRANTY ON ENTIRE UNIT (PARTS, LABOR, & REFRIGERANT) FROM THE DATE OF SUBSTANTIAL COMPLETION.
G4 PROVIDE WITH LOW AMBIENT HEAD PRESSURE CONTROL TO 0F TIME DELAY RELAY, ANTI-SHORT CIRCUIT TIMER AND INSTALL ON NEOPRENE ISOLATORS.
G5 ALL REFRIGERANT PIPE SIZING, REFRIGERANT SPECIALTIES AND ROUTING IN ACCORDANCE WITH MFG APPROVED PROCEDURES.
G6 ENSURE MIN. REQUIRED MAINTENANCE AND AIRFLOW CLEARANCE RECOMMENDED BY MFG.
G7 EER AND SEER RATING IS FOR THE SYSTEM, MEANING INDOOR AND OUTDOOR UNIT.

SCHEDULE FOOT NOTES

1 PROVIDE UNIT WITH SCROLL COMPRESSOR UNLESS OTHERWISE NOTED.
2 PROVIDE WITH TERMINAL BLOCK ACCESSORY AS REQUIRED TO ACCEPT REMOTE FAN AND COMPRESSOR COMMANDS.
3 PROVIDE WITH MODULATING HOT GAS REHEAT.
4 INDOOR FAN SHALL NOT OPERATE WHILE IN DEFROST MODE.
5 PROVIDE UNIT WITH LOUVERED HAIL GUARDS PAINTED TO MATCH THE UNIT (WIRE GUARDS ARE NOT ACCEPTABLE).

INTAKE AND EXHAUST LOUVER SCHEDULE

MARK	LOCATION	CAPACITY UPTO (CFM)	WIDTH (in.)	HEIGHT (in.)	MANUFACTURER MODEL	MOUNT / FLOW	NOTES
L-1	SEE PLANS	535	22	18	RUSKIN ELF211D	WALL INTAKE	1,2,3,4,5,6
L-2	SEE PLANS	1,070	26	18	RUSKIN ELF211D	WALL EXHAUST	1,2,3,4,5,6
L-3	SEE PLANS	200	22	18	RUSKIN ELF211D	WALL EXHAUST	1,2,3,4,5,6
L-4	SEE PLANS	150	16	12	RUSKIN ELF151J	WALL EXHAUST	1,2,3,4,5,6

LOUVER NOTES:

1. PROVIDE MODEL SCHEDULED OR APPROVED EQUAL
2. MAXIMUM RAIN PENETRATION SHALL BE 0.01 OZ/FT^2 AT 803 FPM. LOUVER TO BE SELECTED AT MAX VELOCITY OF 550 FPM.
3. DOUBLE DRAINABLE TYPE WITH ALUMINUM INSECT SCREEN.
4. PROVIDE WITH ALL REQUIRED STRUCTURAL SUPPORTS.
5. REFERENCE PLANS FOR QUANTITY.
6. COORDINATE EXACT LOCATION AND FINISH WITH GC AND A/E. FOR BIDDING PURPOSES ASSUME BRONZE ANODIZED FINISH.

EXHAUST FAN SCHEDULE

FAN #	SERVES	TYPE	MOUNT	DISCHARGE	DRIVE	MAKE	MODEL	CFM	S.P. / W.P.	MAX FAN RPM	MOTOR MAX HP	MOTOR MAX RPM	MOTOR VOLT	MOTOR PH	MAX SONES	MAX WEIGHT	SWITCHING	FOOT-NOTES
E-R	RESTROOM	BATHROOM CEILING	CEILING	6"	DIRECT	GREENHECK	SP-A50-90-VG	70	0.5	838	<.01	838	120	1	2	12	WALL SWITCH, INTERLOCKED WITH LIGHTING	2,3,4
E-L	LOCKER ROOM	BATHROOM CEILING	CEILING	6"	DIRECT	GREENHECK	SP-A50-90-VG	70	0.5	838	<.01	838	120	1	2	12	WALL SWITCH, INTERLOCKED WITH LIGHTING	2,3,4
E-1	SHOP EXHAUST	INLINE	SUSPENDED	OUTDOOR	DIRECT	GREENHECK	SQ-100-VG	1070	0.3	1460	0.14	1460	120	1	7	-	INTERLOCKED WITH FCU-2-1,FCU-2-2	2,3,4
E-2	WAREHOUSE EXHAUST	INLINE	SUSPENDED	OUTDOOR	DIRECT	GREENHECK	SQ-80-VG	200	0.3	1288	0.03	1460	120	1	4.7	-	ON TIME SWITCH CORRESPONDING WITH OCCUPANCY	2,3,4

SCHEDULE GENERAL NOTES

G1 APPROVED EQUAL BY GREENHECK OR PENN.
G2 PREMIUM EFFICIENCY MOTORS WITH INTEGRAL THERMAL OVERLOAD PROTECTION.
G3 PROVIDE ALUMINUM BIRD-INSECT SCREENS. MIN. 70% FREE AREA. DL
G4 PROVIDE FACTORY-MOUNTED NEMA3R DISCONNECTS, PREWIRED TO MOTOR.
G5 PROVIDE STANDARD VIBRATION ISOLATION MOUNTS.

SCHEDULE FOOT NOTES

1 PROVIDE FULLY WELDED 18" GALV. STEEL ROOF CURB WITH DAMPER TRAY AND BACKDRAFT DAMPER PER IECC 2021.
2 PROVIDE WITH PREWIRED FAN SPEED CONTROLLER AT THE FAN.
3 PROVIDE BACKDRAFT DAMPER.
4 SEE PLANS FOR QUANTITIES AND LOCATIONS

ELECTRIC UNIT HEATER SCHEDULE

MARK	EUH-1	EUH-2	EUH-2	EUH-2
SERVES	FIRE RISER ROOM	SHOP AREA	SHOP AREA	SHOP AREA
KW	2	10	10	10
VOLTS/PHASE/HERTZ	120/1/60	240/1/60	240/1/60	240/1/60
WATTS	1440	10000	10000	10000
MCA	15	51.25	51.25	51.25
MANUFACTURER	KING	KING	KING	KING
MODEL NO.	KBP	SKB	SKB	SKB
NOTES	1	1	1	1

NOTES:

1. SHALL INCLUDE BUILT-IN THERMOSTAT, FUSED CONTROL CIRCUIT, AND WALL BRACKET.

ELECTRIC DUCT HEATER (EDH) SCHEDULE

MARK	SERVES	CFM	POSITION	CAPACITY (KW)	STAGES	VAC / PH	MCA	MOCP	BASIS OF DESIGN MODEL	NOTES
EDH-2-1	FCU-2-1	535	DUCT	11	SCR	240 / 1	57.3	60	TUTCO FLIP-ABLE SLIP-IN	ALL
EDH-2-2	FCU-2-2	535	DUCT	11	SCR	240 / 1	57.3	60	TUTCO FLIP-ABLE SLIP-IN	ALL

GENERAL NOTES FOR EDH SCHEDULE

G1 OR APPROVED EQUAL BY INDEECO OR NAILOR.
G2 ALL WORK PER NEC AND NFPA, MOUNT IN ACCORDANCE WITH MFGR. INSTRUCTIONS.
G3 FAN INTERLOCK PER U.L. AND NEC, SUPPLY WITH FLOW PROOF SWITCH, FUSED DISCONNECT AND ALL ACCESSORIES INCLUDING EMS INTERFACE.
G4 EDH ELECTRIC CIRCUITS SEPARATE FROM AHU FAN.
G5 DO NOT EXCEED HEATER AIR PRESSURE DROP OF 0.1" AT SCHEDULED CFM.
G6 HEATERS CONNECTED TO UNITS W/ VFD'S, ENSURE MINIMUM FLOW SETTING FOR PROPER HEATER OPERATIONS AND COORDINATE REQUIREMENTS WITH CONTROLS.
G7 PROVIDE WITH TEMPERATURE LIMIT SWITCH.
G8 REFER TO PLANS FOR DUCT WIDTH AND HEIGHT.
G9 PROVIDE 5-YEAR MANUFACTURER EXTENDED WARRANTY FROM THE DATE OF PROJECT SUBSTANTIAL COMPLETION.
G10 INCLUDE UNIT MOUNTING AND PROVIDE STRUCTURAL SUPPORT AS PER MANUFACTURE RECOMMENDATION.

FOOTNOTES FOR EDH SCHEDULE

1 PROVIDE WITH SCR CONTROLLER FOR FULL CAPACITY RANGE MODULATION.
2 CONTRACTOR TO VERIFY EXACT DUCT SIZE PRIOR TO ORDERING AND INSTALLATION .
3 DUCT HEATER TO HAVE SILICON CONTROLLED RECTIFIER (SCR), ENABLIING CONTROL STAGING FROM FAN COIL UNIT CONTROLLER.
4 PROVIDE INDOOR RATED CONTROL PANEL, WITH INTEGRAL FUSES AND FUSED DISCONNECT PER NEC.
5 PROVIDE: DISCONNECTING CONTACTORS, SCR CONTROL, MANUAL BACK UP LIMITS, POWER FUSING, AIRFLOW SWITCH, ANALOG CTs FOR AMP DRAW, CONTROL TRANSFORMER, MIN. 2" INSULATION, DISCONNECT SWITCH, STEP CONTROLLER, CONTROL PANEL.

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THOMAS PAUL ARTHUR OTTEN
91932
LICENSED
PROFESSIONAL ENGINEER
04/04/2025

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MECHANICAL SCHEDULES

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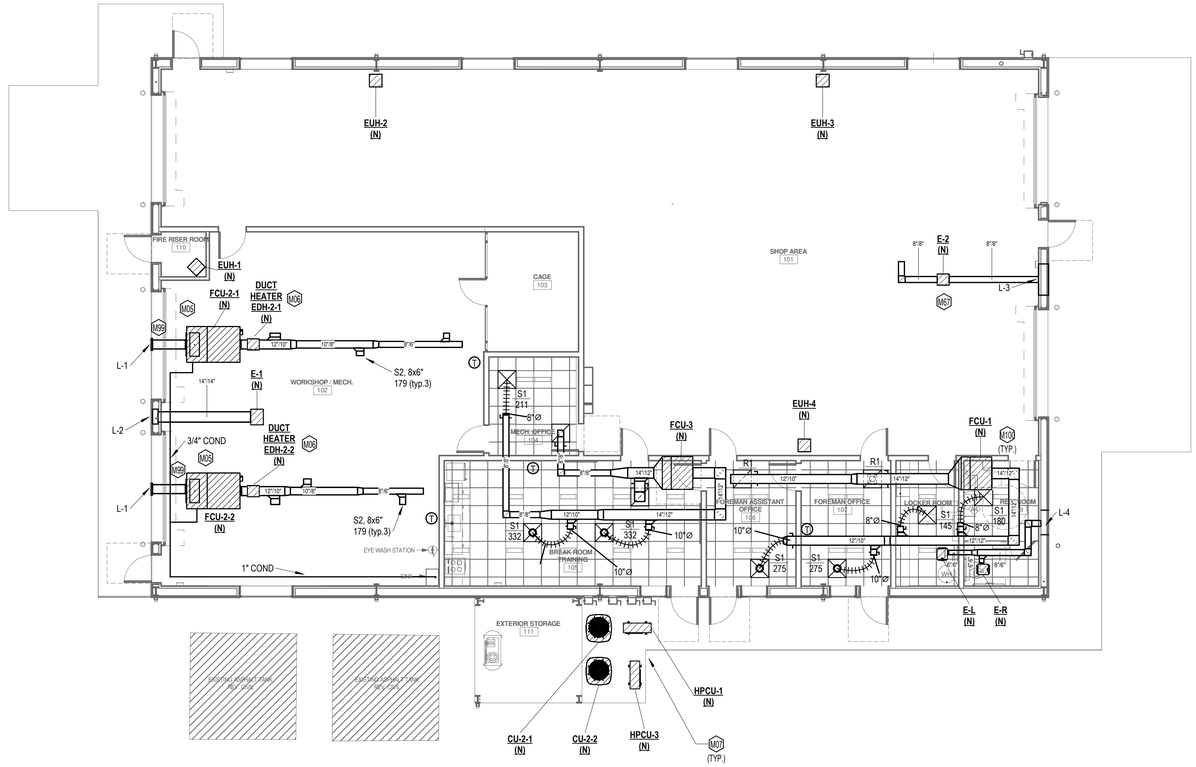

1 LVL01 HVAC NEW WORK PLAN
1/8" = 1'-0"

CONTRACTOR TO PRODUCE SHOP PLANS, INDICATING STRUCTURAL MODIFICATIONS REQUIRED FOR ALL MECHANICAL EQUIPMENT SUPPORTED BY ROOF, OR SUSPENDED FROM STRUCTURE. SHOP PLANS MUST BE PREPARED BY STRUCTURAL ENGINEER, SEE SPECIFICATIONS FOR FURTHER INFORMATION.

HVAC CONTROLS AND SEQUENCE OF OPERATION.

1. ALL FAN COIL UNITS OPERATE UNDER CONTROL OF REMOTE THERMOSTATS.
2. ALL FCU'S WILL OPERATE CONTINUOUSLY DURING OCCUPIED HOURS.

SHOP BUILDING

EXHAUST FAN E-1 WILL OPERATE SIMULTANEOUSLY WITH FCU-2-1 AND FCU-2-2..

EXHAUST FAN E-2 WILL OPERATE CONTINUOSLY DURING OCCUPIED HOURS.

GENERAL MECHANICAL NOTES

1. REFER TO SHEET M1.1 FOR GENERAL NOTES AND LEGENDS.
2. PERFORM ALL WORK IN ACCORDANCE WITH LOCAL CODES.
3. ALL PENETRATIONS OF THE ROOF SHALL BE SHIELDED AND SEALED IN COMPLIANCE WITH REQUIREMENTS OF THE ROOF MFGR AND OWNER'S ROOFING SPECIALIST.
4. FIRE SEAL ALL PENETRATIONS OF FIRE RATED CONSTRUCTION TO PRESERVE THE FIRE RATING. CONFIRM WALL RATINGS WITH OWNER. FOR BIDDING, ASSUME THAT CORRIDOR WALLS ARE RATED ONE HOUR.
5. TESTING, ADJUSTING, AND BALANCING (TAB) WORK FOR HVAC SYSTEMS WITHIN THE SCOPE OF WORK IS REQUIRED FOR PROJECT ACCEPTANCE. REFERENCE SPECIFICATIONS.
6. ALL DUCTWORK SHALL BE SHEET METAL CONSTRUCTED & SUPPORTED IN ACCORDANCE WITH THE LATEST EDITION OF SHEET METAL & AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION, INC. (SMACNA) STANDARD "HVAC DUCT CONSTRUCTION STANDARDS, METAL & FLEXIBLE".
7. DETAILED DIMENSIONED SHOP DRAWINGS SHALL BE PREPARED AND SUBMITTED (MANDATORY REQUIREMENT) BY CONTRACTOR FOR REVIEW AND APPROVAL BY ENGINEER AND OWNER.

MECHANICAL NEW WORK KEYED NOTES

M05 SUSPEND AIR HANDLING UNIT FROM ROOF STRUCTURE, WITH ADDITIONAL REINFORCING AND WEIGHT BEARING MEMBERS AS NECESSARY. LOCATE UNITS AS HIGH AS POSSIBLE, OUT OF THE WAY OF GARAGE DOORS AND OPENING EQUIPMENT. ROUTE 3/4" CONDENSATE DRAIN LINES TO WALL, AND DROP DOWN ALONG WALL, AND DISCHARGE OVER DRAIN SHOWN WITH 2" AIR GAP. SEE NOTE REGARDING SHOP PLAN REQUIREMENT FOR SUPPORTED AND SUSPENDED EQUIPMENT.

M06 INSTALL ELECTRIC DUCT HEATER A MIN. OF 2' FROM ELBOWS ON EITHER SIDE, AND AS PER MANUFACTURER'S INSTALLATION MANUAL.

M07 INSTALL NEW OUTDOOR CONDENSING UNIT/HEAT PUMPS AS SHOWN. CONSULT INSTALLATION MANUALS FOR CLEARANCES BETWEEN UNITS AND NEARBY WALLS. INSTALL NEW CONDENSOR PAD IN LOCATION APPROVED BY OWNER. LEVEL OF PAD TO BE APPROX. 4" ABOVE PAVEMENT. DO NOT ROUTE REFRIGERANT LINES BELOW GRADE. COORDINATE WITH HVAC UNIT MANUFACTURER'S INSTALLATION INSTRUCTIONS AND COORDINATE WITH OWNER.

M67 PROVIDE MIN. 4 FT DUCTING FOR EXHAUST FAN, INCLUDING AT LEAST ONE ELBOW FOR SOUND ATTENUATION PURPOSES. MOUNT DUCTING AS HIGH AS POSSIBLE, MINIMALLY AT SAME HEIGHT AS LOUVER, TRANSITIONING AS NECESSARY TO LOUVER. PROVIDE STRUCTURAL SUPPORT. BELOW ROOF PANEL AS PER SHOP PLANS BY STRUCTURAL ENGINEER. SEE NOTE REGARDING SHOP PLAN REQUIREMENT FOR SUPPORTED AND SUSPENDED EQUIPMENT.

M99 ROVIDE BACKDRAFT DAMPER IN OUTSIDE AIR DUCT, ONE FOR EACH UNIT IN DUCT BRANCH PRECEEDING UNIT NEAR LOUVER.

M100 SUSPEND AIR HANDLING UNIT FROM ROOF STRUCTURE, WITH ADDITIONAL REINFORCING AND WEIGHT BEARING MEMBERS AS NECESSARY. LOCATE UNIT ABOVE CEILING, CLOSE TO WALL TO ALLOW FOR EASY ACCESS WITH LADDER FROM SHOP TO CHANGE OUT FILTER. ROUTE 3/4" CONDENSATE DRAIN LINES TO WALL, AND DROP DOWN ALONG WALL, AND DISCHARGE OVER JANITOR'S SINK LOCKER ROOM WITH 2" AIR GAP. SEE NOTE REGARDING SHOP PLAN REQUIREMENT FOR SUPPORTED AND SUSPENDED EQUIPMENT.

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MECHANICAL FLOOR PLAN

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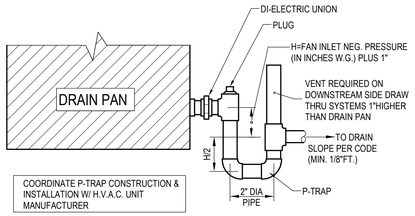
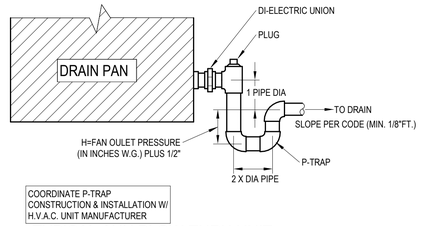
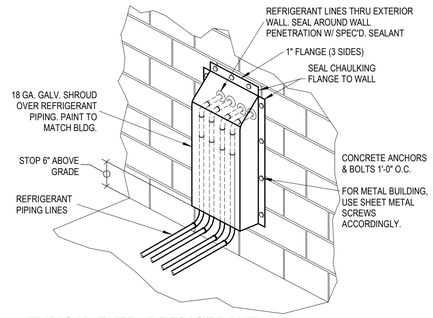


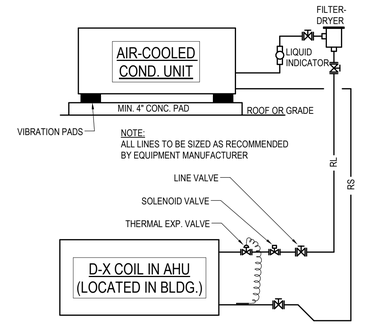
1 TYPICAL AHU DRAW THRU UNIT CONDENSATE DRAIN DETAIL



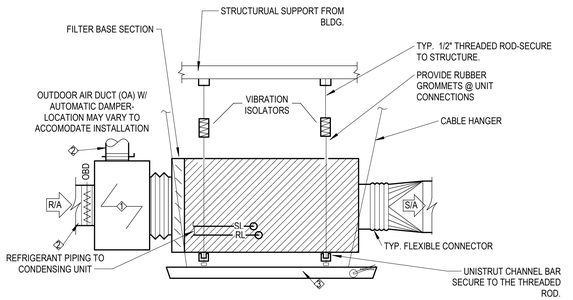
2 TYPICAL AHU BLOW THRU UNIT CONDENSATE DRAIN PIPING DETAIL



3 TYPICAL EXTR. REFRIGERANT PIPING AT WALL PENETRATION SHROUD DETAIL



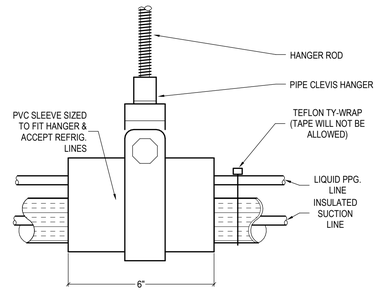
4 TYPICAL REFRIGERANT PIPING COMPONENT DIAGRAM DETAIL



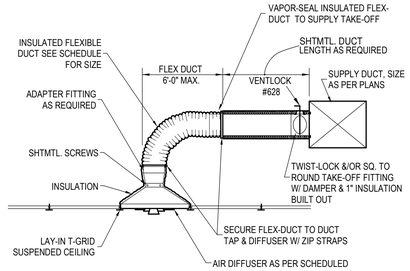
KEYED NOTES:

1. FIELD CONSTRUCTED (INSULATED) SHTMTL. MIXING PLENUM. SIZE TO ACCOMODATE ALL DUCT CONNECTIONS. REF: PLAN.
2. R/A & O/A DUCTING W/ AUTOMATIC BALANCING DAMPER PROVIDE QUAN. & SIZES AS PER PLAN. LOCATIONS ON MIXING PLENUM MAY VARY TO ACCOMODATE INSTALLATION.
3. PROVIDE 3" DEEP SECONDARY PAN UNDER COOLING COIL. EXTEND MIN. 2"< THAN COIL FOOTPRINT & PROVIDE W/ CONDENSATE SENSOR SHUT-OFF SWITCH.

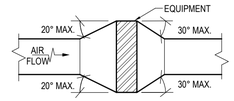
5 TYPICAL INLINE AHU INSTALLATION DETAIL



6 TYPICAL REFRIGERANT BLDG. STRUCTURE HUNG SUPPORT DETAIL



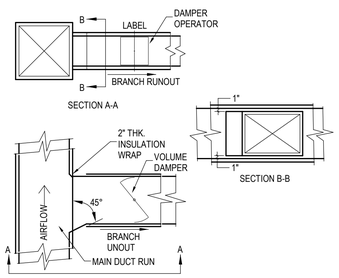
7 TYPICAL SUSPENDED TGRID DIFFUSER INSTALLATION DETAIL



NOTE:
UNLESS OTHERWISE INDICATED ON PLANS, MAXIMUM ANGLES SHOWN SHALL APPLY.

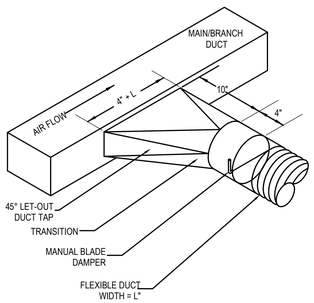
DESIGNER NOTES:
WHEN SPACE DOES NOT PERMIT ANGLES SHOWN ABOVE, DESIGNER SHOULD SHOW MAXIMUM ALLOWABLE ANGLE ON PLANS.

8 TYPICAL DUCTSIZE TRANSITION CONSTRUCTION DETAIL

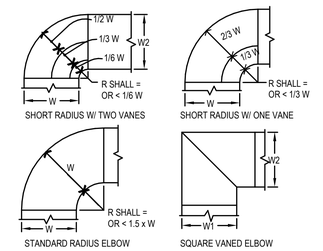


NOTE:
FOR EXTERNALLY INSULATED DUCT SUPPLY AIR DUCT APPLICATIONS SHOWN HERE. FOR RETURN OR EXHAUST DUCT APPLICATIONS DUCT CONFIGURATION SIMILAR EXCEPT AIR FLOW DIRECTION SHALL BE OPPOSITE SHOWN.

9 TAKEOFF RECTANGULAR TO RECTANGULAR DUCT DETAIL



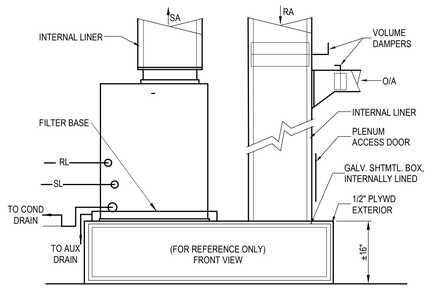
10 TYPICAL RECTANGULAR TO ROUND DUCT TAKEOFF INSTALLATION DETAIL



NOTE:

1. ALL ELBOWS SHALL BE CONSTRUCTED, SUPPORTED, FASTENED & VANED AS SPECIFIED) PER, LATEST EDITION OF "SMACNA".
2. THE INTERIOR SURFACE OF ALL RADIUS ELBOWS SHALL BE MADE ROUND, TO MATCH RADIUS OF ELBOW.
3. WHEN W-1 DOES NOT EQUAL W-2 VANE SHALL BE SINGLE VANE TYPE REGARDLESS OF "W" DIMENSION.
4. ALL SINGLE VANES SHALL HAVE A 2" RADIUS, 1-1/2" MAX. SPACE BETWEEN VANES & A 3/4" TRAILING EDGE.
5. WHEN W-1 EQUALS W-2 & W-1 IS GREATER THAN 20" VANES SHALL BE DOUBLE VANE TYPE.

11 TYPICAL RADIUS & MITERED DUCT ELBOW CONSTRUCTION DETAIL



NOTE:
PROVIDE ANGLE IRON BRACES @ 16" CENTERS AS REQ'D. FOR PLENUM BOX. LINE PLENUM BOX SUPPLY AIR & RETURN AIR DUCTS W/ 1/2" ACOUSTICAL INSULATION USING "STICK PINS" 18" ON & SEAL ALL JOINTS W/ FIRE RATED MASTIC. INSULATE ALL LIQUID LINES AS REQ'D.

12 TYPICAL DRAW THRU AHU INSTALLATION DETAIL

TEESI Engineering
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PRICINCT 2 ROAD AND BRIDGE FACILITY

BASTROP COUNTY
911 SE MARTIN LUTHER KING BLVD
SMITHVILLE TX, 78957

MECHANICAL DETAILS

SHEET TITLE:

REVISIONS:

NO.	DATE

Job No:	T2414
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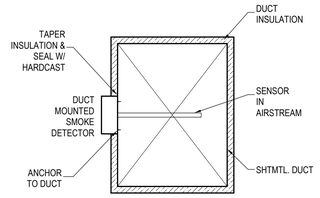
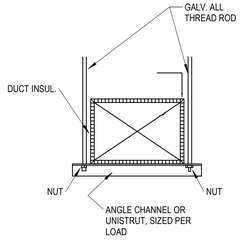
Checked by:	TS/SK/EB
Sheet No.	

M9.1

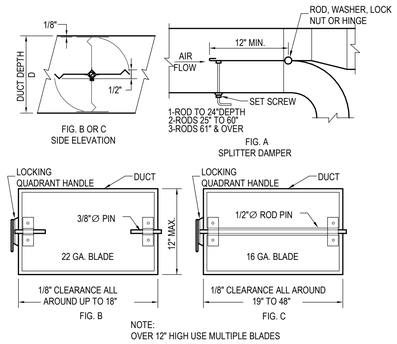
Date: APRIL 2025



1 TYPICAL DUCT MOUNTED SMOKE DETECTOR INSTALLATION DETAIL

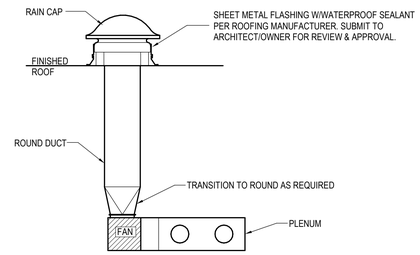


2 M-421 - TRAPEZE DUCT HANGER DETAIL



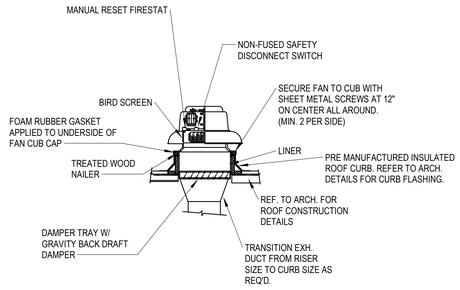
NOTE:
OVER 12" HIGH USE MULTIPLE BLADES

3 TYPICAL AIR VOLUME DAMPER DETAIL



NOTE:
CONTRACTOR TO VERIFY W/ ARCHITECT FOR ALL ROOF SLOPE & MATERIAL COMPOSITION MAKE-UP.

4 TYPICAL EXHAUST FAN DUCT THRU ROOF DETAIL
1/8" = 1'-0"



5 M-422 - ROOF MOUNTED UPBLAST EXHAUST FAN DETAIL
1 1/2" = 1'-0"

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STATE OF TEXAS
THOMAS PAUL ARTHUR OTTEN
91932
LICENSED
PROFESSIONAL ENGINEER
04/04/2025

PRICINCT 2 ROAD AND BRIDGE FACILITY
BASTROP COUNTY
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SMITHVILLE TX, 78957

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Job No:	T2414
Drawn by:	TO
Checked by:	TS/SK/EB
Sheet No.	

M9.2

Date: APRIL 2025

ELECTRICAL ABBREVIATIONS

--A		--I	
AFF	ABOVE FINISHED FLOOR	IN	INCHES
AFC	ABOVE FINISHED CEILING	IOM	INSTALLATION & OPERATION MANUAL
AFG	ABOVE FINISHED GRADE	--K	
AD	ACCESS DOOR	KVA	KILOVOLT-AMPS
AP	ACCESS PANEL	KW	KILOWATTS
A/C	AIR CONDITIONING	K	KILO
APPROX	APPROXIMATE	--L	
ACT	ACTUATOR		
ACCU	AIR COOLED CONDENSING UNIT	LBS	POUNDS
AHU	AIR HANDLING UNIT	LAN	LOCAL AREA NETWORK
AI	ANALOG IN	LG	LARGE
ALM	ALARM	LLT	LOW LIMIT THERMOSTAT
AO	ANALOG OUT	LON	LOCAL OPERATING NETWORK
AUX	AUXILIARY	--M	
--B			
BAS	BUILDING AUTOMATION SYSTEM	MAX	MAXIMUM
BFF	BELOW FINISHED FLOOR	MIN	MINIMUM
BFG	BELOW FINISHED GRADE	MVA	MEGAVOLT-AMPS
BLDG	BUILDING	MOR	MAKE ON RISE
BLR	BOILER		
BTU	BRITISH THERMAL UNIT	--N	
BTUH	BRITISH THERMAL UNIT PER HOUR	NA	NOT APPLICABLE
BOR	BREAK ON RISE	NU	NUMBER
--C		NC	NORMALLY CLOSED
CH	CHILLER	NO	NORMALLY OPEN
CHWP	CHILLED WATER PUMP	--O	
CLG	CEILING		
COM	COMMUNICATIONS	OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
CS	CURRENT STATUS SWITCH		
CT	COOLING TOWER	--P	
CTF	COOLING TOWER FAN	PWM	PULSE WIDTH MODULATION
CTRL	CONTROL		
CU	CONDENSING UNIT		
CWP	CONDENSER WATER PUMP	--Q	
--D		QTY	QUANTITY
DAT	DATA		
DDC	DIRECT DIGITAL CONTROL	--R	
DET	DETECTOR		
DIA	DIAMETER	REC	RECEPTACLE
DIS	DISCRETE INPUT, DIGITAL IN	REF	REFERENCE
DN	DOWN	R	RELAY
DO	DISCRETE OUT, DIGITAL OUT	RM	ROOM
DP	DIFFERENTIAL PRESSURE	RTU	ROOFTOP UNIT
DPS	DIFFERENTIAL PRESSURE SWITCH	--S	
DPT	DIFFERENTIAL PRESSURE TRANSDUCER	SD	SMOKE DETECTOR
DSP	DISCHARGE STATIC PRESSURE	SF	SUPPLY FAN
DX	DIRECT EXPANSION	SOL	SOLENOID
°C	DEGREES CELSIUS	S/S	START/STOP
°F	DEGREES FAHRENHEIT	STAS	STATUS
--E		STG	STAGE
EA	EACH	--T	
EWC	ELECTRIC WATER COOLER		
EWH	ELECTRIC WATER HEATER	TEL	TELEPHON
EXT	EXTERNAL	TYP	E
EDH	ELECTRIC DUCT HEATER	TWR	TYPICAL
EF	EXHAUST FAN	--U	TOWER
EMS	ENERGY MANAGEMENT SYSTEMS	UG	UNDERGROUND
ENA	ENABLE	UGE	UNDERGROUND ELECTRICAL
ENCL	ENCLOSURE	UON	UNLESS OTHERWISE NOTED
ENET	ETHERNET	UPE	UNDERGROUND PRIMARY ELECTRICAL
ERH	ELECTRIC RE-HEAT	USE	UNDERGROUND SECONDARY ELECTRICAL
ERW	ENERGY RECOVERY WHEEL	--V	
ERV	ENERGY RECOVERY VENTILATOR		
ETR	EXISTING TO REMAIN	VAC	VOLTS ALTERNATING CURRENT
EGC	EQUIP. GROUNDING CONDUCTOR	VDC	VOLTS DIRECT CURRENT
--F		VFD	VARIABLE FREQUENCY DRIVE
FCU	FAN COIL UNIT	--W	
FT	FEET/FOOT		
FSD	FIRE/SMOKE DAMPER	W	WATTS
FLEX	FLEXIBLE	WP	WEATHERPROOF
FLR	FLOOR	WD	WATER DETECTOR
FPMB	FAN POWERED MIXING BOX	W/	WITH
FRZ	FREEZER	--X	
--G		XFMR	TRANSFORMER
GALV	GALVANIZE		
GRD	GROUND	--Z	
GRN	GREEN		
GEC	GROUNDING ELECTRODE CONDUCTOR	ZN	ZONE
--H		ZR	ZONE RELAY
HL	HIGH LIMIT THERMOSTAT		
HP	HORSEPOWER		
HRU	HEAT RECOVERY UNIT		
HRV	HEAT RECOVERY VENTILATOR		
HTG	HEATING		
HZ	HERTZ		

BRANCH CIRCUIT SIZING TABLE

MAX CKT AMPS	BASE WIRE SIZE (AWG)	EGC WIRE SIZE (AWG)	LENGTH (FT) FOR 3% DROP AT 120V, 1 PH			
			BASE SIZE	NEXT SIZE	NEXT SIZE	NEXT SIZE
20	12	12	45	70	110	180
30	10	10	45	70	110	180
50	8	10	45	70	110	140
65	6	8	55	85	110	135
85	4	8	65	80	100	130
100	3	8	70	85	110	140
115	2	6	75	90	115	150
130	1	6	80	100	125	160
150	1/0	6	90	110	140	180
175	2/0	6	90	110	140	
200	3/0	6	95	115		
225	4/0	4	100			

VOLTS, PHASE	VOLTAGE FACTOR
120V, 1PH	1.00
208V, 1PH	1.73
277V, 1PH	2.31
480V, 1PH	4.00
208V, 3PH	2.00
480V, 3PH	4.62

EGC = EQUIPMENT GROUNDING CONDUCTOR

NOTES:
1. ALLOWABLE CIRCUIT LENGTH (AL) MAY BE ADJUSTED FROM TABLE LENGTH (TL) BY LOAD FACTOR (LF=AMPS/MAX CKT AMPS) AND VOLTAGE FACTOR (VF) USING THE FORMULA: AL = TL x VF / LF
2. FOR THIS PURPOSE, ASSUME THAT ANY CIRCUIT SERVING ANY UNDESIGNATED RECEPTACLE IS LOADED AT ITS PROTECTION RATING.
3. IF CIRCUIT CONDUCTOR SIZE IS INCREASED FOR VOLTAGE DROP, INCREASE EQUIPMENT GROUNDING CONDUCTOR BY SAME NUMBER OF AWG SIZES (SAME CIRCULAR MILLS RATIO).

ELECTRICAL LEGEND

SYMBOL	DESCRIPTION
CIRCUIT RELATED	
	LIGHTING/POWER CKT. ARROW INDICATES HOME RUN, TICS INDICATE NUMBER OF CONDUCTORS EXCLUDING GROUNDS. TICS GENERALLY USED TO DIFFERENTIATE SEPARATE SWITCH LEGS ON THE SAME CIRCUIT.
	CONDUIT STUBBED OR ROUTED UP
	CONDUIT STUBBED OR ROUTED DOWN
	CONNECT TO EQUIPMENT
J	JUNCTION BOX, MOUNTED AS INDICATED
POWER OUTLETS	
XX	DUPLEX RECEPTACLE, NEMA 5-20R
XX	FOURPLEX RECEPTACLE, NEMA 5-20R
XX	SINGLE RECEPTACLE, NEMA 5-20R, UNLESS OTHERWISE NOTED
XX	FLUSH MOUNTED FLOOR DUPLEX RECEPTACLE WITH COVER AS INDICATED
XX	COMMON NOTATIONS: X-XXR = NEMA CONFIGURATION; IG = ISOLATED GROUND; GFI = GROUND FAULT CIRCUIT INTERRUPTER; WP = WEATHERPROOF GFI
	DUPLEX RECEPTACLE & DATA RECEPTACLE IN DUAL CHANNEL, SURFACE RACEWAY
	FOUR-PLEX RECEPTACLE & DATA RECEPTACLE IN DUAL CHANNEL, SURFACE RACEWAY
TELEPHONE/DATA	
	DATA OUTLET; FLUSH FLOOR DATA OUTLET
	COMB DATA & TELEPHONE OUTLET; FLUSH FLOOR COMB. DATA & TELEPHONE OUTLET
	TELEPHONE OUTLET; FLUSH FLOOR TELEPHONE OUTLET
TV	TV OUTLET BOX
POWER EQUIPMENT	
	DISCONNECT SWITCH, SIZE & TYPE AS INDICATED OR REQUIRED
	COMBINATION STARTER / DISCONNECT SWITCH
	MOTOR STARTER
	TRANSFORMER; THICK LINE DENOTES FRONT
	SWITCHGEAR; THICK LINE DENOTES FRONT
	PANELBOARD
	PANELBOARD - FLUSH MOUNTED
TV/TEL	TV OR TELEPHONE TERMINAL BOARD; 3/4"THK x 8' HT TYPE AC PLYWD.
SRV/HUB	SERVER/HUB
VFD	VARIABLE FREQUENCY DRIVE
LOW VOLTAGE CONTROL	
M	MOTION SENSOR, ARROWS INDICATE DIRECTION OF SENSING FIELD
R	RELAY MODULE W/ LOW VOLTAGE POWER SUPPLY
$	LOW VOLTAGE SWITCH STATION. REF 'MISC DEVICES' BELOW FOR APPLICABLE SWITCH TYPE/FUNCTION CALLOUTS (e.g. DIMMING, 3-WAY, ETC.)
P	PHOTO SENSOR (A=ANOLOG, S=SWITCH)BOR)
	LOW VOLTAGE SIGNAL WIRING
MISC. DEVICES	
TX	THERMOSTAT; MARK INDICATES UNIT OR ZONE CONTROLLED
P	PHOTO-CONTROL RELAY
	POWER/COMM POLE, NUMBER OF CHANNELS &/OR DEVICES AS INDICATED. WIREMOLD OR APPROVED EQUAL
	MOMENTARY CONTACT, PUSHBUTTON, MUSHROOM HEAD
	MOMENTARY CONTACT, PUSHBUTTON
$X	MANUAL SWITCH, CALL OUTS 'X'; 'K'-INDICATES KEYED SWITCH; '2'-DOUBLE POLE, '3'-3-WAY SWITCH; '4'-4-WAY SWITCH; 'M'-DOUBLE THROW, MOMENTARY CONTACT; 'F'-CAPACITOR TYPE, 4 SPEED FAN CONTROL; 'OS'-INTEGRAL OCCUPANCY SENSOR; 'VS'-VACANCY SENSOR MANUAL ON SWITCH; "T"-7-DAY PROGRAMMABLE TIMER; 'D'-DIMMER; 'SC'-SPEED
VS OS	VACANCY SENSOR (TYP. OFFICE), OCCUPANCY SENSOR (TYP. HALLWAYS)
	GROUND BAR

GENERAL LEGEND

POINT OF CONNECTION NEW TO EXISTING OR DISCONNECTION DEMO FROM EXISTING. MAY NOT BE INDICATED AT ALL SUCH POINTS. CROSS REF W/ LINE-WEIGHT AND STYLE CONVENTIONS AT RIGHT.

REVISION CLOUD & MARKER

DETAIL REFERENCE

BOUNDARY MARKS

SHEET REFERENCE

BREAK MARK

PHOTO OR AXON VIEW REFERENCE

APPROX. AXONOMETRIC VIEWING LOCATION & DIRECTION

SHEET REFERENCE

NEW WORK KEYED NOTE

DEMOLITION KEYED NOTE

DETAIL KEYED NOTE

MISC. KEYED NOTE

AREA " "
AREA " "

MATCHLINE

(N) - NEW WORK
(X) - DEMOLITION
(R) - RELOCATE/REINSTALL
(E) - EXISTING, REMAINS

NOTE: PHASING NOTATIONS, e.g. (N), (E), etc. MAY NOT NECESSARILY BE INDICATED ON ALL ITEMS. CROSS REF WITH LINE-WEIGHT AND STYLE CONVENTIONS ABOVE.

NOT ALL LEGEND SYMBOLS SHOWN MAY BE APPLICABLE TO THIS PROJECT

GENERAL ELECTRICAL NOTES

1. ELECTRICAL CONTRACTOR SHALL COORDINATE W/ OTHER TRADES TO MINIMIZE CONFLICTS.
2. ALL NEW WIRE & CABLE SIZES ARE FOR COPPER. ALUMINUM WILL NOT BE ALLOWED.
3. CONFIRM W/ LOCAL CODES, MECHANICAL CONTRACTOR & EQUIPMENT VENDORS ON THE LOCATION & MOUNTING METHOD FOR DISCONNECT SWITCHES, MANUAL MOTOR STARTERS, COMBINATION STARTER/DISCONNECTS, ETC. PRIOR TO ELECTRICAL ROUGH-IN & INSTALLATION.
4. ELECTRICAL CONTRACTOR SHALL COORDINATE WORK W/ MECHANICAL DRAWINGS & REPORT ANY DISCREPANCIES TO ARCHITECT/ENGINEER IMMEDIATELY.
5. UNLESS OTHERWISE NOTED, BRANCH CIRCUIT CONDUCTORS & EQUIPMENT GROUNDING CONDUCTORS SHALL BE COPPER, THWN-2, SIZED PER BRANCH CIRCUIT SIZING TABLE, THIS SHEET.
6. ALL ELECTRICAL EQUIPMENT SHALL BE GROUNDED & BONDED PER THE NEC. ISOLATED GROUND RECEPTACLES SHALL HAVE SEPARATE GROUND CONDUCTOR SIZED SAME AS EQUIPMENT GROUNDING CONDUCTOR.
7. ELECTRICAL CONTRACTOR SHALL MAKE FINAL CONNECTIONS TO OWNER-PROVIDED EQUIPMENT.
8. ALL J-BOXES SHALL BE ACCESSIBLE FOR FUTURE SERVICE PER NEC.
9. CONDUITS SHALL NOT BE ROUTED EXPOSED IN FINISHED AREAS UNLESS NOTED.
10. ALL INTERIOR CONDUIT SHALL BE EMT OR RGSC.
11. EQUIPMENT OR MATERIAL SUBSTITUTED AS APPROVED EQUAL TO THAT SHOWN ON PLANS & SPECIFIED SHALL BE COMPATIBLE IN ALL RESPECTS. ANY CHANGES OR MODIFICATIONS REQUIRED TO ACCOMMODATE THE SUBSTITUTED ITEMS SHALL BE MADE BY THE CONTRACTOR WITH APPROVAL FROM & AT NO EXTRA COST TO THE OWNER.
12. MOUNTING HEIGHTS FOR OUTLETS, SWITCHES & CONTROLS SHALL BE IN COMPLIANCE W/ TEXAS ACCESSIBILITY STANDARDS.
13. ELECTRICAL CONTRACTOR SHALL PROVIDE ROUGH-IN & POWER FOR OTHER TRADES.
14. ALL WALL MOUNTED PANELBOARDS NOT LOCATED IN MECHANICAL OR ELECTRICAL EQUIPMENT ROOMS SHALL BE FLUSH MOUNTED, UNLESS NOTED OTHERWISE. FROM FLUSH MOUNTED PANELS, PROVIDE AT LEAST ONE 3/4" CONDUIT TO ABOVE ACCESSIBLE CEILING FOR EACH THREE POLES WITHOUT WIRE CONNECTED.
15. ALL RECEPTACLES IN RESTROOMS OR OUTDOORS SHALL BE GFI RECEPTACLES. ALL RECEPTACLES WITHIN 6 FEET OF THE OUTSIDE EDGE OF SINK(S) SHALL BE GFI RECEPTACLES. THESE REQUIREMENTS APPLY WHETHER OR NOT RECEPTACLES ARE MARKED AS GFI RECEPTACLES ON THE POWER PLAN.
16. ELECTRICAL CONTRACTOR SHALL CLOSELY COORDINATE HIS ROUGH-IN W/ ALL OTHER TRADES & SUBCONTRACTORS FOR THE EXACT MOUNTING HEIGHT REQUIREMENTS. NOTIFY THE OWNER/ENGINEER OF ANY CONFLICT PRIOR TO ROUGH-IN.
17. CONTRACTOR SHALL COORDINATE W/ THE OWNER FOR THE REMOVAL OF OWNER'S MATERIALS IN THE WORK AREA.
18. ALL OCCUPIED WORK AREAS SHALL BE LEFT IN A WIPED CLEAN CONDITION EACH TIME THE CONTRACTOR LEAVES THE WORK AREA.
19. CONTRACTOR SHALL USE A DUST COLLECTING VACUUM DURING ANY DRILLING OR HAMMER DRILLING TO HELP MAINTAIN A CLEAN WORK ENVIRONMENT. COORDINATE W/ OWNER FOR APPROPRIATE TIMES FOR DRILLING.
20. ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL ALL DEVICES REQUIRED TO MEET CODE REQUIREMENTS WHETHER SHOWN OR NOT.
21. ALL WORK SHALL COMPLY WITH APPLICABLE LOCAL, STATE AND FEDERAL CODES AND ORDINANCES. FOLLOW RECOMMENDED PRACTICES AS DEFINED BY ASME, SMACNA, ASHRAE, NFPA, APPLICABLE BUILDING CODES, APPLICABLE ELECTRICAL CODE, NATIONAL ELECTRICAL CODE, AGA, ADA AND OSHA.

ONE-LINE WIRING LEGEND

1/2	MOTOR CONNECTION, NUMBER IN CIRCLE INDICATES HORSEPOWER
	GROUNDING ELECTRODE
	RELAY WITHOUT POWER SUPPLY
	RELAY WITH POWER SUPPLY
	CIRCUIT BREAKER
	NORMALLY OPEN (NO) CONTACT
	NORMALLY CLOSED (NC) CONTACT
	SINGLE POLE SINGLE THROW (SPST) SWITCH
	SINGLE POLE DOUBLE THROW (SPDT) SWITCH
H O A	HAND - OFF - AUTO (HOA) SELECTOR SWITCH
	TRANSFORMER

LIGHTING LEGEND

- REF: TO LIGHTING FIXTURE SCHEDULE -

	LIGHT FIXTURE (Fixture size per Schedule)
	LIGHT FIXTURE (Fixture size per Schedule & furnished with Battery Back-up Unit)
	SMALL DIRECTIONAL LIGHT FIXTURE
	SMALL LIGHT FIXTURE
	WALL MOUNTED SMALL LIGHT FIXTURE
	SMALL LIGHT FIXTURE (With Battery Back-up)
E	AID LIGHT FIXTURE
	BATTERY EMERGENCY LIGHT FIXTURE DUAL HEAD UNIT
	POLE MOUNTED SITE LIGHTING
	FLOOD LIGHTING
	TRACK LIGHTING
	EXIT LIGHT FIXTURE (Arrow denotes egress direction, fill denotes single &/or double faced)

GENERAL DEMOLITION NOTES

1. FIELD VERIFY ALL EXISTING CONDITIONS, INCLUDING EQUIPMENT AND UTILITY SERVICE LOCATIONS, PRIOR TO START OF ANY WORK. VISIT JOB SITE PRIOR TO BIDDING TO VERIFY EXISTING CONDITIONS. NOTIFY GC AND ENGINEER IMMEDIATELY IF ANY DISCREPANCIES ARE FOUND.
2. PERFORM ALL WORK AND DISPOSAL/RECYCLING IN COMPLIANCE WITH APPLICABLE FEDERAL, STATE, AND LOCAL LAWS, CODES, AND ORDINANCES.
3. KEEP THE CONSTRUCTION AREA CLEAN AT ALL TIMES. RESTORE ANY WORK SPACE TO WIPED-CLEAN STATUS BEFORE SCHEDULED OCCUPANCY BY OWNER.
4. COORDINATE WITH APPROPRIATE TRADES TO DISCONNECT RELATED SERVICES BEFORE DEMOLITION OF ANY ITEM. CLOSE AND TAG OUT WATER AND GAS VALVES. TAG AND LOCK OUT ELECTRICAL POWER. DISABLE AND DOCUMENT STATUS OF FIRE ALARM, SECURITY, AND CONTROL POINTS.
5. WHERE PIPING OR CONDUIT IS REMOVED, REMOVE ALL ANCILLARY SUPPORTS, VALVES, DEVICES AND CONNECTORS NOT TO BE REUSED.
6. OPENINGS IN WALLS, CEILINGS, FLOORS, AND ROOFS WHERE PENETRATING DUCTS, PIPES, ETC. ARE REMOVED BUT NOT REPLACED IN KIND, SHALL BE SHORED AND PATCHED WITH LIKE MATERIALS AND FINISH TO THE SURROUNDING SURFACE.
7. CAP & SEAL ANY PIPES LEFT OPEN-ENDED BY DEMOLITION.
8. REFERENCE HAZARDOUS MATERIAL ABATEMENT SPECIFICATIONS FOR IDENTIFICATION OF HAZARDOUS MATERIALS IN THE PROJECT AREA AND INSTRUCTIONS FOR SCOPE INVOLVED THEREWITH. DO NOT PROCEED WITH ANY WORK THAT MAY DISTURB ASBESTOS OR OTHER IDENTIFIED HAZARDOUS MATERIALS UNTIL ANY REQUIRED ABATEMENT HAS BEEN COMPLETED.

CONDUIT SIZING/FILL SCHEDULE

CONDUCTOR SIZE (AWG/MCM)	MAXIMUM NUMBER CONDUCTORS (INCLUDES NEUTRAL & GROUNDS, SEE NOTE 3) NOMINAL CONDUIT SIZE							
	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"
14	9	17	28	51	70	118	170	265
12	6	12	20	37	51	86	124	193
10	4	7	13	23	32	54	78	122
8	2	4	7	13	18	31	45	70
6	1	3	5	9	13	22	32	51
4	1	1	3	6	8	14	20	31
3	1	1	3	5	7	12	17	26
2	1	1	2	4	6	10	14	22
1	0	1	1	3	4	7	10	16
1/0	0	1	1	2	3	6	9	14
2/0	0	1	1	1	3	5	7	11
3/0	0	1	1	1	2	4	6	9
4/0	0	0	1	1	1	3	5	8
250	0	0	1	1	1	3	4	6
300	0	0	0	1	1	2	3	5
350	0	0	0	1	1	1	3	5
400	0	0	0	1	1	1	3	4
500	0	0	0	1	1	1	2	3

SEE NOTE 4

SEE NOTE 5

NOTES:
1. TABLE VALUES ARE BASED ON NATIONAL ELECTRIC CODE LIMIT TO 40% OF CONDUIT CROSS SECTION AND ASSUME COMMON CONDITIONS OF PROPER CABLING AND ALIGNMENT OF CONDUCTORS WHERE LENGTH OF PULL AND NUMBER OF BENDS ARE WITHIN REASONABLE LIMITS.
2. TABLE ASSUMES THWN-2 CONDUCTORS OF THE SAME SIZE. FOR DIFFERENT WIRING TYPES WHERE SPECIFICALLY INDICATED IN THE DESIGN, OR FOR DIFFERENT SIZED WIRES IN A SINGLE CONDUIT, CALCULATE AND LIMIT FILL PERCENT BASED ON ACTUAL WIRE AND CONDUIT CROSS SECTIONS IN ACCORDANCE WITH THE NATIONAL ELECTRIC CODE.
3. EQUIPMENT GROUNDING OR BONDING CONDUCTORS, WHERE INSTALLED, SHALL BE INCLUDED IN CONDUIT FILL LIMITATIONS ABOVE. FOR CONDUIT SIZING PURPOSES, ASSUME EGC AT SAME SIZE AS PHASE CONDUCTORS.
4. DERATE CONDUCTORS ADDITIONALLY FROM SIZES ON PLANS FOR INDOOR (AMBIENT TEMP<86°F) INSTALLATIONS OF MORE THAN 6 CURRENT-CARRYING CONDUCTORS IN SINGLE RACEWAY IN ACCORDANCE WITH NEC.
5. DERATE CONDUCTORS ADDITIONALLY FROM SIZES ON PLANS FOR OUTDOOR (OR INDOOR WHERE >86° AMBIENT) INSTALLATIONS OF MORE THAN 3 CURRENT-CARRYING CONDUCTORS IN SINGLE RACEWAY, IN ACCORDANCE WITH NEC.

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04/04/2025

PRICINCT 2 ROAD AND BRIDGE FACILITY

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ELECTRICAL GENERAL NOTES, LEGENDS, AND SCHEDULES

SHEET TITLE:

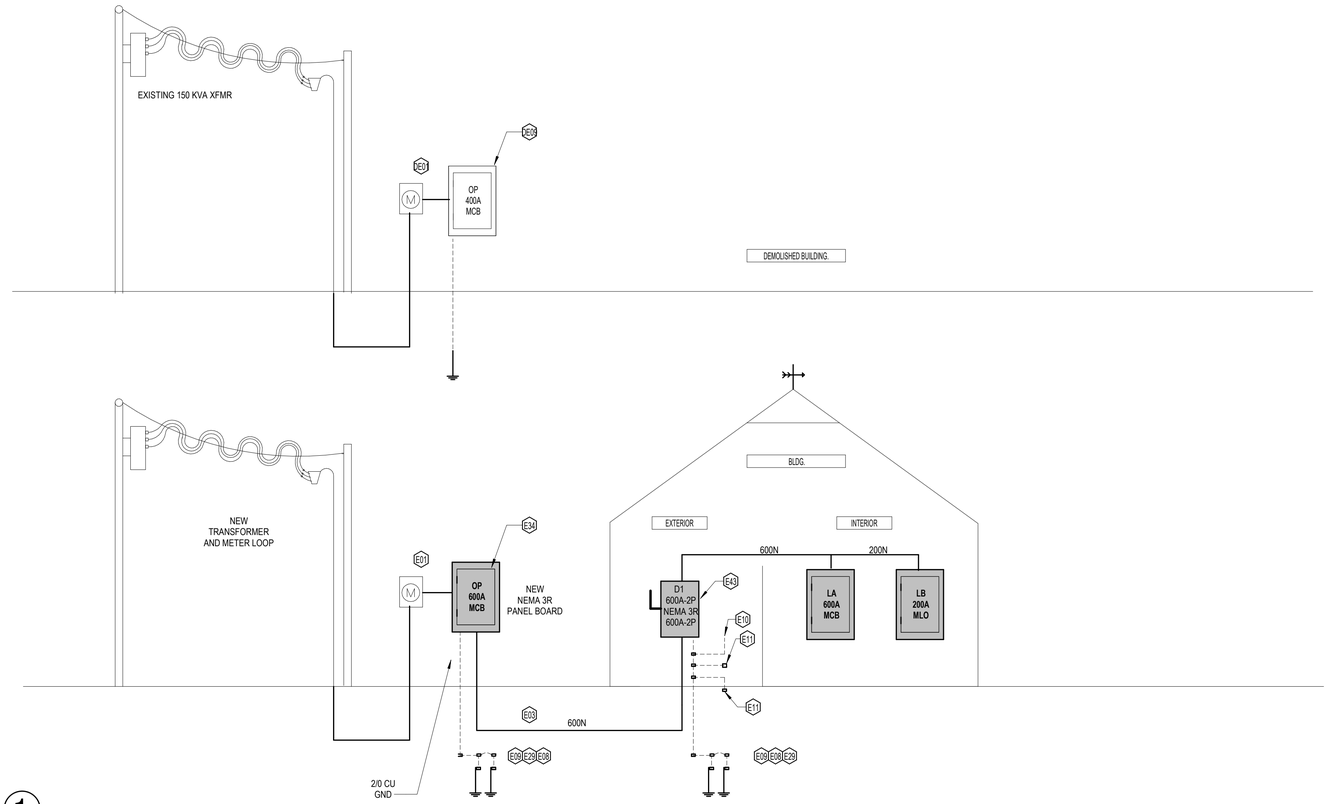
REVISIONS:

NO.	DATE

Job No: T2414
Drawn by: TO
Checked by: TS/SK/EB
Sheet No.

E1.1

Date: APRIL 2025



1 POWER RISER DIAGRAM E2.1
1/8" = 1'-0"

EXISTING POWER METER BY CITY OF SMITHVILLE

ELECTRICAL RISER LEGEND

COMPONENTS

NEW **EXISTING**

FEEDER
X = MIN. WIRE & CONDUIT SIZES. NEW WIRE IN EXISTING CONDUIT NOTED WHERE APPLICABLE.

TRANSFORMER
X = MARK & RATING

METER

DISCONNECT
X = RATING, TYPE, FUSING

PANELBOARD
X = MARK, MAIN RTG & TYPE

MAIN SWITCH BOARD OR DISTRIBUTION PANEL
X = MARK, MAIN RTG & TYPE

SUB-COMPONENTS

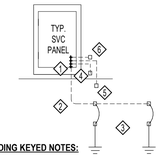
4" (U.O.N.) CONCRETE HOUSEKEEPING PAD.
PADS FOR EXISTING EQUIP'T TO REMAIN U.O.N.

C-CHANNEL AND THREADED ROD HANGERS
COORD'T WITH STRUCTURAL ENGINEER FOR BLDG LOAD CAPACITY, HANGING LOC'NS, ATTACHMENT METHODS, AND C-CHANNEL&ROD SIZES&QTY's.

GROUNDING AND BONDING
BOND NEW EQUIPMENT TO BUILDING'S GROUNDING SYSTEM. PROVIDE ADDITIONAL GROUNDING ELECRODES AND BONDING WHERE NOTED.

ROOM XXX — **SPACE/BLDG BOUNDARIES & NAMES**

TYPICAL SERVICE GROUNDING CONNECTIONS



SERVICE GROUNDING KEYED NOTES:

1. CONNECT GROUND WIRES TO SERVICE PANEL GROUND BUS ONLY. DO NOT GROUND NEUTRAL.
2. PROVIDE #3/0 AWG GROUNDING CONDUCTOR (GEC), BARE, 36" OR DEEPER IN EARTH WHERE HORIZONTAL.
3. PROVIDE 2 X 5/8" DIA. GALV STEEL GROUNDING RODS, MIN. 8' LENGTH, DRIVEN VERTICAL. PROVIDE #4 AWG JUMPER FOR EACH GROUND ROD. SPACE GROUND RODS 10 FT FROM BLDG AND EACH OTHER.
4. IF WATER SUPPLY PIPING TO THE BUILDING QUALIFIES AS A GROUNDING ELECTRODE (METAL, 10 FT CONTINUOUS BURIED), PROVIDE #4 AWG GEC JUMPER FROM BUILDING STEEL TO WATER PIPE AT ENTRY POINT INSIDE BUILDING AND TERMINATE WITH LISTED GROUND CLAMPS. OTHERWISE, BOND TO INDOOR METAL WATER PIPE.
5. COORDINATE WITH NEW FOUNDATION WORK WHERE APPLICABLE TO ENSURE THAT A GALVANIZED ROD IS EMBEDDED IN AND PROTRUDED FROM THE FOUNDATION NEARBY TO CREATE A CONCRETE-ENCASED ELECTRODE (UNDER GROUND). ROD SHOULD BE 1/2" HOT DIP GALV. STEEL, WITH AT LEAST 20' HORIZONTAL IN THE BOTTOM OF THE GRADE BEAM, TIED TO THE REINFORCING STEEL IN THE USUAL MANNER FOR RENFORCING STEEL. PROTRUSION SHALL BE SUITABLE FOR ELECTRIC CONNECTION BY EXOTHERMIC WELDING PROCESS. PROVIDE #4 AWG BONDING JUMPER TO ROD PROTRUSION AND CONNECT THUSLY.
6. PROVIDE #4 AWG BONDING JUMPER CONNECTED TO BUILDING STEEL AS APPLICABLE AND WHERE ALLOWED BY STRUCTURAL ENGINEER. CONNECT AT THE NEAREST ACCESSIBLE LOCATION. PROVIDE ACCESS DOOR FOR INSPECTION IF LOCAITON IS CONCEALED. UTILIZE EITHER BOLTED GROUNDING PLATE, EXOTHERMIC WELD, OR LISTED CLAMP FOR CONNECTION TO STEEL.

GENERAL SINGLE LINE NOTES

1. ALL ELECTRICAL WORK FOR THIS PROJECT IS NEW UNLESS OTHERWISE IDENTIFIED.
2. SEE SHEET E1.1 FOR GENERAL NOTES AND LEGENDS.
3. REFER TO PANELBOARD SCHEDULES ON SHEETS E2.2, AND TO SINGLE LINE RISER DIAGRAM ON SHEET E2.1 FOR SCHEMATIC SCOPE OVERVIEW.
4. REFER TO BOTTOM OF PANEL SCHEDULES ON E2 SERIES SHEETS AND SHEET E1.1 FOR SIZES OF FEEDER CONDUIT AND CONDUCTORS.

ELECTRICAL DEMO KEYED NOTES

DE01 COORDINATE WITH OWNER AND UTILITY COMPANY FOR REMOVAL OF METER AND ARRANGE FOR NEW TRANSFORMER AND METER LOOP TO BE INSTALLED.

DE09 EXISTING OUTDOOR PANEL TO BE REMOVED.

ELECTRICAL NEW WORK KEYED NOTES

E01 THE FOLLOWING ARE OWNER PROVIDED AND INSTALLED BY UTILITY. NEW ELECTRICAL SERVICE INCLUDING POWER POLE AND METER, SECONDARY CONDUIT FROM TRANSFORMER, TRANSFORMER, GROUNDING ELECTRODES AT TRANSFORMER, AND METERING EQUIPMENT ENCLOSURES. COORDINATE WITH ELECTRICAL UTILITY WHEN CONNECTING TO NEW ELECTRIC SERVICE.

E03 BURY NEW CONDUITS A MINIMUM OF 36" BELOW GRADE.

E08 CONNECT GEC TO GROUND RODS WITH #4 JUMPERS. GROUND ROD CONNECTIONS MUST BE INSPECTABLE.

E09 TWO 8' GROUND RODS TO BE DRIVEN 12" BELOW GRADE. GROUND RODS SHOULD BE AT LEAST 6' APART.

E10 BOND TO METAL INDOOR WATER PIPE WITH #4 JUMPERS AND PIPE CLAMPS

E11 CONNECT TO BOTH BUILDING STEEL AND FOUNDATION REINFORCED STEEL WITH #3/0 CONDUCTORS. COORDINATE LOCATIONS AND METHODS OF CONNECTION TO SLAB REINFORCEMENT AND BUILDING STRUCTURAL STEEL WITH STRUCTURAL ENGINEER.

E29 PROVIDE BARE COPPER GROUNDING ELECTRODE CONDUCTOR NETWORK CONSISTING OF 2/0 MAIN CONDUCTOR JOINED WITH IRREVERSIBLE CONNECTORS. USE CRIMP OR EXOTHERMIC WELDS EQUIVALENT TO "CADWELD" ABOVE GRADE, AND EXOTHERMIC WELDS ONLY BELOW GRADE.

E34 PROVIDE NEW OUTDOOR PANELBOARD.

E43 GROUNDED CONDUCTOR TO BE ISOLATED FROM NEUTRAL CONDUCTOR.

FEEDER SCHEDULE

MARK	CONDUCTOR QUANTITY AND SIZE	CONDUIT SIZE	SETS	COMMENTS
600N	CU, 3 350 KCMIL, 1#1 G	2-1/2	2	
200N	CU, 3 3/0 KCMIL, 1#3 G	2	1	

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SINGLE LINE DIAGRAM

SHEET TITLE:

REVISIONS:

NO.	DATE

Job No: T2414
Drawn by: TO
Checked by: TS/SK/EB
Sheet No.

E2.1

Date: APRIL 2025

NEW PANEL 'MDP'

PROJECT : BASTROP | MAIN CIRCUIT BREAKER : 600 **MCB** | ENCLOSURE : NEMA 3R
PROJECT # : T2414 | MAIN LUGS ONLY : | MOUNTING : SURFACE
LOCATION : OUTDOOR RACK | BUSSING : 600A | CB TYPE : STANDARD
NOTES : | VOLTAGE : 240/120 | PROVIDE : NEUTRAL BUS
SCHEDULE DATE : 04/04/25 | INTERRUPTING : 65 kAIC RMS SYM | GROUND BUS

CKT	AMPS	POLE	CIRCUIT DESCRIPTION	LOAD	TYPE	PH	TYPE	LOAD	CIRCUIT DESCRIPTION	AMPS	POLE	CKT
1	600	2	PANEL LA	67,871		A						2
3				69,376		B						4
5						A						6
7						B						8
9						A						10
11						B						12
13						A						14
15						B						16
17						A						18
19						B						20
21						A						22
23						B						24
25						A						26
27						B						28
29						A						30
31						B						32
33						A						34
35						B						36
37						A						38
39						B						40
41						A						42

	PANEL VA	SUB FEED	FEED THRU	TOTAL CONN	TOTAL DEMAND VA	TOTAL DEMAND AMPS
PHASE A	0	67,871	0	67,871	66,000	550
PHASE B	0	69,376	0	69,376	67,463	562
	0	137,246	0	137,246	133,463	556

*Total Amps on this line represents the average of the phases

VOLTAGE (L-N)	120	PANEL LOAD ANALYSIS						SCHEDULE DATE :		NEC NOTES	
LOAD TYPE	LOAD DESC	PANEL VA	SUB FEED	FEED THRU	TOTAL CONN	DEMAND FACTOR	NEC NOTES	DEMAND VA	1	TABLE 220.44
0	RECPT	-	12,540		12,540	0.90	1	11,270	2	ART 215.2(A)(1)
1	LTG	-	3,388		3,388	1.25	2	4,235	3	ART 220.51
2	EQUIP	-	37,280		37,280	1.00		37,280	4	TABLE 220.56
3	MTR	-	7,020		7,020	1.00		7,020	5	TABLE 620.14
4	COMP	-	67,418		-	1.00		-	6	ART 430.24
5	HEAT	0			67,418	1.00		67,418		
6	A/C	-	-		-	0.00	3	-		
7	KITCH	-	9,600		9,600	0.65	4	6,240		
8	ELEV	-	-		-	1.00	5			
9	1.25	-	137,246		137,246	1.25	1, 6		PHASE BALANCE	
TOTAL VA		-	67,871	-		0.97		133,463	A	1.1%
PHASE	A	-	69,376		67,871	0.97		66,000	B	1.1%
PHASE	B	-	137,246		69,376 137,246	0.97		67,463	NEUTRAL CURRENT	
TOTAL VA		-		-		0.97		133,463	12.20	AMPS

NEW PANEL 'LA'

PROJECT : BASTROP | MAIN CIRCUIT BREAKER : 600 **MCB** | ENCLOSURE : NEMA 1
PROJECT # : T2414 | MAIN LUGS ONLY : | MOUNTING : SURFACE
LOCATION : SHOP | BUSSING : 600A | CB TYPE : STANDARD
NOTES : | VOLTAGE : 240/120 | PROVIDE : NEUTRAL BUS
SCHEDULE DATE : 04/04/25 | INTERRUPTING : 42 kAIC RMS SYM | GROUND BUS

CKT	AMPS	POLE	CIRCUIT DESCRIPTION	LOAD	TYPE	PH	TYPE	LOAD	CIRCUIT DESCRIPTION	AMPS	POLE	CKT
1	60	2	EUH-2	5,000	5	A	0	1,200	KITCHEN OUTLET 1	30	1	2
3				5,000	5	B	0	1,200	KITCHEN OUTLET 2	30	1	4
5	60	2	EUH-3	5,000	5	A	0	1,200	KITCHEN OUTLET 3	30	1	6
7				5,000	5	B	0	1,200	KITCHEN OUTLET 4	30	1	8
9	60	2	EUH-4	5,000	2	A	7	4,800	220V OVEN RANGE	50	2	10
11				5,000	2	B	7	4,800				12
13	60	2	AUX. DUCT HEATER 2-1	5,500	5	A	2	5,000	220V WORKSHOP OUTLET	30	1	14
15				5,500	5	B	2	5,000			1	16
17	60	2	AUX. DUCT HEATER 2-2	5,500	5	A	0	720	EXTERIOR OUTLETS	30	1	18
19				5,500	5	B	5	1,440	FIRE ROOM UNIT HEATER EUH-1	20	1	20
21	20	1	BREAK ROOM / TRAINING OUTLETS	1,260	0	A		16,607	PANEL LB	200	2	22
23	20	1	WAREHOUSE AREA OUTLETS	1,440	0	B		16,828				24
25	20	1	MECHANICAL OFFICE OUTLETS	720	0	A	2	2,880	240V OUTLET	30	2	26
27	20	1	WORKSHOP / MECH. OUTLETS	720	0	B	2	2,880				28
29						A	1	1,074	WORKSHOP / MECH. LIGHTING	30	1	30
31	20	1	WORKSHOP / MECH. OUTLETS	720	0	B	1	1,388	WAREHOUSE LIGHTING	30	1	32
33	30	2	240V OUTLET	2,880	2	A	1	650	BREAK/OFICE/LOCKER/RESTROOM LIGHTING	30	1	34
35				2,880	2	B	2	2,880	240V OUTLET	30	2	36
37			PROVIDE TYPE 1 SURGE PROTECTOR SUCH AS			A	2	2,880				38
39			THQLSURGE OR SIMILAR			B			SPACE			40
41			SPACE			A			SPACE			42

	PANEL VA	SUB FEED	FEED THRU	TOTAL CONN	TOTAL DEMAND VA	TOTAL DEMAND AMPS
PHASE A	51,264	16,607	0	67,871	66,000	550
PHASE B	52,548	16,828	0	69,376	67,463	562
	103,812	33,434	0	137,246	133,463	556

*Total Amps on this line represents the average of the phases

VOLTAGE (L-N)	120	PANEL LOAD ANALYSIS						SCHEDULE DATE :		NEC NOTES	
LOAD TYPE	LOAD DESC	PANEL VA	SUB FEED	FEED THRU	TOTAL CONN	DEMAND FACTOR	NEC NOTES	DEMAND VA	1	TABLE 220.44
0	RECPT	10,380	2,160		12,540	0.90	1	11,270	2	ART 215.2(A)(1)
1	LTG	3,112	276		3,388	1.25	2	4,235	3	ART 220.51
2	EQUIP	37,280	-		37,280	1.00		37,280	4	TABLE 220.56
3	MTR	-	7,020		7,020	1.00		7,020	5	TABLE 620.14
4	COMP	-	-		-	1.00		-	6	ART 430.24
5	HEAT	43440	23,978		67,418	1.00		67,418		
6	A/C	-	-		-	0.00	3	-		
7	KITCH	9,600	-		9,600	0.65	4	6,240		
8	ELEV	-	-		-	1.00	5	-		
9	1.25	-	-		-	1.25	1, 6	-	PHASE BALANCE	
TOTAL VA		103,812	33,434	-	137,246	0.97		133,463	A	1.1%
PHASE	A	51,264	16,607		67,871	0.97		66,000	B	1.1%
PHASE	B	52,548	16,828		69,376	0.97		67,463	NEUTRAL CURRENT	
TOTAL VA		103,812	33,434	-	137,246	0.97		133,463	12.20	AMPS

NEW PANEL 'LB'

PROJECT : BASTROP | MAIN CIRCUIT BREAKER : | ENCLOSURE : NEMA 1
PROJECT # : T2414 | MAIN LUGS ONLY : 200A | MOUNTING : SURFACE
LOCATION : SHOP | BUSSING : 200A | CB TYPE : STANDARD
NOTES : | VOLTAGE : 240/120 | PROVIDE : NEUTRAL BUS
SCHEDULE DATE : 04/04/25 | INTERRUPTING : 22 kAIC RMS SYM | GROUND BUS

CKT	AMPS	POLE	CIRCUIT DESCRIPTION	LOAD	TYPE	PH	TYPE	LOAD	CIRCUIT DESCRIPTION	AMPS	POLE	CKT
1	20	1	SPARE			A	5	508.8	FCU-2-1	15	2	2
3	15	1	EXHAUST FAN E-R AND E-L	15	5	B	5	508.8				4
5	15	1	EXHAUST FAN E-1	528	5	A	5	508.8	FCU-2-2	15	2	6
7	15	1	EXHAUST FAN E-2	528	5	B	5	508.8				8
9	30	1	EXTERIOR BUILDING SIDES LIGHTING	161	1	A	5	1152	HPCU-1	35	2	10
11	20	1	LOCKER ROOM/RESTROOM OUTLETS	720	0	B	5	1,152				12
13	20	1	FOREMAN AND ASSISTANT OFFICE OUTLETS	1,440	0	A	5	1,152	HPCU-3	35	2	14
15	20	1	GARAGE DOOR OPENER	1,404	3	B	5	1,152				16
17	20	1	GARAGE DOOR OPENER	1,404	3	A	5	2,208	CU-2-1	35	2	18
19	20	1	GARAGE DOOR OPENER	1,404	3	B	5	2,208				20
21	20	1	GARAGE DOOR OPENER	1,404	3	A	5	2,208	CU-2-2	35	2	22
23	20	1	GARAGE DOOR OPENER	1,404	3	B	5	2,208				24
25						A	5	3,500	WATER HEATER	30	2	26
27						B	5	3,500				28
29						A	5	432	CP-1	15	1	30
31						B	1	115	EXTERIOR BUILDING FRONT/BACK LIGHTING	30	1	32
33						A						34
35						B						36
37						A						38
39						B						40
41						A						42

	PANEL VA	SUB FEED	FEED THRU	TOTAL CONN	TOTAL DEMAND VA	TOTAL DEMAND AMPS
PHASE A	16,607	0	0	16,607	16,641	139
PHASE B	16,828	0	0	16,828	16,862	141
	33,434	0	0	33,434	33,503	140

*Total Amps on this line represents the average of the phases

VOLTAGE (L-N)	120	PANEL LOAD ANALYSIS						SCHEDULE DATE :		NEC NOTES	
LOAD TYPE	LOAD DESC	PANEL VA	SUB FEED	FEED THRU	TOTAL CONN	DEMAND FACTOR	NEC NOTES	DEMAND VA	1	TABLE 220.44
0	RECPT	2,160			2,160	1.00	1	2,160	2	ART 215.2(A)(1)
1	LTG	276			276	1.25	2	345	3	ART 220.51
2	EQUIP	-			-	1.00		-	4	TABLE 220.56
3	MTR	7,020			7,020	1.00		7,020	5	TABLE 620.14
4	COMP	-			-	1.00		-	6	ART 430.24
5	HEAT	23978.2			23,978	1.00		23,978		
6	A/C	-			-	0.00	3	-		
7	KITCH	-			-	0.65	4	-		
8	ELEV	-			-	1.00	5	-		
9	1.25	-			33,434	1.25	1, 6	-	PHASE BALANCE	
TOTAL VA		33,434	-	-		1.00		33,503	A	0.7%
PHASE	A	16,607			16,607	1.00		16,641	B	0.7%
PHASE	B	16,828			16,828 33,434	1.00		16,862	NEUTRAL CURRENT	
TOTAL VA		33,434	-	-		1.00		33,503	1.8	AMPS

SURGE PROTECTIVE DEVICE SCHEDULE

PART 1		PART 2	L-N	L-G	N-G	L-L
PANEL MARK	L1A	NOM. V.	120	120	0	240
UL TYPE	2	SVR	403	405	440	736
ENCLOSURE	NEMA 4X	VPR	700	700	800	1000
NOM. FREQ.	60 HZ	MCOV	150	150	150	320
SCCR	>=PANEL	C3 #	1000	1000	1000	1500
LOAD AMPS	N/A	I(n)	100	100	100	100
PROTECTION	30 A [1]	MOV	YES	YES	YES	YES
MAKE	THOR SYSTEMS	SAD	OK	OK	OK	OK
MODEL	TSnc	FILTER	OK	OK	OK	OK
FOOTNOTES	[1]					

GENERAL NOTES:

G2 SIZE WIRE IN ACCORDANCE WITH TVSS LISTING AND MANUFACTURER'S RECOMMENDATIONS.

G3 ROUTE WIRE WITH MINIMUM BENDS POSSIBLE. USE MINIMUM BEND RADIUS OF 12".

G4 ANY SUBSTITUTE DEVICE MUST BE DOCUMENTED AS EQUAL.

FOOTNOTES:

[1] CONNECT VIA 30 AMP FUSE OR BREAKER IN PANEL.

ABBREVIATIONS AND NOTES FOR PANELBOARD SCHEDULES

ABBREVIATIONS

CB	CIRCUIT BREAKER
CNDT	CONDUIT
EGC	EQUIPMENT GROUNDING CONDUCTOR
NEU	NEUTRAL
PH	PHASE
TM	THERMAL-MAGNETIC
SS	SOLID STATE
IL	CURRENT LIMITING
GFI	GROUND FAULT INTERRUPTER (5 mA)
GFE	GROUND FAULT EQUIPMENT ROTECTION (1/2 NOM. RATING, 0.2 SEC. U.O.N.)
SW/F	SWITCH/FUSE
FR/TR	FRAME/TRIP
XBS	AUXILIARY BUS SECTION
HPOU	HEAT PUMP OUTDOOR UNIT
HPIU	HEAT PUMP INDOOR UNIT
OCP	OVERCURRENT PROTECTION

GENERAL NOTES

1. WIRE SIZES ARE EXPRESSED IN AWG UP TO 4/0 AND IN KCM FOR LARGER CONDUCTORS. SIZES SHOWN ARE MINIMUM, AND MUST BE INCREASED FOR TEMPERATURE DERATING AND VOLTAGE DROP. SEE VOLTAGE DROP CORRECTION TABLE ON SHEET E1.1 FOR CIRCUITS BELOW 400A.
2. REFER TO CONDUIT SIZING/FILL SCHEDULE ON SHEET E1.1 FOR CONDUIT SIZE REQUIREMENTS.
3. CONFIRM CIRCUIT CHARACTERISTICS WITH EQUIPMENT SUPPLIERS BEFORE ORDERING IF POSSIBLE. COORDINATE WITH ENGINEER TO RESOLVE CIRCUIT, WIRE, RECEPTACLE, AND LOAD DISCREPANCIES.
4. LABEL EACH DISCONNECT SWITCH WITH THE NAME OF THE EQUIPMENT AND THE CIRCUIT NUMBER.
5. LABEL THE FACE OF EACH RECEPTACLE OUTLET COVER PLATE AND THE INSIDE OF EACH SWITCH COVER PLATE WITH THE CIRCUIT NUMBER(S).

SERVICE ENTRANCE NOTES

1. FAULT RATINGS IN PANEL SCHEDULES ARE BASED ON THE FOLLOWING SOURCE ASSUMPTIONS: 240V SPLIT PHASE XFMR(s) HAVING MAX 225kVA CAPACITY, MIN 5% IMPEDANCE AND MIN. 200 FT PHASE CONDUCTOR FEEDERS TO NEW BUILDING. NOTIFY ENGINEER IF ANY OF THESE LIMITS ARE BREACHED.
2. REFER TO NEC AND TO PLANS AND DIAGRAMS FOR GROUNDING REQUIREMENTS.

BRACKETED NOTES (APPLY WHERE INDICATED BY '[.]')

PANELBOARD BRACKETED NOTES:

1. UNLESS SPECIFICALLY APPROVED BY THE ENGINEER IN WRITING, PROVIDE BRANCHES NUMBERED AS SCHEDULED AND POSITIONED ACCORDINGY IN THE PANEL. FOR SQUARE D I-LINE PANELS, THE LEFT AND RIGHT SIDES MAY BE REVERSED, AND THE MAIN MAY BE MOUNTED ON EITHER SIDE.
2. FOR WALL MOUNTED EQUIPMENT, PROVIDE HINGED FRONT FOR ACCESS TO PANEL INTERIOR AND HINGED DOOR FOOR ACCESS TO DEVICE HANDLES ONLY.
3. AT CONTRACTOR'S OPTION, PROVIDE PANELBOARD WITH MAIN TM CB THAT IS SERIES RATED WITH BRANCHES SO THAT NOMINAL 10 KAIC BRANCH BREAKERS MAY BE USED WHILE RETAINING THE SERIES RATING INDICATED. FAULT RATING MAY NOT RELY ON A BREAKER OUTSIDE OF THE PANEL.
4. FAULT RATING MAY RELY ON SERIES RATING OF PANEL MAIN AND PANEL BRANCHES, BUT NOT ON ANY EXTERNAL DEVICES.

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SMITHVILLE TX, 78957

PANEL SCHEDULES

SHEET TITLE:

REVISIONS:

NO.	DATE

Job No:	T2414
Drawn by:	TO
Checked by:	TS/SK/EB
Sheet No.	

E2.2

Date: APRIL 2025

EQUIPMENT CONNECTION SCHEDULE

UNIT	DISCONNECT	CONDUCTORS	NOTES
WATER HEATER	PLUG AND CORD	2 #10 AND 1#12 GND IN 1/2" CONDUIT	
E-R	15A/1P GENERAL-USE SNAP SWITCH	2 #12 AND 1#12 GND IN 1/2" CONDUIT	
E-L	15A/1P GENERAL-USE SNAP SWITCH	2 #12 AND 1#12 GND IN 1/2" CONDUIT	
E-1	15A/1P GENERAL-USE SNAP SWITCH	2 #12 AND 1#12 GND IN 1/2" CONDUIT	
E-2	15A/1P GENERAL-USE SNAP SWITCH	2 #12 AND 1#12 GND IN 1/2" CONDUIT	
AUX. DUCT HEATER 2-1	60A/2P/ FUSED/N-1	2 #6 AND 1#10 GND IN 3/4" CONDUIT	
AUX. DUCT HEATER 2-2	60A/2P/ FUSED/N-1	2 #6 AND 1#10 GND IN 3/4" CONDUIT	
CP-1, Circ. Pump	PLUG AND CORD	2 #12 AND 1#12 GND IN 1/2" CONDUIT	
FCU-2-1	15A/2P GENERAL-USE SNAP SWITCH	2 #12 AND 1#12 GND IN 1/2" CONDUIT	
FCU-2-2	15A/2P GENERAL-USE SNAP SWITCH	2 #12 AND 1#12 GND IN 1/2" CONDUIT	
HPCU-1	40A/2P/ NF/N-3R	2 #10 AND 1#12 GND IN 3/4" CONDUIT	
HPCU-3	40A/2P/ NF/N-3R	2 #10 AND 1#12 GND IN 3/4" CONDUIT	
CU-2-1	40A/2P/ NF/N-3R	2 #10 AND 1#12 GND IN 3/4" CONDUIT	
CU-2-2	40A/2P/ NF/N-3R	2 #10 AND 1#12 GND IN 3/4" CONDUIT	
UNIT HEATER, FIRE ROOM	20A/1P GENERAL-USE SNAP SWITCH	2 #12 AND 1#12 GND IN 1/2" CONDUIT	
UNIT HEATER EUH-2	60A/2P/ FUSED/N-1	2 #6 AND 1#10 GND IN 3/4" CONDUIT	
UNIT HEATER EUH-3	60A/2P/ FUSED/N-1	2 #6 AND 1#10 GND IN 3/4" CONDUIT	
UNIT HEATER EUH-4	60A/2P/ FUSED/N-1	2 #6 AND 1#10 GND IN 3/4" CONDUIT	

General Notes for All Equipment:
1. Provide one switch per unit within eyesight of each unit.

Notes:

LIGHTING FIXTURE SCHEDULE

TAG TYPE	MFG	CATALOG NO.	MOUNTING	VOLTAGE	COLOR TEMP (K)	INPUT VA (MAX)	DESCRIPTION	NOTES
A	LITHONIA LIGHTING	CPX 2X4 4000LM 40K	RECESSED	120	4000	38.9	2' X 4' LED RECESSED FLAT PANEL, DIMMABLE VIA 0-10V	1
C	LITHONIA LIGHTING	CPX 2X2 3200 LM 50K	RECESSED	120	4000	31.5	2' X S' LED RECESSED FLAT PANEL, DIMMABLE VIA 0-10V	1
D	LITHONIA LIGHTING	CSS L48 4000 LM MVOLT 40K 80 CRI [CS ALL OPTIONS]	SURFACE	120	4000	34.2	LED STRIP LIGHT, DIMMABLE	1
H	LITHONIA LIGHTING	CPHB 24LM MVOLT 40K	HIGH BAY	120	4000	172.33	COMPACT PRO HIGHBAY, GLARE CONTROL LENS, DIMMABLE	1
W	LITHONIA LIGHTING	TWX LED P1 40K MVOLT DDBXD	EXTERIOR WALL	120	4000	23W	EXTERIOR WALLPACK, DARK BRONZE	1
E1	LITHONIA LIGHTING	EMERGENCY EXIT LIGHT	WALL OR STEM	120	-	4.3	2-LAMP WALL MOUNTED EGRESS LAMP	1
E2	LITHONIA LIGHTING	EMERGENCY LIGHT	WALL	120	-	0.33	2-LAMP WALL MOUNTED EGRESS LAMP	1

GENERAL NOTES:

1. SEE PLANS FOR QUANTITIES.

2. PROVIDE AN ADDITIONAL NON-SWITCHED HOT LEG TO ALL EMERGENCY FIXTURES FOR BATTERY CHARGING AND POWER-LOSS DETECTION. PROVIDE AN EXTRA HOT AND SPLICE AROUND CONTACTORS/CONTROLLERS IF NECESSARY.

3. ALL EXIT SIGNS TO BE NON-SWITCHED.

NOTES:

1. ALL FIXTURE SUSTITUTIONS MUST MEET CONFORM TO LUMEN PER WATT AND COMPLY WITH CURRENT ENERGY CODES (IECC).

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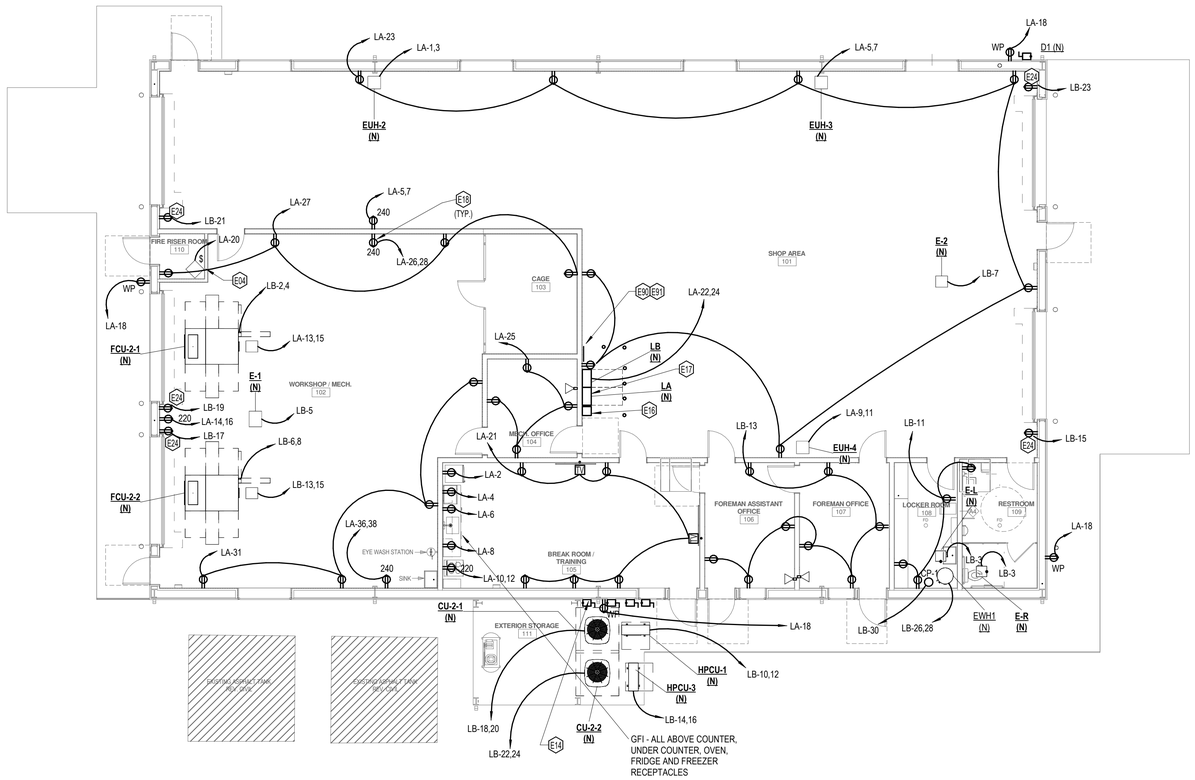
ELECTRICAL SCHEDULES

SHEET TITLE:

REVISIONS:

NO.	DATE

Job No:	T2414
Drawn by:	TO
Checked by:	TS/SK/EB
Sheet No.	E2.3
Date:	APRIL 2025



1 LVL01 POWER NEW WORK PLAN
1/8" = 1'-0"

GENERAL ELECTRICAL NOTES

1. REFER TO SHEET E1.1 FOR GENERAL NOTES AND LEGENDS.
2. NOT ALL EXISTING DEVICES MAY BE SHOWN.
3. SNAP SWITCHES USED AS DISCONNECTS SHALL BE AC GENERAL USE SNAP SWITCHES PER NEC 2017 404.14(A)(3)
4. FOR ELECTRICAL EQUIPMENT BEING REPLACED:
   A. RECORD THE CIRCUIT NUMBER AND BREAKER RATING OF EQUIPMENT.
   B. RECORD ANY UNSATISFACTORY CIRCUIT CONDITIONS.
   C. REPORT IN TABULAR FORM (UNIT #, CIRCUIT #(s), V/A/P, DEFICIENCIES IF ANY) TO ENGINEER AND OWNER FOR O&M RECORDS AND CORRECTIVE ACTION IF NEEDED.

ELECTRICAL NEW WORK KEYED NOTES

E04	PROVIDE ELECTRIC UNIT HEATER MODEL MARKEL 1.5KW, 120V/1PH WITH THERMOSTAT.
E14	FOR OUTDOOR HVAC UNITS MOUNT DISCONNECT ON ADJACENT WALL UNLESS OTHERWISE NOTED. PROVIDE AND MOUNT ALL OUTDOOR AND INDOOR DISCONNECTS SEPERATE FROM ALL HVAC EQUIPMENT EVEN IF DISCONNECT IS NOT PHYSICALLY SHOWN ON DRAWINGS.
E16	LOCATION OF FIRE ALARM PANEL (PROVIDED BY OTHERS).
E17	ROUTE CONDUIT FOR PANELS L1A FROM DISCONNECT UP THROUGH CONDUIT ATTACHED TO STRUCTURE OF METAL BUILDING. PROVIDE AND INSTALL BOLLARDS AS SHOWN TO PROTECT THE ELECTRICAL EQUIPMENT FROM VEHICLE TRAFFIC.
E18	COORDINATE WITH OWNER ON THEIR EXISTING EQUIPMENT FOR EXACT NEMA OUTLET TYPES FOR 240V OUTLETS.
E24	INSTALL RECEPTACLE FOR GARAGE DOOR OPENER 2 FT FROM THE SIDE OF THE OPENING AND 1 FT. BELOW TOP OF OPENING. COORDINATE EXACT LOCATION AND HEIGHT WITH OWNER.
E90	PROVIDE FIRE-RETARDANT TREATED PLYWOOD FOR TELECOM AND DATACOM DEVICE MOUNTING BACKBOARD. BACKBOARD TO BE SIZED BY TELECOM INSTALLER.
E91	PROVIDE COMMUNICATIONS SYSTEM GROUNDING ELECTRODE RISER EXTENDING FROM SYSTEM GROUNDING ELECTRODE TO DATA ROOM (SEE SPECIFICATIONS FOR SIZE), WITH 1/2" X 12" COPPER BUS ON STANDOFF BRACKETS, WALL MOUNTED TO FIRE RATED BACKING.

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POWER PLAN

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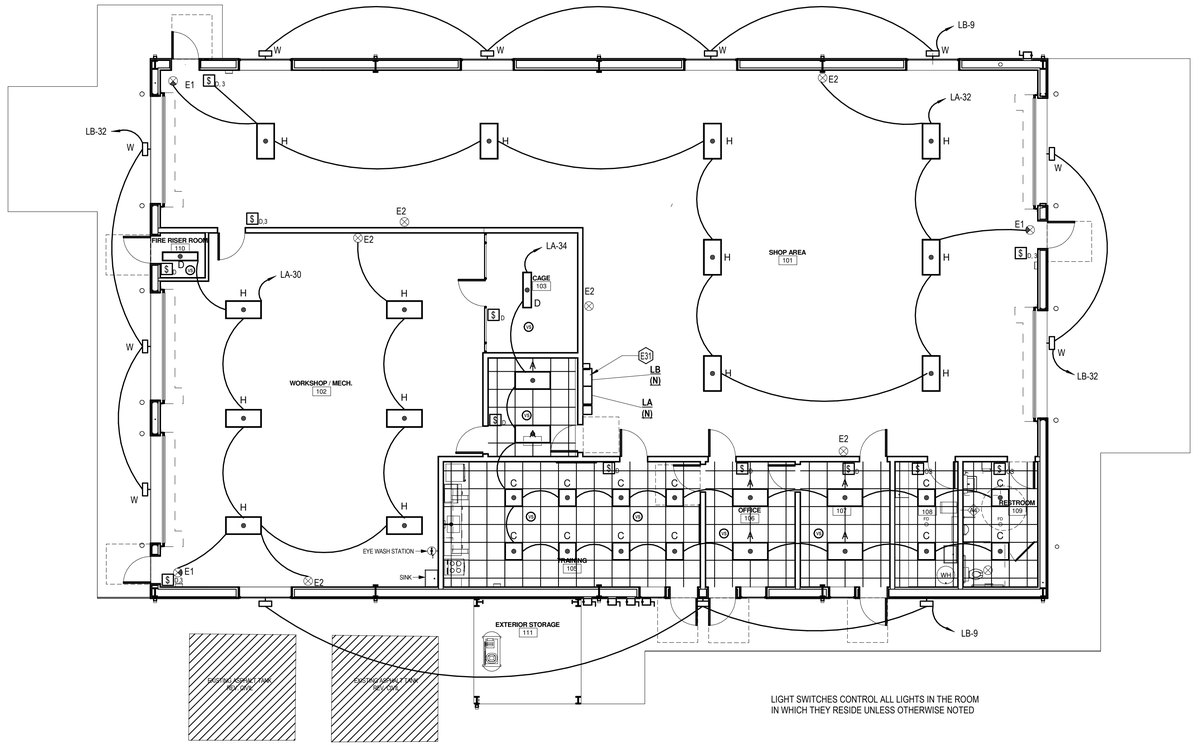

1 LVL01 LIGHTING NEW WORK PLAN
1/8" = 1'-0"

GENERAL ELECTRICAL NOTES

1. REFER TO SHEET E1.1 FOR GENERAL NOTES AND LEGENDS.
2. NOT ALL EXISTING DEVICES MAY BE SHOWN.
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   B. RECORD ANY UNSATISFACTORY CIRCUIT CONDITIONS.
   C. REPORT IN TABULAR FORM (UNIT #, CIRCUIT #(s), V/A/P, DEFICIENCIES IF ANY) TO ENGINEER AND OWNER FOR O&M RECORDS AND CORRECTIVE ACTION IF NEEDED.

LIGHTING INSTALL KEYED NOTES

ELECTRICAL NEW WORK KEYED NOTES

E31 INSTALL LITHONIA NDTC DIGITAL TIME CLOCK OR EQUAL TO CONTROL EXTERIOR LIGHTS.

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LIGHTING PLAN
SHEET TITLE:

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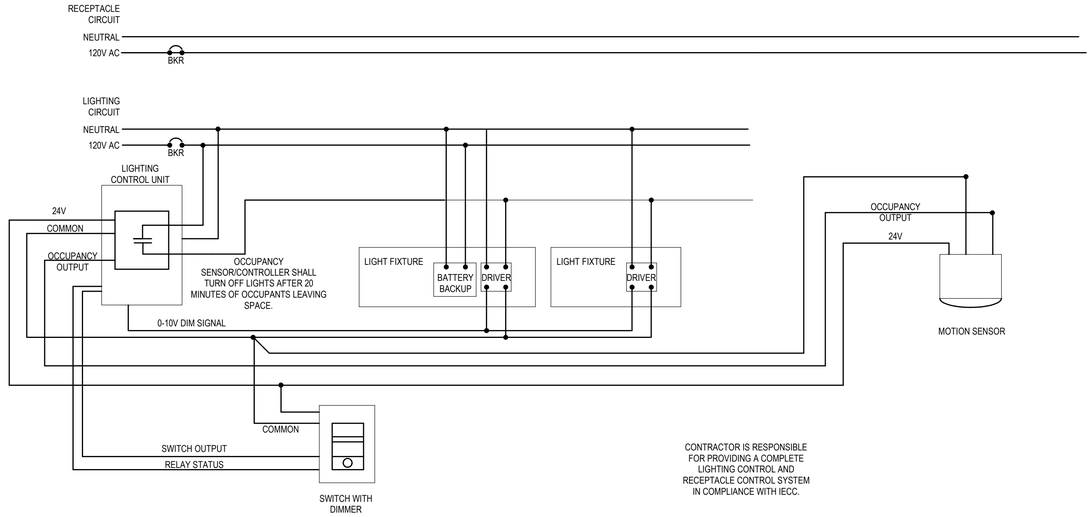
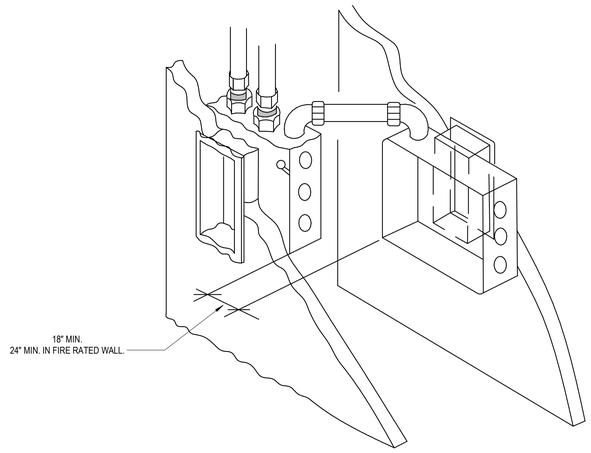
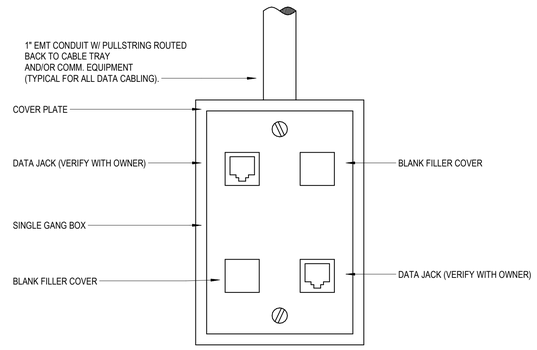
Sheet No.
E5.2
Date: APRIL 2025



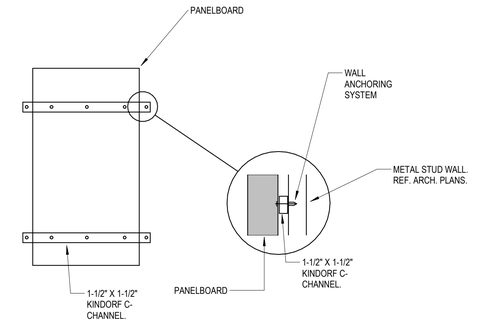
1 TYP. LIGHTING CONTROLS FOR SINGLE SWITCHED LED FIX. w DIMMING & OCCUPANCY SENSOR



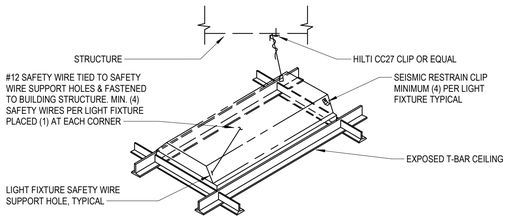
2 BACK TO BACK TYPICAL CONDUIT BOX MOUNTING DETAIL.



3 E-051 - TYPICAL COMM. OUTLET DETAIL.

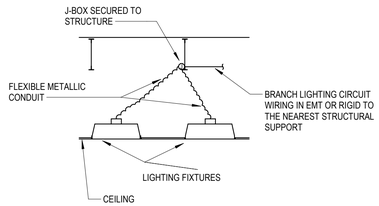


4 E-052 - TYPICAL PANELBOARD WALL SURFACE MOUNTING DETAIL

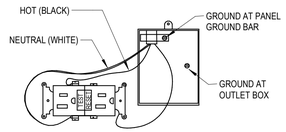


NOTES:
1. ALL WIRES ARE TO BE TAUT WITH A MINIMUM OF 3 TIGHT TURNS AROUND SELF - TYPICAL.
2. THIS DETAIL IS FOR REFERENCE ONLY. MOUNTING LOCATIONS MAY REQUIRE ADDITIONAL STRUCTURAL SUPPORT WHICH SHALL BE PROVIDED BY THE ELECTRICAL CONTRACTOR DURING INSTALLATION.

5 E-053 - LIGHTING FIXTURE SUPPORT DETAIL



6 E-054 - LIGHTING FIXTURE WIRING DETAIL



7 E-055 - ABOVE COUNTER GFCI INSTALLATION DETAIL

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ELECTRICAL DETAILS

SHEET TITLE

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Sheet No.	

E6.0

Date: APRIL 2025

1. IMPORTANT: INSTALLER CREDENTIALS AND RESPONSIBILITY: INSTALLER SHALL BE LICENSED BY THE STATE OF TEXAS AS A FIRE ALARM DESIGNER AND INSTALLER AND EXECUTE ALL WORK UNDER THIS CONTRACT ACCORDING TO THE LAWS AND REGULATIONS GOVERNING SUCH LICENSE. ALL SUBMITTALS, INSTALLATION DRAWINGS AND RECORD DOCUMENTS SHALL BEAR THE NAME, REGISTRATION NUMBER AND SIGNATURE OF THE LICENSED PARTY. FIRE ALARM CONTRACTOR TO OBTAIN SYSTEM APPROVAL FROM LOCAL FIRE MARSHALL, SYSTEM PLANNER'S NAME AND LICENSE NUMBER ARE TO APPEAR ON DESIGN AND SHOP DRAWINGS.

2. THE CONTRACTOR IS EXPECTED TO EXAMINE PHYSICAL CONDITIONS, COORDINATE THE ACTUAL DEVICE LOCATIONS AS NECESSARY TO ACCOMMODATE THE EXISTING CONDITIONS, OBSTRUCTIONS, MANUFACTURERS INSTALLATION SPECIFICATIONS, APPLICABLE CODES, AND THE WORK OF OTHERS IN ORDER TO DESIGN AND INSTALL A FULLY FUNCTIONAL SYSTEM. THE COST ASSOCIATED WITH THIS TASK SHALL BE INCLUDED IN THE CONTRACTOR'S BASE BID.

3. CONTRACTOR TO PROVIDE SUBMITTALS, SUBMIT FOR PERMITTING, PROVIDE TURNKEY DESIGN AND INSTALLATION, AND ALL CERTIFICATIONS AND DOCUMENTATION AS REQUIRED TO PROVIDE A FULLY OPERATING FA SYSTEM ACCEPTABLE TO AUTHORITY HAVING JURISDICTION (AHJ). PROVIDE CODE-COMPLIANT FA SYSTEM, MEETING ADA, INCLUDING BUT NOT LIMITED TO : FIRE ALARM CONTROL PANELS (FACP), FIRE ALARM ANNUNCIATION PANELS (FAAP), POWER SUPPLIES, CONDUITS/RACEWAYS (ROUGH-IN), BATTERIES, ZONE EXPANDERS, SENSORS, SIGNALS, ACTUATORS, CABLES AND ALL REQUIRED DEVICES, ACCESSORIES, DOCUMENTATION, OWNER TRAINING, AND CERTIFICATION.

4. FIRE ALARM CONTRACTOR HAS FINAL RESPONSIBILITY FOR DESIGNING, INSTALLING, COMMISSIONING, & CERTIFYING FIRE ALARM SYSTEM PER NFPA, ADA, NEC, & LOCAL FIRE PROTECTION JURISDICTION REQUIREMENTS.

5. WHEN COMMISSIONING FIRE ALARM SYSTEM. ENSURE & VERIFY USE OF ACTUAL LOCATION CODING (ROOM NUMBERS, ZONE NUMBERS, AREAS, ETC.). IN SOME CASES LOCATION CODING MAY DEVIATE FROM DRAWINGS. INVALID OR INACCURATE LOCATION CODE OUTPUTS FROM ANY SYSTEM WILL RESULT IN UNCONDITIONAL SYSTEM REJECTION, UNTIL LOCATION CODING IS CORRECTED.

6. FIRE-STOPPING SHALL BE ACCOMPLISHED WITH AN APPROVED STOPPING METHOD. CONTRACTOR SHALL SUBMIT FIRE-STOPPING METHOD PRIOR TO INSTALLATION.

7. DESCRIPTION FOR FIRE ALARM SYSTEM DEVICE LABELS AND GRAPHICS SHALL BE COORDINATED WITH OWNER.

8. CONTRACTOR SHALL PROVIDE O&M MANUALS & TRAINING FOR OWNER STAFF & ALARM TECHNICIANS.

9. ALL EQUIPMENT SHALL BE ATTACHED TO WALL & CEILING/FLOOR ASSEMBLIES & SHALL BE HELD FIRMLY IN PLACE.

10. ALL WORK SHALL BE IN ACCORDANCE WITH THE CURRENT NEC AND NFPA 72.

11. PROVIDE PLASTIC COVER AT EACH MANUAL PULL STATION.

12. INSTALL DUCT SMOKE DETECTORS AT ALL AIR HANDLER UNITS (AHU) AND SMOKE DAMPERS IN ACCORDANCE WITH NFPA 72. PROVIDE REMOTE TEST STATIONS FOR ALL DUCT SMOKE DETECTORS IN ACCORDANCE WITH NFPA 72. FIRE ALARM CONTRACTOR SHALL FURNISH THE DUCT SMOKE DETECTORS, THE MECHANICAL CONTRACTOR SHALL INSTALL THE DUCT SMOKE DETECTORS, AND THE FIRE ALARM CONTRACTOR SHALL CONNECT THE DUCT SMOKE DETECTORS TO THE FIRE ALARM SYSTEM. REFERENCE MECHANICAL PLANS FOR AHU DATA & FSD LOCATIONS.

13. MECHANICAL CONTRACTOR SHALL FURNISH AND INSTALL THE FIRE/SMOKE DAMPERS, THE ELECTRICAL CONTRACTOR SHALL PROVIDE POWER TO THE FIRE/SMOKE DAMPERS, AND THE FIRE ALARM CONTRACTOR SHALL CONNECT THE FIRE/SMOKE DAMPER TO THE FIRE ALARM SYSTEM. COORDINATE WITH THE MECHANICAL PLANS FOR FIRE/SMOKE DAMPER LOCATION.

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FIRE ALARM NOTES

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E8.0

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PLUMBING ABBREVIATIONS

A		
	ACT	ACTUATOR
	AD	ACCESS DOOR
	AFC	ABOVE FINISHED CEILING
	AFF	ABOVE FINISHED FLOOR
	AFG	ABOVE FINISHED GRADE
	AI	ANALOG IN
	ALM	ALARM
	AO	ANALOG OUT
	AP	ACCESS PANEL
	APPROX	APPROXIMATE
	AS	AIR SEPARATOR
	AUX	AUXILARY
	AV	ACID VENT
	AW	ACID WASTE
B		
	BAS	BUILDING AUTOMATION SYSTEM
	BCS	BUILDING CONTROL SYSTEM
	BCU	BUILDING CONTROL UNIT
	BFF	BELOW FINISHED FLOOR
	BFS	BELOW FINISHED SLAB
	BFG	BELOW FINISHED GRADE
	BLDG	BUILDING
	BOP	BOTTOM OF PIPE
	BTU	BRITISH THERMAL UNIT
	BTUH	BRITISH THERMAL UNIT PER HOUR
C		
	CH	CHILLER
	CHW	CHILLED WATER
	CHWP	CHILLED WATER PUMP
	CHWR	CHILLED WATER RETURN
	CHWS	CHILLED WATER SUPPLY
	CI	CAST IRON
	CKV	CHECK VALVE
	CLG	CEILING
	CO	CLEANOUT
	COND	CONDENSATE
	CP	CIRCULATING PUMP
	CT	COOLING TOWER
	CTRL	CONTROL
	CU	COPPER
	CV	CONSTANT VOLUME, CONRTOL VALVE
	CW	COLD WATER/CITY WATER
D		
	DCW	DOMESTIC COLD WATER
	DDC	DIRECT DIGITAL CONTROL
	DET	DETECTOR
	DFA	DROP FROM ABOVE
	DHW	DOMESTIC HOT WATER
	DI	DUCTILE IRON
	DIA	DIAMETER
	DIS	DISCRETE INPUT, DIGITAL IN
	DN	DOWN
	DO	DISCRETE OUT, DIGITAL OUT
	DP	PIFFERENTIAL PRESSURE
	DPS	DIFFERENTIAL PRESSURE SWITCH
	DPT	DIFFEREINTIAL PRESSURE TRANSDUCER
	DR	DRAIN
	DS	DOWN SPOUT
	DTB	DROP TO BELOW
E		
	EA	EACH
	EL	ELBOW
	EMS	ENERGY MANAGEMENT SYSTEM
	ENA	ENABLE
	ENCL	ENCLOSURE
	ENET	ETHERNET
	EP	EXPLOSION PROOF
	ERH	ELECTRIC RE-HEAT
	ETR	EXISTING TO REMAIN
	EWC	ELECTRIC WATER COOLER
	EWH	ELECTRIC WATER HEATER
	EWT	ENTERING WATER TEMPERATURE
	EWS	EYE WASH STATION
	EXT	EXTERNAL
F		
	FA	FRESH AIR
	FCO	FLOOR CLEAN-OUT
	FD	FIRE DAMPER/FLOOR DRAIN
	FH	FIRE HYDRANT
	FLEX	FLEXIBLE
	FLR	FLOOR
	FLTR	FILTER
	FM	FLOW MONITOR
	FOH	FEET OF HEAD
	FPS	FEET PER SECOND
	FS	FLOOR SINK
	FT	FEET/FOOT
G		
	G	GAS
	GAL	GALLONS
	GCO	GRADE CLEANOUT
	GEN	GENERAL
	GPM	GALLONS PER MINUTE
	GPH	GALLONS PER HOUR
	GT	GREASE TRAP
H		
	HA	HAMMER ARRESTOR
	HB	HOSE BIBB
	HP	HORSEPOWER
	HR	HOUR
	HTG	HEATING
	HUM	HUMIDITY
	HW	HOT WATER (DOMESTIC)
	HWR	HOT WATER RETURN
	HWS	HOT WATER SUPPLY
	HX	HEAT EXCHANGER
I		
	IN	INCHES
	INV	INVERT
	IOM	INSTALLATION & OPERATION MANUAL
	IS	IMMERSION SENSOR
K		
	K	KILO
	KW	KILOWATTS
L		
	LBS	POUNDS
	LG	LARGE
	LWT	LEAVING WATER TEMPERATURE
M		
	MAX	MAXIMUM
	MBH	THOUSAND BTU'S PER HR.
	MH	MANHOLE
	MIN	MINIMUM
	MS	MOP SINK
	MZ	MULTI-ZONE
N		
	NA	NOT APPLICABLE
	NC	NORMALLY CLOSED
	NG	NATURAL GAS
	NO	NORMALLY OPEN
	NU	NUMBER
O		
	ODF	OUTSIDE DRINKING FOUNTAIN
	OF	OVERFLOW
	OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
	OSD	OPEN SIGHT DRAIN
P		
	PCR	PUMPED CONDENSATE
	PD	PRESSURE DROP
	PMP	PUMP
	PPG	PIPING
	PSI	POUNDS PER SQUARE INCH
Q		
	QTY	QUANTITY
R		
	RD	ROOF DRAIN
	RECIR	RECIRCULATION
	REF	REFERENCE
	REV	REVISION
	RFB	RISE FROM BELOW
	RM	ROOM
	RTA	RISE TO ABOVE
	RV	RELIEF VALVE
S		
	SFV	SHUT-OFF VALVE
	SHT	SHEET
	SOL	SOLENOID
	SPC	SPACE
	S_PT	SETPOINT
	S/S	START/STOP
	SS	SANITARY SEWER
	STAS	STATUS
	STG	STAGE
	STM	STEAM
	STS	STORM SEWER
	STZ	SINGLE ZONE
	SV	SOLENOID VALVE
	SW	SANITARY WASTE
T		
	TE	TEMPERATURE ELEMENT
	TEMP	TEMPERATURE
	TP	TRAP PRIMER
	TPRV	TEM. PRESSURE RELIEF VALVE
	TRV	THERMOSTATIC RECIRC. VALVE
	TW	TEMPERED WATER
	TWCO	TWO WAY CLEAN OUT
	TWR	TOWER
	TYP	TYPICAL
U		
	UH	UNIT HEATER
	UON	UNLESS OTHERWISE NOTED
V		
	V	VENT/VOLTS
	VEL	VELOCITY
	VFD	VARIABLE FREQUENCY DRIVE
	VTR	VENT THRU ROOF
W		
	W	WATTS
	W/	WITH
	WC	WATER CLOSET
	WCO	WATER CLEANOUT
	WCU	WATER COOLED UNIT
	WD	WATER DETECTOR
	WH	WATER HYDRANT
	WP	WEATHERPROOF
Z		
	ZN	ZONE
	ZR	ZONE RELAY

PLUMBING NOTES

1. PLUMBING CONTRACTOR SHALL REFER TO ARCHITECTURAL PLANS FOR A.D.A. PLUMBING FIXTURE & STANDARD MOUNTING HEIGHTS.
2. PLUMBING CONTRACTOR SHALL INSTALL TRAP GUARDS IN ALL FLOOR DRAINS & FLOOR SINKS.
3. PLUMBING CONTRACTOR SHALL COORDINATE ALL PIPE ROUTING ABOVE CEILING WITH THE MECHANICAL & ELECTRICAL CONTRACTORS BEFORE INSTALLING.
4. PLUMBING CONTRACTOR SHALL COORDINATE THE MOUNTING HEIGHTS OF ALL AIR HANDLERS WITH THE MECHANICAL CONTRACTOR TO GUARANTEE POSITIVE DRAINAGE OF THE CONDENSATE DRAINS (1/8" PER FOOT SLOPE - MINIMUM).
5. PLUMBING VENTS SHALL NOT BE INSTALLED WITHIN 10' OF ANY FRESH AIR INTAKES. COORDINATE ALL WORK WITH MECHANICAL CONTRACTOR.
6. ALL VALVES SHALL BE INSTALLED NO HIGHER THAN 2'-0" ABOVE THE CEILING. ACCESS DOORS SHALL BE INSTALLED IN GYPBOARD CEILINGS.
7. ALL PIPING PENETRATIONS SHALL BE SLEEVED & GROUTED AROUND OUTSIDE OF SLEEVE. FILL VOIDS AROUND THE PIPING WITH FIRE SEALANT APPROVED FOR THE PURPOSE.
8. ALL DISSIMILAR METAL CONNECTIONS SHALL BE INSTALLED WITH DIELECTRIC UNIONS IMMEDIATELY TO MINIMIZE USE OF GALVANIZED PIPE MATERIAL.
9. MOUNT A.D.A. FLUSH CONTROLS TO WIDE SIDE OF STALL.
10. THE PLUMBING CONTRACTOR SHALL MINIMIZE ALL PLUMBING VENT PENETRATIONS THRU ROOF. PAINT ALL VENTS ON ROOF TO MATCH THE COLOR TONE OF THE METAL ROOF COLOR.
11. THE PLUMBING CONTRACTOR SHALL ALIGN ALL VENTS THRU ROOF IN A REASONABLE MANNER.
12. THE PLUMBING CONTRACTOR SHALL VENT ALL SANITARY WASTE SEPARATELY FROM THE ACID WASTE VENTS.
13. THE PLUMBING INSTALLATION SHALL BE IN ACCORDANCE WITH A.D.A. & LOCAL PLUMBING CODE.
14. INSTALL INSULATION KITS AT ALL HANDICAP LAVATORIES & SINKS.
15. CAULK AROUND ALL PLUMBING FIXTURES.
16. WHERE COLD WATER IS PROVIDED TO TWO CONNECTIONS, CONNECT COLD WATER TO BOTH CONNECTIONS.
17. ALL TOILET SEATS TO BE OPEN FRONT LESS COVER.
18. PROVIDE BACKING SUPPORT FOR ALL WALL HUNG PLUMBING EQUIPMENT.
19. LAVATORIES SHALL CONFORM TO ANSI Z124.3, ASME A112.19 /CSA B45.2, ASME A112.19.2 /CSA B45.1 OR ASME A112.19.3 /CSA B45.4. GROUP WASHUP EQUIPMENT SHALL CONFORM TO REQMNTS OF IPC SECTION 402. EVERY 20 INCHES OF RIM SPACE SHALL BE CONSIDERED ONE (1) LAVATORY.
20. TEMPERED WATER SHALL BE DELIVERED FROM LAVATORIES AND GROUP WASH FIXTURES THRU AN APPROVED TEMPERATURE LIMITING DEVICE CONFORMING TO ASSE 1070 OR CSA B125.3.
21. WATER CLOSETS SHALL CONFORM TO CONSUMPTION REQMNTS OF IPC SECTION 604.4, AND TO ANSI Z124.4, ASME A112.19 /CSA B45.1, ASME A112.19 /CSA B45.4 OR CSA B45.5. WATER CLOSETS SHALL CONFORM TO HYDRAULIC REQMNTS OF ASME A112.19.2 /CSA B45.1. WC TANKS SHALL CONFORM TO ANSI Z124.4, ASME A112.19.2 /CSA B45.1, ASME A112.19.3 /CSA B45.4 CSA B45.5. ELECTRO-HYDRAULIC WC SHALL COMPLY WITH ASME 112..19.2 CSA B45.1.
22. WATER CLOSETS SHALL BE EQUIPPED WITH SEATS OF SMOOTH NON-ABSORBANT MATERIAL, BE OF THE HINGED OPEN FRONT TYPE AND BE SIZED FOR THE WC BOWL TYPE.

PLUMBING SYMBOLS LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
———	SANITARY WASTE	——— - ———	DOMESTIC COLD WATER
▪▪▪▪▪▪▪▪▪▪	SANITARY VENT	——— - - ———	DOMESTIC HOT WATER SUPPLY
——— GW ———	SW TO GREASE TRAP	——— - - - ———	DOMESTIC HOT WATER RETURN
——— GT ———	GREASE TRAP		FLOOR DRAIN
——— NG ———	NATURAL GAS		SHUT OFF VALVE
	SAW CUT REGION		CLEAN OUT

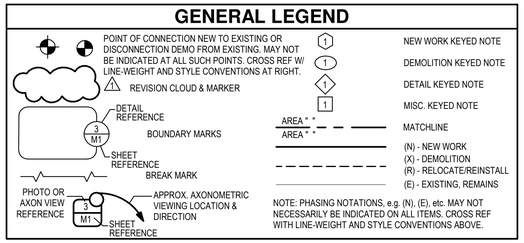
PLUMBING FIXTURE PIPING SCHEDULE

FIXTURE MARK	PIPE SIZE					FIXTURE DESCRIPTION/REMARKS
	COLD	HOT	TRAP	WASTE	VENT	
WC	1-1/4"	---	---	4"	2"	FLOOR MOUNTED, SCHEDULED HEIGHT (NOTE #2), FLUSH VALVE
WC	1-1/4"	---	---	4"	2"	WALL MOUNTED, SCHEDULED HEIGHT (NOTE #2), FLUSH VALVE
SH	3/4"	3/4"	3"	3"	2"	SHOWER SPRAY-HEAD & FLOOR DRAIN
LAV	1/2"	1/2"	1-1/4"	2"	2"	COUNTER-TOP MOUNTED OR WALL MOUNTED (NOTE #2).
SINK	1/2"	1/2"	1-1/4"	2"	2"	COUNTER-TOP MOUNTED OR WALL MOUNTED.
MS	3/4"	3/4"	3"	3"	2"	FLOOR MOUNTED MOP SINK.
UR	3/4"	---	---	2"	2"	WALL MOUNTED URINAL.
EWC	1/2"	---	1-1/4"	2"	2"	ELECTRICAL WATER COOLER (NOTE #2).
FD	---	---	3"	3"	2"	FLOOR DRAIN.
TP	1/2"	---	---	---	---	TRAP PRIMER.

NOTES:

1. PIPE SIZES FOR REFERENCE ONLY. REFERENCE PLANS AND EQUIPMENT MANUFACTURER FOR EXACT SIZES.
2. REF: ARCHITECTURAL PLANS FOR MOUNTING HEIGHTS OF FIXTURES.

GENERAL LEGEND



GENERAL CONCRETE CUT/PATCH NOTES

1. FIELD VERIFY EXISTING CONDITIONS, PRIOR TO START OF ANY WORK. CONFIRM ROUTE AFTER SCANNING WITH CONCRETE-PENETRATING EQUIPMENT SUCH AS HILIT FERROSCAN OR GROUND-PENETRATING RADAR (GPR) TO FIND AND AVOID EMBEDDED ITEMS.
2. COORDINATE PLACEMENT OF DRILLED CORES AND ROUTING OF TRENCH CUTS WITH ALL AVAILABLE DRAWINGS SHOWING STRUCTURAL FEATURES SUCH AS BEAMS AND REINFORCEMENT, AS WELL AS ANY BEARING SUBSTRATE, ALSO, EXAMINE MECHANICAL, ELECTRICAL AND PLUMBING DRAWINGS THAT MAY SHOW OR INFER THE LOCATIONS OF EMBEDDED ITEMS.
3. PLUMBING LINES SHALL BE PLACED AT A DEPTH TO EITHER COMPLETELY PASS BELOW THE BOTTOM OF THE EXISTING FOUNDATION BEAMS OR WITHIN THE MIDDLE THIRD OF THE BEAM DEPTH. TAKE CARE TO NOT DAMAGE ANY BEAM REINFORCING WHILE DRILLING. MAXIMUM CORE SIZE SHALL NOT EXCEED 8" IN DIAMETER. CORES THROUGH THE MIDDLE THIRD OF THE BEAM DEPTH SHALL BE HORIZONTAL AND PERPENDICULAR TO THE FACE OF BEAM.
4. PLAN CONCRETE CUT PLACEMENT AND WIDTH TO ALLOW FOR THE FOLLOWING:
   A. AVOID ANY CUTS LONGER THAN 30" THAT ARE PARALLEL WITH, AND WITHIN 12"OF, A BEAM OR EXISTING WALL TO REMAIN.
   B. SUFFICIENT WIDTH TO REPAIR REBAR BY LAP-AND-TIE SPLICES.
   C. SUFFICIENT CUT WIDTH TO ALLOW FOR TRENCH SIDES TO MAINTAIN A STABLE SLOPE AND STILL BE WIDE ENOUGH FOR THE NEW BURIED ITEMS PLUS SAND CUSHION.
   D. DO NOT OVERCUT TRENCH SIDES UNLESS SUCH CUTS ARE SQUARED OFF THEREAFTER.
5. DRILL SMALL PILOT HOLES AS NECESSARY AT INTENDED LIMITS OF SLAB DEMOLITION TO ENSURE THAT SAWCUTS DO NOT CONFLICT WITH EXISTING FOUNDATION BEAMS.
6. PEEL BACK OR REMOVE FLOOR COVERING TO BEYOND THE WORK AREA. IF FLOORING IS REUSABLE, PRESERVE IT. ANY SHEET MATERIAL OR CARPET TO BE RE-INSTALLED SHALL BE CLEANLY CUT DOWN THE CENTERLINE OF THE TRENCH AND FOLDED OUTWARD SO THAT ONLY ONE AXIAL SEAM IS REQUIRED TO RESTORE IT.
7. CUT CONCRETE SLAB IN TRENCH PATH USING ONE OF THE FOLLOWING METHODS, SUBJECT TO APPROVAL BY THE OWNER, ARCHITECT, AND STRUCTURAL ENGINEER AS APPLICABLE FOR THE PROJECT:
   A. TO PRESERVE EMBEDDED REBARS AND AVOID NEED TO DRILL AND EPOXY REPLACEMENT REBARS:
      a. SAW-CUT SIDES TO DEPTH OF STEEL TOP ONLY.
      b. SAW-CUT TRENCH CENTERLINE THROUGH SLAB, BUT NOT THROUGH BEAMS.
      c. CUT SLAB TO DEPTH OF STEEL TOP ONLY AT EACH SIDE OF EACH BEAM, AND CUT FULLY THROUGH THE SLAB AT LEAST THIRTY (30) BAR DIAMETERS AWAY FROM THE BEAM.
   B. FOR LESS CUTTING AND MORE DIFFICULT STEEL REPAIR:
      a. SAW-CUT TRENCH SIDES THROUGH SLAB, BUT NOT THROUGH BEAMS.
      b. CUT FULLY THROUGH THE SLAB AT EACH SIDE OF EACH BEAM.
8. BREAK OUT SLAB CONCRETE (AND BEND BACK REBAR AS REQUIRED) TO EXCAVATE TRENCH AND INSTALL ITEMS BELOW FLOOR AND BEAMS.
9. EXISTING VAPOR BARRIER SHALL BE CUT ALONG THE CENTERLINE OF THE INTENDED TRENCH AND PULLED BACK PRIOR TO TRENCH EXCAVATION.
10. EXCAVATE SUBSTRATE ENSURING THAT SLAB EDGES ARE NOT UNDERMINED. PROVIDE AT LEAST 1" CUSHION OF SAND AROUND ALL SIDES OF INSTALLED ITEMS. BACKFILL WITH EXCAVATED MATERIAL IN HORIZONTAL LOOSE LIFTS NOT EXCEEDING 6" AND COMPACT LIFTS ABOVE 95% OF THE STANDARD PROCTOR (ASTM D 698) MAXIMUM DRY DENSITY AND WITHIN -3% TO 3% OPTIMAL MOISTURE CONTENT.
11. RESTORE CONTINUITY OF REBAR BY LAP-AND-TIE SPLICES. IF AND WHERE EXISTING REBAR CANNOT BE SO RESTORED, DRILL INTO SLAB EDGES ON EACH SIDE AND ANCHOR REPAIR REBAR IN EACH HOLE WITH EPOXY, LAP BARS AND TIE THEM. EPOXY FOR DOWELS INTO EXISTING CONCRETE SHALL BE INTENDED FOR HORIZONTAL APPLICATION AND SHALL BE CAPABLE OF DEVELOPING THE YIELD STRENGTH OF THE DOWEL WITH EMBEDMENT AS SPECIFIED BY THE EPOXY MANUFACTURER. EPOXY TECHNICAL DATA SHALL BE SUBMITTED TO THE A/E FOR APPROVAL PRIOR TO USE. FOLLOW MANUFACTURER'S INSTRUCTIONS. SUBMIT DETAILS OF EMBEDMENT AND LAP-AND-TIE SPLICES TO STRUCTURAL ENGINEER FOR APPROVAL PRIOR TO INSTALLATION. NEW REINFORCING SHALL BE OF SIZE AND SPACING IDENTICAL TO ORIGINAL REINFORCING.
12. PLACE INFILL CONCRETE AT LEAST FULL THICKNESS OF ORIGINAL SLAB AND TROWEL SMOOTH WITH EXISTING TOP OF SLAB. USE CONCRETE WITH AT LEAST 4000 PSI STRENGTH, AND APPROVED BY THE STRUCTURAL ENGINEER.
13. REPLACE OR RESTORE FLOOR FINISH TO MATCH SURROUNDINGS AS DIRECTED BY OWNER AND ARCHITECT.

PLUMBING PIPING SUPPORT SPACING

PIPING MATERIAL	SIZE (DIA)	MAXIMUM HORIZONTAL SPACING (FT)	MAXIMUM VERTICAL SPACING (FT)	NOTES
ABS PIPE	---	4	10	2
ALUMINUM PIPE & TUBING	---	10	15	---
BRASS PIPE	---	10	10	---
BRASS TUBING	≤ 1-1/4"	6	10	---
BRASS TUBING	≥ 1-1/2"	10	10	---
CAST IRON PIPE	---	5	15	1
COPPER & COPPER ALLOY PIPE	---	12	10	---
COPPER & COPPER ALLOY TUBING	≤ 1-1/4"	6	10	---
COPPER & COPPER ALLOY TUBING	≥ 1-1/2"	10	10	---
CPVC PIPE & TUBING	≤ 1"	3	10	2
CPVC PIPE & TUBING	≥ 1-1/4"	4	10	2
STEEL PIPE	---	12	15	---
STEEL TUBING	---	8	10	---
LEAD PIPE	---	CONTINUOUS	4	---
PP PIPE & TUBING	---	2-2/3 (32 INCHES)	10	2
PEX TUBING	---	2-2/3 (32 INCHES)	10	2
PVC PIPE	---	4	10	2

SOURCE REF: 2021 UNIFORM PLUMBING CODE; LOCATION: T:\Design Master\01 - PROJECT FILE Structure Folders For Project Folder\Design\12 - Design Phase\Plbg\Calculations

NOTES:

1. THE MAXIMUM HORIZONTAL SPACING OF CAST IRON PIPE HANGERS SHALL BE INCREASED TO 10 FEET WHERE 10 FOOT LENGTHS OF PIPE ARE INSTALLED.
2. PROVIDE MID-STORY GUIDES.

GENERAL PLUMBING NOTES

1. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, & FEDERAL CODES/STANDARDS. CRAFTSMANSHIP & MATERIAL SHALL BE OF THE HIGHEST QUALITY.
2. REFER TO SPECIFICATION DIVISION 22 FOR ADDITIONAL INFORMATION REGARDING THE PROJECT. THE DRAWINGS & THE SPECIFICATIONS ARE BOTH INCLUDED IN THE CONTRACT DOCUMENTS.
3. ALL PLUMBING SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST EDITION OF THE AMERICAN SOCIETY OF PLUMBING ENGINEERS "DATA BOOK".
4. THE CONTRACTOR SHALL REVIEW THE CONTRACT DOCUMENTS FULLY PRIOR TO THE SUBMITTAL PHASE OF THE PROJECT. CONFLICTS WITHIN & BETWEEN THE CONTRACT DOCUMENTS SHALL BE NOTED IN WRITING TO THE ENGINEER PRIOR TO SUBMITTING DATA SHEETS FOR REVIEW.
5. IT IS THE INTENT OF THE DRAWINGS TO SHOW A COMPLETE DESIGN IN EVERY RESPECT. THE CONTRACTOR SHALL BE RESPONSIBLE FOR A COMPLETE & FULLY FUNCTIONAL INSTALLATION. THE PRIME CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING THE WORK BETWEEN SUBCONTRACTORS TO ASSURE THAT THE INSTALLATION WILL BE COMPLETE WITHOUT ADDITIONAL COST TO THE CONTRACT.
6. AVOID EXCESSIVE OFFSETS IN PIPING UNLESS SPECIFICALLY INDICATED.
7. PROVIDE VALVE HANDLE EXTENSIONS AS REQUIRED TO ACCOMMODATE CLEARANCE OF INSULATION. VALVE HANDLE ACTUATION SHALL NOT DISTURB INSULATION.
8. BOTH THE SUBCONTRACTOR FOREMAN & THE PRIME CONTRACTOR FOREMAN SHALL VISUALLY INSPECT THE QUALITY & COMPLETENESS OF INSTALLATION PRIOR TO REQUESTING A FIELD OBSERVATION BY THE ENGINEER. PROVIDE A MINIMUM OF TWENTY-FOUR HOUR WRITTEN NOTICE TO THE ENGINEER PRIOR TO ANY FIELD OBSERVATION REQUIREMENTS.
9. DO NOT COVER ANY MECHANICAL OR PLUMBING WORK IN WALLS, BENEATH SLABS, IN TRENCHES, ABOVE CEILINGS, ETC. PRIOR TO REQUESTING OBSERVATION BY THE ENGINEER. ALL WORK COVERED WITHOUT OBSERVATION BY THE ENGINEER SHALL BE UNCOVERED FOR OBSERVATION.
10. ALL EQUIPMENT, FIXTURES, & PIPING SHALL BE INSTALLED PARALLEL TO BUILDING LINES.
11. SCHEDULING SHALL BE CLOSELY COORDINATED WITH THE OWNER, & NO WORK SHALL PROCEED WITHOUT AN OWNER-APPROVED SCHEDULE. WORK SHALL BE DONE SO AS TO MINIMIZE DISRUPTIONS TO BUILDING ACTIVITIES. SCHEDULE ALL SHUTDOWNS AT LEAST 48 HOURS IN ADVANCE WITH OWNER IN WRITING. REFER TO SPECIFICATIONS FOR AREAS REQUIRING SPECIAL ACCESS, SCHEDULING, &/OR SECURITY.
12. CONTRACTOR SHALL COORDINATE WITH OTHER TRADES. CONFLICTS SHALL BE BROUGHT TO THE ATTENTION OF THE PRIME CONTRACTOR, THE ARCHITECT/ENGINEER, & AS NECESSARY, THE OWNER.
13. AT SUBSTANTIAL COMPLETION OF EQUIPMENT INSTALLATION, BIND & TURN OVER ALL EQUIPMENT OPERATION & MAINTENANCE MATERIAL TO OWNER.
14. KEEP PIPING INTERIOR CLEAN & FREE OF DEBRIS THROUGHOUT THE PROJECT. CAP ALL OPEN ENDS OF PIPING EXPOSED TO THE ELEMENTS.
15. EQUIPMENT OR MATERIALS SUBSTITUTED AS APPROVED EQUAL TO THAT SHOWN ON THE PLANS & SPECIFIED SHALL BE COMPATIBLE IN ALL RESPECTS. ANY CHANGES OR MODIFICATIONS REQUIRED TO ACCOMMODATE THE SUBSTITUTED ITEMS SHALL BE MADE BY THE CONTRACTOR AT NO EXTRA COST TO THE OWNER.
16. FIRE-STOP ALL DEMISING WALL PENETRATIONS. ALL EXTERIOR WALL PENETRATIONS TO BE SEALED WEATHER TIGHT.
17. ALL OCCUPIED WORK AREAS SHALL BE LEFT IN A WIPE CLEAN & SECURE CONDITION EACH TIME THE CONTRACTOR LEAVES THE WORK AREA.
18. CONTRACTOR SHALL USE A DUST COLLECTING VACUUM DURING ANY DRILLING OR HAMMER DRILLING TO HELP MAINTAIN A CLEAN WORK ENVIRONMENT. COORDINATE WITH THE GENERAL CONTRACTOR FOR APPROPRIATE TIMES FOR DRILLING.
19. HORIZONTAL VENT PIPING SHALL BE SLOPED TO FACILITATE LIQUID GRAVITY FLOW BACK TO THE SOIL OR WATER WASTE PIPE.
20. PROVIDE SHUTOFF VALVES IN ALL DOMESTIC WATER PIPING SYSTEM BRANCHES IN WHICH BRANCH PIPING SERVES TWO OR MORE FIXTURES.
21. UNLESS OTHERWISE NOTED, ALL DOMESTIC COLD & HOT WATER PIPING SHALL BE 3/4-INCH SIZE.
22. UNLESS OTHERWISE NOTED, ALL PIPING SHALL BE OVERHEAD OR TIGHT TO UNDERSIDE OF SLAB, WITH SPACE FOR INSULATION IF REQUIRED.
23. INSTALL PIPING SO THAT ALL VALVES, STRAINERS, UNIONS, TRAPS, FLANGES, & OTHER APPURTENANCES REQUIRING ACCESS ARE ACCESSIBLE.
24. WHERE DOMESTIC COLD & HOT WATER PIPING DROPS INTO A PIPE CHASE, THE SIZE SHOWN FOR THE PIPE DROPS SHALL BE USED TO THE LAST FIXTURE.
25. INSTALL ALL PIPING WITHOUT FORCING OR SPRINGING.
26. ALL PIPING SHALL GRADE TO LOW POINTS. PROVIDE HOSE & DRAIN VALVES AT THE BOTTOM OF ALL RISERS & LOW POINTS.
27. UNIONS &/OR FLANGES SHALL BE INSTALLED AT EACH PIECE OF EQUIPMENT, IN BYPASSES, & IN LONG PIPING RUNS (100-FEET OR GREATER) TO PERMIT DISASSEMBLY FOR ANY ALTERATIONS & REPAIRS.
28. ALL VALVES SHALL BE ADJUSTED FOR SMOOTH & EASY OPERATION.
29. ALL VALVES (EXCEPT CONTROL VALVES) & STRAINERS SHALL BE FULL SIZE OF PIPE BEFORE REDUCING SIZE TO MAKE CONNECTION TO EQUIPMENT & CONTROLS.
30. PROVIDE ALL PLUMBING FIXTURES & EQUIPMENT WITH ACCESSIBLE STOPS.
31. UNLESS OTHERWISE NOTED, DRAINS SHALL BE INSTALLED AT THE LOW POINT OF AREAS, WALKWAYS, FLOORS, ETC.
32. ALL VALVES SHALL BE INSTALLED SO THAT VALVE REMAINS IN SERVICE WHEN EQUIPMENT OR PIPING ON EQUIPMENT SIDE OF VALVE IS REMOVED.
33. ALL PIPING WORK SHALL BE COORDINATED WITH ALL TRADES INVOLVED. OFFSETS IN PIPING AROUND OBSTRUCTIONS SHALL BE PROVIDED AT NO ADDITIONAL COST TO THE OWNER.
34. INSULATE ALL SUPPLY PIPING IN UNCONDITIONED SPACE WITH A LEAST 1/2" INSULATION FOR FREEZE PROTECTION. WHERE DIRECTLY EXPOSED TO AMBIENT OUTDOOR AIR TEMPERATURES, ALSO PROVIDE THERMOSTATIC ELECTRIC HEAT TAPE, RATED 1 WATT PER LINEAR FOOT.
35. ALL PIPING TO BE INSULATED PER IECC ENERGY CODE, 2021 EDITION .

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PLUMBING GENERAL NOTES AND LEGENDS

SHEET TITLE:

REVISIONS:

NO.	DATE

Job No:	T2414
Drawn by:	TO
Checked by:	TS/SK/EB
Sheet No.	P1.1
Date:	APRIL 2025

PLUMBING FIXTURE SCHEDULE:

MARK	PLUMBING FIXTURES	MANUFACTURE & MODEL NO.	TRIM
CP-1	DOMESTIC HOT WATER	BELL & GOSSET, SERIES 100 Model # BG-106190	5 GPM @ 7.5 FEET HEAD, 1/12 HP, 120 V, 3/4" FLANGED, ALL BRONZE, IN LINE W/ REMOTE SENSING AQUA STAT CONTROLLER (B&G AQS-XX) AND TIMER (B&G TC-1) PER IECC
FCO	FLOOR CLEANOUT	WADE,# W-8130-AF &/OR MIFAB C1100-R-1 J.R.SMITH, #4031L ZURN, ZN1400-BZ1	PVC FLOOR CLEANOUT W/ ADJUSTABLE BRASS TOP, BRASS W/ ROUND NICKEL BRONZE VP TOP, PLUG & STAIN NICKEL BRONZE SECURED SCOR. COVER. PROVIDED WITH ROUGH-IN COVER AND POST POUR ADJUSTABILITY
TWCO	TWO-WAY GRADE CLEANOUT	J.R.SMITH, #4031L ZURN, ZN1400-BZ1	SETS OF FITTINGS & CONCRETE PADS W/ OPPOSED Y-FITTINGS
WCO	WALL CLEANOUT	WADE,# W-8470-R &/OR MIFAB C1430-RD J.R.SMITH, #4402C &/OR #4472T ZURN Z1441-C	BRASS PLUG W/ ROUND POLISHED BRASS VANDAL PROOF SCREW ACCESS COVER PLATE
FD-1	FLOOR DRAIN CP REST ROOMS.	PROSET T*5630-F-CI, T*5630-F-P, (* INDICATES PIPE SIZE) OR APPROVED EQUAL. ZURN Z1072	1/2" TRAP PRIMER CONNECTION ON PLANS, *** DIGIT IN MODEL NUMBER DENOTES CONNECTION SIZE. REFERENCE PLANS. INTEGRAL TRAP GUARD OR EQUIVALENT: NORMALLY CLOSED TRAP SEAL DEVICE; OPEN AGAINST AS LITTLE 1 OZ. INLET WATER; HOLD SEAL AGAINST 2" W.G. AT OULET; DRAIN SNAKE ACCEPTING: ELASTOMERIC GUARD MATERIAL TESTED TO CSA B602-05 OR EQUIVALENT STANDARD FOR TENSILE STRENGTH HARDNESS, OIL/FLUID IMMERSION, WATER ABSORPTION, HEAT AGING, LOW TEMP FLEXIBILITY & TEAR STRENGTH.
TP	TRAP PRIMER	PRECISION PLUMBING PRODUCTS MIFAB M500/MI-100/MI-300 ZURN Z1022-XL	INDIVIDUAL & MULTIPLE MODULES REQUIRED SEE PLANS & DETAILS
HB	HOSE BIB /WALL HYDRANT, OUTDOOR	ZE MIFAB MHY-16-3; ZURN Z1321-XL	W/ VACUUM BREAKER ENCASED STAINLESS STEEL BOX. CONCEALED HOSE CONNECTION & KEY ACTIVATED. NON-FREEZE TYPE.
LAV-B	LAVATORY ADA COMPLIANT (LAV & ALL ACCESSORIES) COLD & HOT WATER	KOHLER K2006-0; ZURN Z5364 WALL HUNG (8" CENTER) REF: ARCHITECTURAL PLANS FOR MOUNTING HEIGHT	VITREOUS CHINA WHITE C.P. RIGID SUPPLIES WITH REMOVABLE STOPS. C.P.-PTRAP W/ CLEANOUT. LAV FAUCET T&S BRASS B-2990-WH4-CRM; OR ZURN Z831R4-XL-ICT W/ COVER FLANGE, VANDAL RESISTANT FAUCET & AERATOR, WATTS L1170 OR ZURN Z831R4-XL-ICT HOT H2O MIXING VALVE, WALL BRACKET AND GRID STRAINER DRAIN, CHROME FINISH 3/8" ODLP SUPPLIES ADA COMPLIANT LAVGUARD, INSTALL ALL BRASS CARTRIDGE WITH THE FAUCET LAV SUPPORT W/ CONCEALED ARM - MIFAB MC-41 OR ZURN Z1231.
MS-B	MOP BASIN FLOOR MTD.	ZURN, Z1996-36	PROVIDE W/ SHELF, FAUCET MOD. Z843M1-XL, HOSE & HOSE BRACKET MOD. Z1996-HH, MOP HANGER MOD. Z1996-MH, STRAINER MODEL 1453-BB, OR ZURN Z5850-D3 DRAIN CONNECTION QDC3-2, BUMPER GUARD, SERVICE FAUCET TO BE 8" CC.
SK-1	SINK CW & HW (ADULTS)	ELKAY LRAD2219C SINGLE BOWL - 6.5" DEEP ADA COMPLIANT	PROVIDE W/ T&S BRASS B-2866-01 OR ZURN Z831C4-XL-ICT FAUCET & ELKAY LKAD-35, OR ZURN ZSS3000W-SS DRAIN SYSTEM. COORDINATE SIZE W/ MILLWORK. REFERENCE ARCHITECTURAL PLANS.
TMV-1	TEMPERING MIXING VALVE (LAWLER, ARMSTRONG/LEONARD SYMMONS)	LEONARD LV-186-983 LAWLER MOD 804 ARMSTRONG RADA 40 OR RADA 50	HIGH-LOW THERMOSTATIC WATER MIXING VALVE - SIZED FOR EACH APPLICATION OR APPROVED EQUAL BY LEONARD MEGRATION OR SYMMONS.
LTMV-1	TEMPERING MIXNG VALVE FOR SINGLE LAVATORIES & SINKS	WATTS MOD.#LFMMV-UT-M1 POWERS MOD.#LFLM4951; ZURN ZW1070XL	PROVIDE MIXING VALVE ON EACH SINGLE SINK &/OR LAVATORY. SIZE FOR 1/2" CONNECTIONS.
UR "A"	URINAL ELONGATED URINAL @ 14" RIM	KOHLER DEXTER K-5016-ET-0; ZURN Z5730 (ADA)	WALL HUNG WHITE VITREOUS CHINA SIPHON JET FLUSH ACTION SLOAN ROYAL FLUSH VALVE #186-0.5, 0.5 GAL. FLUSH VALVE (3912697) JR SMITH 0836. ZURN Z6003AV-EWS FLUSH VALVE & ZURN Z1221 CARRIER SYSTEM ALTERNATE SENSOR FV: ZER6003AV-EWS-CPM
US2	WASH SINK	EAGLE, 2424-1-16/4-IF	SINK INCLUDES FAUCET. PROVIDE STAINLESS STEEL DRAIN.
WS1	EYEWASH	HUGHES 18GS45GT WITH SIGNAGE	20"X30"X103"
WC-C	WATER CLOSET FLOOR MOUNTED (17" HIGH), ADA HEIGHT	KOHLER K-3519 ZURN Z5560 1.6 GPF OR Z5561 1.1 GPF ELONGATED BOWL ADA COMPLIANT	W/ K4484 FLUSHMETER PRESSURE ASSISTED TANK, #735084-400 TANK COVER WHITE, SLOAN VALVE FLUSHMATE III TANK SYSTEM; BARRINGTON PRESSURE ASSISTED 1.6 GPF TOILET

NOTES:

1. REFERENCE ARCHITECTURAL PLANS FOR MOUNTING HEIGHTS AND OTHER PERTINENT INFO.
2. PROVIDE SINK DISPOSER ROUGH-IN PREP ONLY IN THE FOOD PRODUCTION AREA.
2. CONTRACTOR TO VERIFY ALL MANUFACTURER MODEL NUMBERS W/ SUGGESTED MANUFACTURERS LATEST MATCHING COMPONENT & IT'S CORRESPONDING MODEL NUMBER.
3. PROVIDE ALL SINKS & LAV'S SUPPLIED W/ HOT WATER - 'POWERS' HYDROGUARD SERIES LFLM495 (FOR SINGLE FIXTURE) LFLM490 (FOR UP TO FOUR FIXTURES MAX.)
   THERMOSTATIC TEMPERING VALVE(S) OR APPROVED EQUAL.

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PRICINCT 2 ROAD AND BRIDGE FACILITY
BASTROP COUNTY
911 SE MARTIN LUTHER KING BLVD
SMITHVILLE TX, 78957

PLUMBING SCHEDULES

SHEET TITLE:

REVISIONS:

NO.	DATE

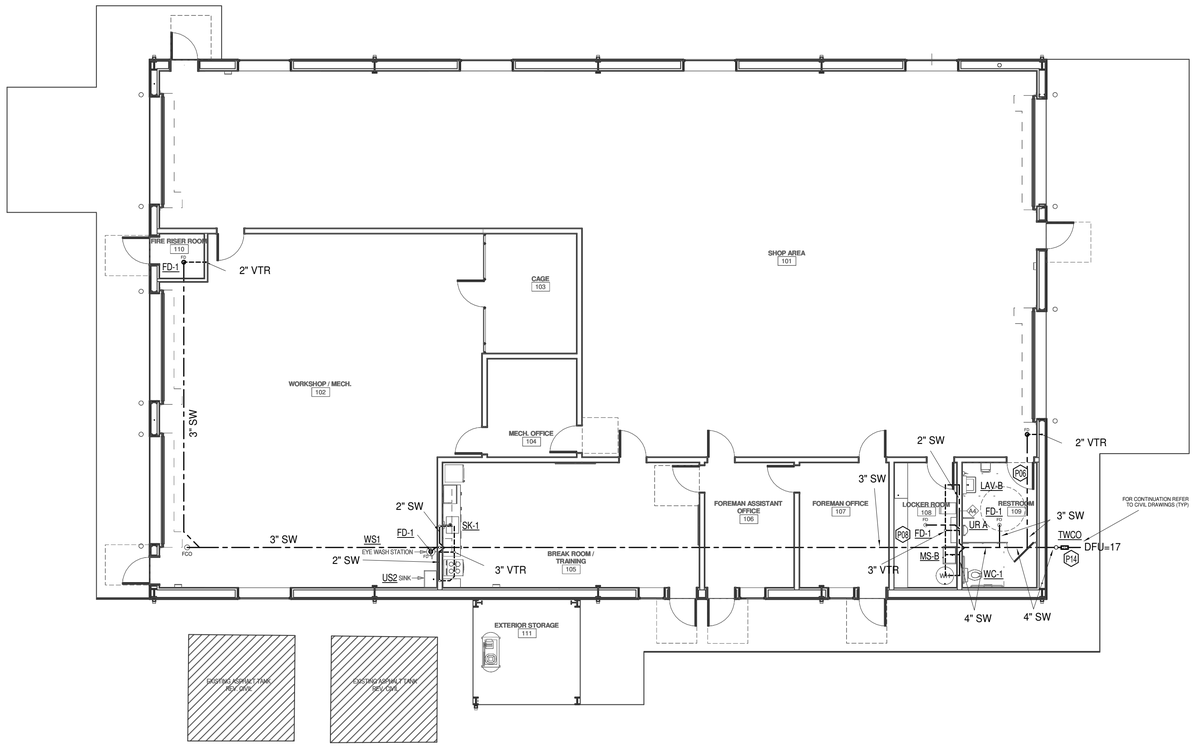
Job No:	T2414
Drawn by:	TO
Checked by:	TS/SK/EB
Sheet No.	

P2.1

Date: APRIL 2025

GENERAL PLUMBING NOTES

1. REFER TO SHEET P1.1 FOR GENERAL NOTES AND LEGENDS.



1 LVL01 SANITARY & VENT PLAN
1/8" = 1'-0"

PLUMBING NEW WORK KEYED NOTES

P06 TYPICAL RESTROOM LAYOUT & DESIGN INCLUDES FLOOR DRAIN (FD-1), WATER CLOSET (WC-C), LAVATORY (LAV-B), URINAL (UR-A), SANITARY WASTE & VENT FOR EACH. DHW, DCW AND HW RECIRQ FOR LAV-B, DCW FOR WC-C AND UR-A. PROVIDE TRAP PRIMER (TP) ON FLOOR DRAIN AND TEMPERING VALVE (LTMV-1) ON LAVATORY.

P08 COORDINATE FLOOR SINK AND/OR DRAIN LOCATIONS WITH MECHANICAL EQUIPMENT, WATER HEATER, EQUIPMENT DRAINS, COMPRESSOR, CONDENSATE ROUTING, ETC. PROVIDE TRAP PRIMER (TP) ON FLOOR SINK. (TYP)

P14 COORDINATE BELOW GRADE SS INVERTS AND DW SUPPLY PIPING ELEVATIONS WITH FOUNDATION GRADE BEAMS UPON ENTERING AND EXITING THE BUILDING. (TYP)

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SANITARY AND VENT INSTALLATION PLAN

SHEET TITLE:

REVISIONS:

NO.	DATE

Job No:	T2414
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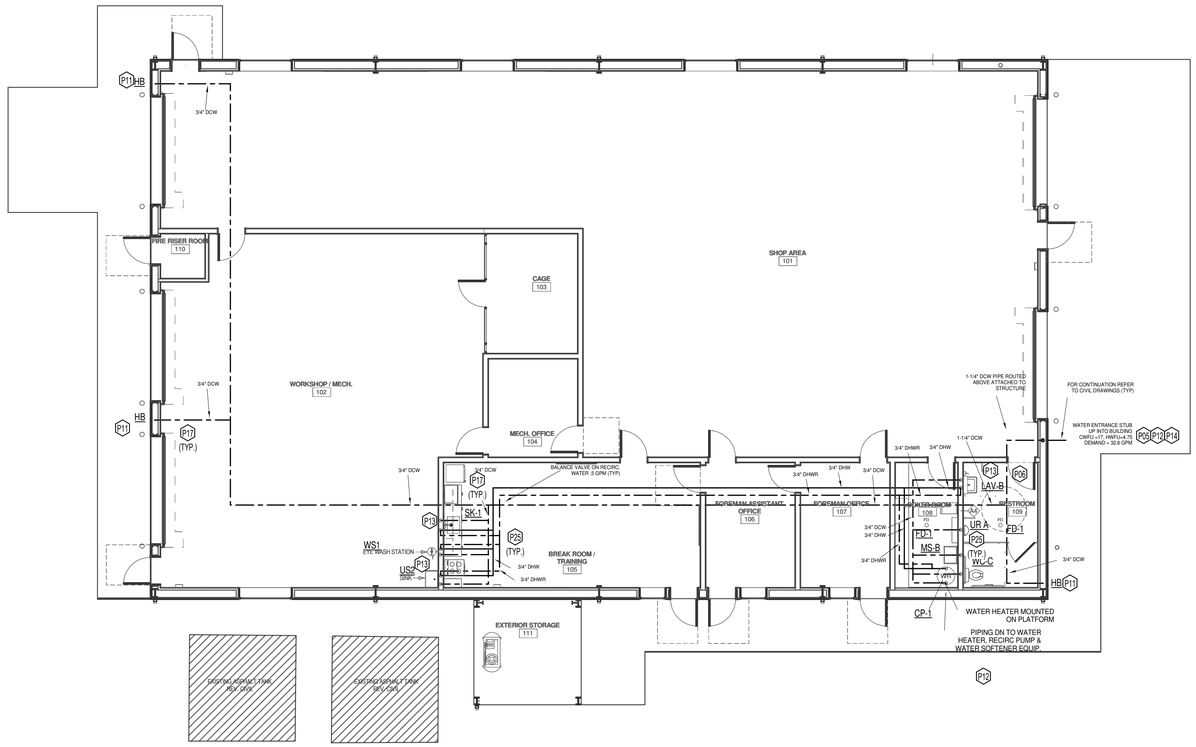
Checked by:	TS/SK/EB
Sheet No.	**P4.1**
Date:	APRIL 2025



1 LVL01 DOMESTIC WATER PLAN
1/8" = 1'-0"

GENERAL PLUMBING NOTES

1. REFER TO SHEET P1.1 FOR GENERAL NOTES AND LEGENDS.

PLUMBING NEW WORK KEYED NOTES

P05 PROVIDE DOUBLE CHECK BACKFLOW WITH ISOLATION VALVES AT DOMESTIC WATER ENTRY INTO THE BUILDING. PROVIDE DRAINAGE PIPE ROUTED TO NEARBY FLOOR DRAIN. PROVIDE 2" AIR GAP WHERE BACKFLOW ASSEMBLY DRAINS TO DRAINAGE PIPE. ALLOW CLEARANCES FOR MAINTENANCE. COORDINATE LOCATION WITH ALL OTHER TRADES

P06 TYPICAL RESTROOM LAYOUT & DESIGN INCLUDES FLOOR DRAIN (FD-1), WATER CLOSET (WC-C), LAVATORY (LAV-B), URINAL (UR-A), SANITARY WASTE & VENT FOR EACH. DHW, DCW AND HW RECIRQ FOR LAV-B. DCW FOR WC-C AND UR-A. PROVIDE TRAP PRIMER (TP) ON FLOOR DRAIN AND TEMPERING VALVE (LTMV-1) ON LAVATORY.

P11 ISOLATION VALVE WITH 3/4" DW DOWN TO HOSE BIB (TYP)

P12 WATER SOFTENING PIPING, CONNECTIONS, AND EQUIPMENT BY OTHERS

P13 DHW PIPING DOWN TO SINKS AND LAVATORIES SHALL MEET IECC 2018 REQUIREMENTS FOR CONNECTION TO PLUMBING FIXTURE. THE 3/4" DHW SUPPLY PIPING IS TO DROP DOWN CLOSE ENOUGH TO FIXTURE THEN BRANCH OFF WITH 1/2" DHW CONNECTION SO THAT THE 1/2" LENGTH FROM 3/4" DHW SUPPLY TO FIXTURE CONNECTION IS 24" MAX. THE 3/4" DHWS PIPING AT THE 1/2" BRANCH CONTINUES ON AS 3/4" DHWR AND THEN UP TO THE 3/4" DHWR PIPING OVERHEAD, THROUGH THE VALVES AND BACK TO THE HW HEATER. (TYP)

P14 COORDINATE BELOW GRADE SS INVERTS AND DW SUPPLY PIPING ELEVATIONS WITH FOUNDATION GRADE BEAMS UPON ENTERING AND EXITING THE BUILDING. (TYP)

P17 MODIFICATIONS TO STRUCTURE MAY BE NECESSARY WHEN ROUTING INTERIOR PIPING. OWNER TO CONSULT WITH A STRUCTURAL ENGINEER AND /OR PREFABRICATED BUILDING PROVIDER. (TYP)

P25 PROVIDE ACCESSIBLE ISOLATION VALVES ABOVE CEILING IN EACH FIXTURE BRANCH.

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04/04/2025

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DOMESTIC WATER INSTALLATION PLAN
SHEET TITLE:

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NO.	DATE

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Sheet No.	P4.2
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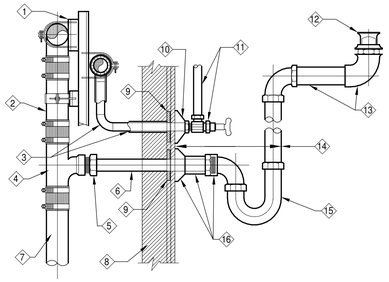
GEN. NOTES :

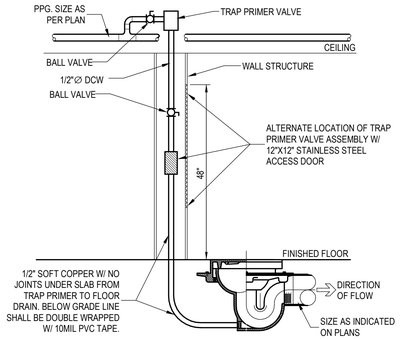
1. ALL EXPOSED PIPING, VALVES, EQUIPMENT, ECT. TO BE A.D.A. COMPLIANT.
2. INSULATION SHALL RUN CONTINUOUS THRU SUPPORTS, REF. GEN. NOTES & SPECIFICATIONS.
3. NO-HUB PIPE CLAMPS SHALL BE MINIMUM 4-BAND, TYP.



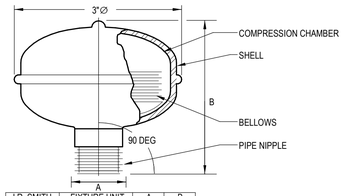
DETAIL KEYED NOTES:

1. FOR PPG. SUPPORTS REF: PPG. HANGERS & SUPPORTS DETAIL.
2. VENT PPG. SIZED PER PLAN.
3. TYPE 'L' COPPER PIPE (INSULATE PER SPEC'S.).
4. 2"x1-1/2" FOR (SINK, EDF'S & LAV'S.) SANITARY TAPPED TEE.
5. NIBCO TYPE DWV 804 ADAPTOR.
6. TYPE 'L' COPPER PIPE.
7. CAST IRON SANITARY WASTE (2" MIN.). REF: TO PLANS FOR LOCATION/ROUTING.
8. WALL CONSTRUCTION (REF: ARCH. DWG'S.)
9. COPPER STUB-OUT SUPPORT BRACKETS TO SPAN STUDS, SOLDER TO PIPE, OR ENGINEER APPROVED EQUAL. PIPE INSULATION: STUB TO BACK OF BRACKET & SEAL.
10. NIBCO TYPE 604 CHROME PLATED BRASS ESCUTCHEON.
11. HEAVY LAVATORY SUPPLY KIT: HEAVY PATTERN COMMERCIAL, 1/4 TURN BALL ANGLE STOP VALVE W/ LOOSE KEY HANDLES & HEAVY CHROME PLATED COPPER SUPPLIES W/ INSULATED COVERS. (TYP. DO NOT USE BRAIDED FLEXIBLE SUPPLY CONNECTORS.)
12. GRID STRAINER.
13. A.D.A LAVATORY OFFSET, USE AS REQUIRED TO ACHIEVE (T.A.S.) COMPLIANCE, REQUIRES ENGINEER APPROVAL.
14. LOCATE P-TRAP TO PROVIDE FOR MIN. KNEE CLEARANCE OF 8" (PER T.A.S.).
15. HEAVY CHROME PLATED 17 GAUGE BRASS P-TRAP & HEAVY CHROME BRASS ELBOW. INSULATE ALL EXPOSED SINK WASTE & WATER OUTLET PPG. & STOP VALVES, AS PER SPECIFICATIONS & (T.A.S.).
16. NIBCO DWV TRAP ADAPTOR & HEAVY CHROME PLATED BRASS COVER TUBE OR CHROME PLATED BRASS NIPPLE. PROVIDE CHROME PLATED SOLID CAST BRASS ESCUTHEON W/ SET SCREW, (TYP. AT WASTE & WATER WALL PENETRATIONS).

1 TYPICAL LAVATORY & SINK PIPING CONNECTION DETAIL



2 TYPICAL TRAP PRIMER & ASSEMBLY CONNECTION DETAIL

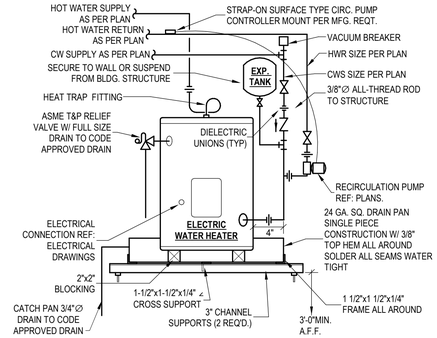


J.R. SMITH FIG. NO	FIXTURE UNIT RATING	A SIZE	B SIZE
5005	1 - 11	3/4"	4"
5010	12 - 32	1"	5"
5020	33 - 60	1"	6"
5030	61 - 113	1"	7"
5040	114 - 154	1"	8"
5050	155 - 330	1"	9"

NOTE:

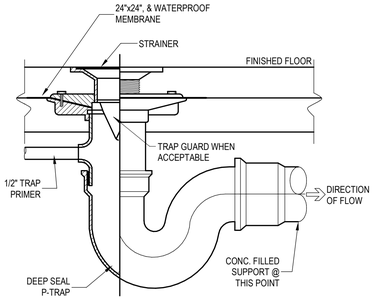
1. SELECT & INSTALL WATER HAMMER ARRESTORS PER PDH-WH 201.
2. INSTALL WATER HAMMER ARRESTORS AT END OF EACH BRANCH LINE BETWEEN LAST 2 FIXTURES SERVED.
3. INSTALL ADDITIONAL WATER HAMMER ARRESTOR IN BRANCH LINES EXCEEDING 20' IN LENGTH.
4. INSTALL WATER HAMMER ARRESTORS IN UPRIGHT POSITION W/ GATE VALVE.
5. INSTALL MIN. 6"x 8" ACCESS PANEL, FINISH TO BE SELECTED BY OWNER/ARCHITECT.

3 TYPICAL WATER HAMMER ARRESTOR DETAIL



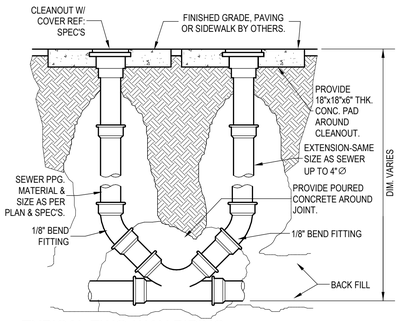
NOTES: 1) ALL DHW PIPING TO BE INSULATED PER IECC, CURRENT EDITION.

4 TYPICAL SMALL ELECTRIC WATER HEATER W/ RECIR. PUMP & PIPING DETAIL

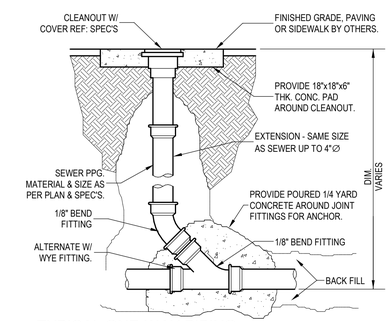


NOTE:
PROVIDE A PROSET/MIFAB OR APPROVED EQUAL FLOOR/SINK DRAIN TRAP GUARD WHEN TRAP PRIMER IS NOT ACCEPTABLE.

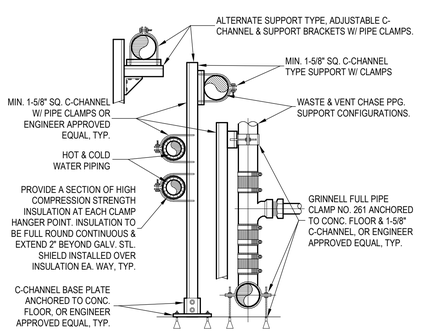
5 TYPICAL FLOOR DRAIN w TRAP PRIMER INSTALLATION DETAIL



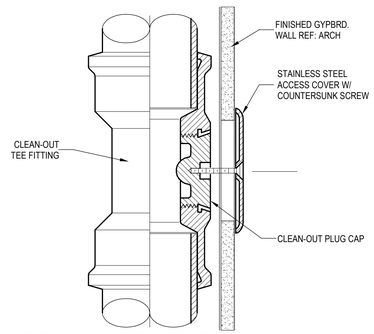
6 TYPICAL TWO-WAY PIPING CLEANOUT INSTALLATIONDETAIL



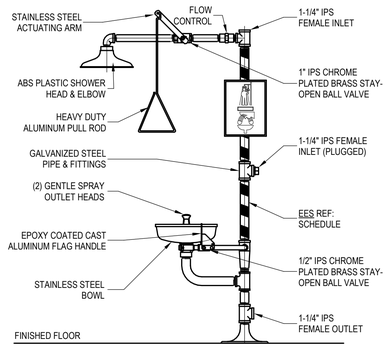
7 TYPICAL ONE-WAY PIPING CLEANOUT INSTALLATION DETAIL



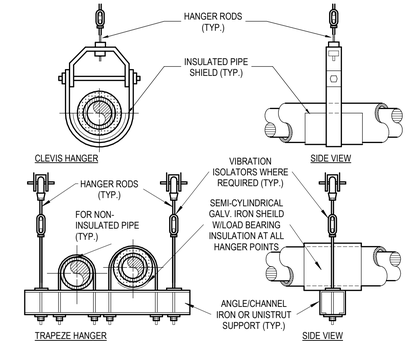
8 TYPICAL WASTE & VENT PIPING HANGER SUPPORT DETAIL



9 TYPICAL WASTE & VENT WALL CLEANOUT INSTALLATION DETAIL



10 TYPICAL EMERGENCY EYE FACE SHOWER WASH DETAIL



11 TYPICAL TYPE VI PIPE STRUCTURE HUNG SUPPORT DETAIL

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PLUMBING DETAILS

SHEET TITLE:

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Sheet No.	**P9.1**
Date:	APRIL 2025

FIRE PROTECTION SYSTEM PERFORMANCE SPECIFICATION

PART 1 – GENERAL

1.01 WORK INCLUDED

A. This specifications section is to provide general guidance for establishing an overall scope and cost proposal for the project. This is a turn key installation (design & construction) for complete code approved wet pipe automatic fire sprinkler system, class 1 wet stand pipe. Reference Architectural plans for construction material and other relevant information.
B. The requirements of Section 230101 apply to all work described in this section.
C. Scope Includes:
   1. Pipe and fittings
   2. Hydraulic design for fully sprinklered areas within project limits.
   3. Complete drawings
   4. Coordination with other systems.
   5. Flow tests for design evaluation of water supply
   6. Submissions to approval authorities
   7. Securing of approvals and permits
   8. Installation of complete system
D. Related Work Specified Elsewhere:
   1. Section 230529 Hangers and Supports

1.02 SYSTEM DESCRIPTION

A. An approved design and installation as required to render a fully sprinklered building (s). Sprinkler system shall be wet-pipe type. The Building shall also have a class-I wet standpipe. Adequate heat will be provided above all ceilings to prevent sprinkler piping from freezing. Insulation furnished at roof and heat provided by Owner.

1.03 REFERENCES

A. NFPA 13 – Standard for Installation of Sprinkler Systems.
B. NFPA 13R - Standard for Installation of Sprinkler Systems in Low-Rise Residential Occupancies.
C. NFPA 14 - Standard for Installation of Standpipe and Hose Systems.
D. ANSI/ASTM 120 – Welded and seamless steel piping for ordinary uses, spec. For black and hot-dipped zinc coated (galvanized).
E. ASTM A795 Spec for black and hot dipped zinc coated welded seamless steel pipe for fire protection use.
F. ANSI/ASTM A53 Spec for welded and seamless steel pipe.
G. ANSI A17.1 Elevator Safety Code.
H. ANSI B36.10 Wrought Steel Pipe.
I. ASTM A135 Spec for electric resistance welded steel pipe.
J. ANSI B15.4 Cast Iron Threaded Fittings Class 125 and 250.
K. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings.
L. ANSI B16.3 Malleable Iron Threaded Fittings Class 150 and 300.
M. ANSI B16.9 Factory-Made Wrought Steel Buttwelded Fittings.
N. ANSI B16.25 Buttwelding Ends for Pipes, Valves, Flanges and Fittings.
O. ASTM A234 Spec for piping fittings for wrought carbon steel and alloy steel for moderate and elevated temperatures.
P. ANSI B16.5 Steel Pipe Flanges and Flanged Fittings.
Q. ANSI B16.11 Flanged Steel Fittings, Socket Welded and Threaded.
R. ANSI/ASTM A47 Malleable Iron Castings.

1.04 DESIGN CRITERIA

A. Type Hydraulically calculated. Uniform discharge density design shall be based on hydraulic calculations using method outlined in NFPA 13&13R or as noted in Part3. Density of discharge from sprinkler heads shall conform with NFPA 13 or 13R as applicable. Calculations shall be made in an approved manner, and be complete from the water service to each sprinkler head. At Contractor's option, and for no increase in Contract Sum, any pipe sizes indicated on the drawings – service main, standpipes, etc – may be increased to accommodate a more efficient hydraulically calculated design.
B. FP Drawings are for reference only. The Fire Sprinkler Contractor is responsible for the design of a complete fire sprinkler and standpipe system. Obtain a recent (within past 3 months) Flow Test from the water utility, coordinate with Architect office since recent request for flow data has been made. Flow Test must be witnessed by Architect/Owner.
C. Occupancy Classification: Comply with NFPA 13/13R as applicable and authority having jurisdiction. Anticipated Ordinary Hazard Group II. Confirm classification with Architect and AHJ.
D. Head Locations: Coordinate head locations in public areas, such as entry, lobbies, corridors and toilet rooms with Architectural reflected ceiling plans. Layout head so as to place them a minimum of 6 inches from any ceiling diffuser or light fixtures etc., in grid or tile pattern.
E. Design spacing of sprinkler heads and selection sizes shall conform to the requirements of NFPA 13 or 13R applicable for the occupancy.
F. Friction losses in pipe will be based upon the Hazen and Williams formula.
G. Plenum Coordination: Sprinkler piping shall be fully coordinated with the other systems installed in the areas above the ceiling. Ductwork shall be allowed to be installed tight to beams and joists. Sprinkler piping shall reside either in bar joist webbing spaces, or below and tight against the underside of the ductwork. In no case shall sprinkler piping cause are condition ducts to be routed lower than necessary.

1.05 DESIGN & DESIGN APPROVAL

A. Provide a complete sprinkler system design. Meet the requirement of the following authorities:
   1. Designed by a licensed Engineer in the State of Texas hired by the contractor.
   2. City of Austin, Texas Fire Marshall.
   3. Owner's insurance underwriter.
   4. NFPA 101- 1997.
   5. NFPA 13 & 13R, 2016 Edition.
   6. NFPA 14, current edition
B. The responsibility for the the design and installation rests with the Contractor. Contractor to prepare plans for AHJ approval. The system design and installation shall be approved by all of the following:
   1. City of Austin, Texas.
   2. Owner's insurance underwriter.
   3. Licensed Engineer in the State of Texas hired by the contractor.
A. Document Standards: Conform to the requirements of the following documents (Latest Editions Apply):
   1. NFPA 13
   2. NFPA 14
   3. NFPA 20
   4. NFPA 72

1.

1.06 QUALITY ASSURANCE

A. Devices: All engineered components used shall be in accordance with NFPA standards, shall be manufactured for use on fire protection systems, and shall be UL and FM labeled for the application fire protection application.
B. Piping materials and connections shall comply with the NFPA standards, and shall be acceptable to code authorities.

1.07 SUBMITTALS

A. Contractor is responsible for obtaining and submitting plans to the AHJ, include:
   1. Manufacturers Data on all Components.
   2. Definitions of where each type of head/s will be installed.
   3. System drawings as required for Approval agencies.
   4. Hydraulic calculations.
   5. Details and sections as required to define the design indicated.
   6. Wiring and piping diagrams shown in interconnecting and alarm signaling devices.
   7. Contractor qualifications

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Following is the list of approved manufacturers
   1. Viking Corporation
   2. Star
   3. Reliable Fire Protection Equipment
   4. Central Sprinkler Co.
   5. Grinnell Corporation

2.02 PIPE AND FITTINGS

A. General: All piping materials used shall conform to the requirements of NFPA #13 or 13R as applicable for sprinklers, NFPA 14 for standpipes, and the local enforcing officials for the exact application.
B. Joints and Couplings:
   1. Sprinklers: Per NFPA #13 or 13R as applicable.
   2. Standpipes: Per NFPA 14

2.03 SPRINKLER HEAD

A. Provide a QUICK RESPONSE type heads.
B. Sprinkler head to be semi recessed with chrome, brass or white finish per Architect. Spare sprinkler heads, storage box and wrench shall be installed adjacent to sprinkler riser. Standard or Extended Coverage heads are acceptable in finished areas.

2.04 SPRINKLER RISER

A. Sprinkler riser shall include a certified double check back flow assembly in accordance with local applicable codes and requirements. Riser shall include alarm check valve, water motor alarm gong wall mounted. Riser Check and Electric Weatherproof bell are acceptable alternatives if approved by Owner & AHJ. System connection to fire department shall be flush type with chrome finish. Fire department connection shall be hydraulically calculated and sized to supply the system demand. Potter Roemer Figure 5820 series. Provide flow and tamper switches for control valves and wiring by electrical. Central station monitoring and notification as required by code to be designed and installed by the contractor or licensed and certified subcontractor thereof.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Run piping concealed above furred ceilings and in joists to minimize obstructions. Expose only heads.
B. Protect sprinkler heads against mechanical injury with standard guards as required by NFPA.
C. Make on-the-job measurements and coordinate work and space requirements with all other crafts prior to fabrication. No additional costs shall be incurred by the Owner due to removal, relocation or any other modifications required to coordinate this work within space limitations of the building or work by other trades.
D. Prior to connecting the above ground sprinkler system to the underground supply. The contractor shall flush the piping as required by NFPA.
E. Make provision to ensure that City supply source shall not drop below acceptable levels of peak system demand. (City supply pressure shall not drop below 20 psi at peak system demand.)
F. Fire Sprinkler System Installation Company must have at least five years of experience of installing similar system.

1.

FIRE PROTECTION SYSTEM DESIGN AND CONSTRUCTION NOTES

1. INSTRUCTION INCLUDED HERE ARE FOR GENERAL CONTRACTOR TO INCLUDE IN HIS BID ALL COSTS ASSOCIATED WITH DESIGN AND INSTALLATION OF CODE COMPLIANT FIRE SPRINKLER SYSTEM FOR THE PROJECT. **GENERAL SYSTEM CONFIGURATION SHOWN ON FP PLANS IS FOR REFERENCE AND BUDGET PRICING ASSISTANCE ONLY. FIRE SPRINKLER CONTRACTOR IS RESPONSIBLE FOR SEALED/PERMITTED RECORD DESIGN AND INSTALLATION IN ACCORDANCE WITH LOCAL CODES AND NOTED REQUIREMENTS HEREIN.**
2. THE FIRE SPRINKLER CONTRACTOR SHALL PROVIDE TURNKEY DESIGN AND INSTALLATION AS REQUIRED TO RENDER A FULLY SPRINKLED BUILDING IN ACCORDANCE WITH THE LATEST NFPA AND AHJ PROVISIONS. FIRE SPRINKLER SYSTEM CONTRACTOR SHALL INSTALL A WET PIPE SPRINKLER SYSTEM IN COMPLIANCE WITH THE NATIONAL FIRE PREVENTION ASSOCIATION 13R GUIDELINES AND ALL LOCAL FIRE CODES AND/OR PER THE OWNER'S FIRE INSURANCE CARRIER. THE DESIGNER SHALL BE PROFESSIONAL ENGINEER IN THE STATE OF TEXAS, EXPERIENCED WITH THE DESIGN OF FIRE SPRINKLER SYSTEMS.
3. THE FIRE SPRINKLER DESIGN-BUILD CONTRACTOR SHALL CONTACT THE PROJECT ARCHITECT AND ATTAIN REQUIRED PLANS AND A COPY OF FIRE CODE CONSULTANT'S ANALYSES FOR THE PROJECT.
4. DESIGN FOR CODE COMPLIANCE, BUT NOT LESS THAN R-2 OCCUPANCY, TYPE V-A CONSTRUCTION, REQUIRING AT LEAST .05 GPM PER SQ. FT IN THE DESIGN COMPARTMENT (OR AT MOST COVERAGE AREA OF UP TO 4 HEADS THEREIN), AT A RESIDUAL PRESSURE AT SPRINKLER HEAD OF 17 PSI (MIN.), OR AS REQUIRED BY THE LISTED FLOW AND K-VALUE OF THE HEADS IN THE DESIGN AREA WHERE GREATER.
5. BEFORE COMMENCING SPRINKLER SYSTEM DESIGN AND/OR INSTALLATION, CONTRACTOR SHALL OBTAIN A FLOW DATA REPORT FROM POINT OF CONNECTION TO FIRE RISER FROM THE CITY, STATING DATE AND TIME DATA WAS TAKEN, AND OBSERVED BY FIRE DEPARTMENT AS REQUIRED BY LOCAL CODE.
6. "TYPICAL INSPECTORS FIRE TEST STATION" REQUIREMENTS SHALL BE COORDINATED WITH THE CITY AND THE ARCHITECT/OWNER.
7. INSTALLATION OF ALL FIRE EQUIPMENT AND DEVICES SHALL BE IN COMPLIANCE WITH MANUFACTURER SPECIFICATIONS AND METHODS OF INSTALLATION AND IN COMPLIANCE WITH CODE.
8. AFTER INSTALLATION OF THE SYSTEM IS COMPLETED AND AT SUCH TIME AS DIRECTED BY THE OWNER, THE CONTRACTOR SHALL CONDUCT A COMPLETE SYSTEM OPERATION TEST FOR APPROVAL.
9. ALL SHUT OFF VALVES IN SPRINKLER, STANDPIPE, AND COMBINED SYSTEMS SHALL BE APPROVED INDICATING TYPE.
10. COORDINATE SPRINKLER HEAD LOCATIONS WITH THE REFLECTED CEILING PLAN AND LIGHTING PLAN AND MAKE MINOR MODIFICATIONS AS NEEDED.
11. SUBMIT HYDRAULIC CALCULATIONS AND SHOP DRAWINGS FOR REVIEW AND APPROVAL BY OWNER'S INSURANCE UNDERWRITER, LOCAL FIRE MARSHALL AND OTHER AGENCIES HAVING JURISDICTION FOR REVIEW.
12. FINAL PIPING LAYOUT AND SIZES TO BE DETERMINED BY FIRE PROTECTION DESIGN BUILD CONTRACTOR.
13. SEE ARCHITECTURAL SHEETS FOR BUILDING MATERIALS, FIRE WALLS LOCATIONS, ELECTRICAL ROOMS, STORAGE, ETC. ENSURE ADEQUATE INSULATION TO PREVENT FREEZING OF WET-TYPE FIRE PROTECTION PIPING.
14. REFERENCE CIVIL PLANS FOR ANY EXISTING AND NEW FIRE LOOPS AT THE SITE. ALL SITE RELATED WORK MUST BE FULLY COORDINATED WITH OWNER, CITY, UTILITY, CIVIL AND LOCAL FIRE MARSHAL. CONSULT WITH OWNER AND ARCHITECT FOR SCOPE CLARIFICATION, IF REQUIRED.
15.

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LICENSED PROFESSIONAL ENGINEER
04/04/2025

PRICINCT 2 ROAD AND BRIDGE FACILITY
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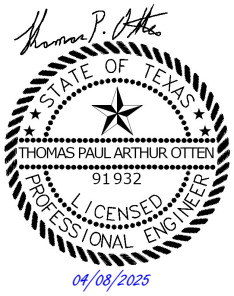
FIRE PROTECTION GENERAL NOTES, LEGENDS, & SCHEDULES

SHEET TITLE:

REVISIONS:

NO.	DATE

Job No:	T2414
Drawn by:	TO
Checked by:	TS/SK/EB
Sheet No.	FP1.1
Date:	APRIL 2025



MEP SPECIFICATIONS TOC

DIVISION 22 – PLUMBING

220000	GENERAL REQUIREMENTS FOR PLUMBING WORK
220517	SLEEVE AND SLEEVE SEALS FOR PLUMBING & HVAC PIPING
220523	GENERAL-DUTY VALVES FOR PLUMBING PIPING
220529	HANGERS AND SUPPORTS FOR PLUMBING PIPING & EQUIPMENT
220553	IDENTIFICATION FOR PLUMBING & HVAC PIPING AND EQUIPMENT
220719	PLUMBING PIPING INSULATION
221112	WATER DISTRIBUTION PIPING
221119	DOMESTIC WATER PIPING SPECIALTIES
221316	SANITARY WASTE AND VENT PIPING

DIVISION 23 - MECHANICAL

230101	GENERAL REQUIREMENTS FOR MECHANICAL WORK
230513	COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
230517	SLEEVES AND SLEEVE SEALS FOR HVAC PIPING
230518	ESCUTCHEONS FOR HVAC PIPING
230529	HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
230548	VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT
230553	IDENTIFICATIONS FOR HVAC PIPING AND EQUIPMENT
230593	TESTING, ADJUSTING AND BALANCING
230713	DUCT INSULATION
230719	HVAC PIPING INSULATION
232300	REFRIGERANT PIPING
233113	METAL DUCTS
233300	DUCT ACCESSORIES
233423	POWER VENTILATORS
233713	DIFFUSERS, REGISTERS AND GRILLES
238126	SPLIT-SYSTEM AIR-CONDITIONING UNITS

DIVISION 24-25 – NOT USED

DIVISION 26 – ELECTRICAL

260100	GENERAL REQUIREMENTS FOR ELECTRICAL WORK
260519	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND TABLES
260520	UNDERCARPET ELECTRICAL POWER CABLES
260523	CONTROL-VOLTAGE ELECTRICAL POWER CABLES
260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
260544	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING
260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS
260923	LIGHTING CONTROL DEVICES
262200	LOW VOLTAGE TRANSFORMERS
262413	SWITCHBOARDS
262416	PANELBOARDS
262726	WIRING DEVICES
262813	FUSES
262816	ENCLOSED SWITCHES AND CIRCUIT BREAKERS
262913	ENCLOSED CONTROLLERS

264313	SURGE PROTECTIVE DEVICES
265100	INTERIOR LIGHTING
265600	EXTERIOR LIGHTING
267100	ROOF-RELATED ELECTRICAL PROVISIONS

END

DIVISION 22

PLUMBING

SECTION 220000 - GENERAL REQUIREMENTS FOR PLUMBING WORK

PART 1 - GENERAL

1.1 SCOPE

A. This project involves construction of a facility titled “BCCSF – BASTROP COUNTY COMBINED SERVICES FACILITY” as shown on the plans and described herein.

1.2 DRAWINGS

A. Do not scale from the Drawings; contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements. Contractor shall determine exact locations from field measurements. Refer also to all architectural, structural, etc., drawings. The lack of specific detail of all offsets, transitions, etc., shall not relieve the Contractor of responsibility to provide such necessary elements to coordinate his work with building construction and with other trades.

1.3 BIDDING

A. All bids must be based only on the equipment and materials as scheduled on the drawings and as specified, or on equivalent equipment and materials from a pre-approved alternate manufacturer. No bids may be based on a substitute or alternative without specific written prior approval from the Engineer. Any Contractor who assumes equivalence of products and who bases his bid on that assumption does so at his own risk. A listing of approved alternative manufacturers does not mean that all products of a particular alternative manufacturer are acceptable alternatives to the scheduled items.

1.4 INTENT

A. All equipment, materials and labor that may be necessary to complete work in accordance with the intent of these plans and specifications shall be furnished by the Contractor without additional cost.

B. All systems represented in the documents shall, unless specifically noted to the contrary, be provided and installed complete with all necessary components to form a complete and functioning system. Submission of bids will be considered confirmation that complete and functional systems have been included in the bids.

C. If any discrepancy or confusion is perceived in the documents, the Contractor shall call such to the attention of the Engineer for clarification of the documents prior to bidding or construction. If any inconsistencies or contradictions within the construction documents are discovered after the construction contracts are awarded, the Engineer and/or Engineer shall determine the intent and correct interpretation of the construction documents.

D. Contractor shall supervise and direct the work competently and efficiently and in accordance with the drawings and specifications. Contractor shall be responsible for using construction means, methods, techniques, sequences, and procedures as are compatible with the project's

requirements and will result in a project completed in accordance with the requirements of the drawings and specifications.

1.5 CODES, PERMITS AND FEES

A. Contractor shall comply with all local, state and national codes and shall pay for all applicable costs, fees and permits.

1.6 EXAMINATION OF SITE

A. Each contractor submitting proposal(s) for this work shall examine the site and shall take into consideration conditions that may affect the work. No information given on the plans shall relieve the Contractor of this responsibility. Submission of a bid shall be considered as compliance with the site examination requirements.

B. Contractor shall verify location, size, elevation, pressure, and any other pertinent data of existing utilities. Additional costs incurred due to a failure to verify such data and to coordinate associated work with respective utility providers shall not be the Owner's responsibility but shall be borne by Contractor.

C. Excavate by hand and with caution to locate all utilities prior to machine excavation. Should any service be interrupted, Contractor shall repair it immediately and at no cost to the Owner.

1.7 CONNECTION TO UTILITIES

A. All costs associated with providing utilities including, but not limited to, connection fees, boring under roads, etc., shall be included in the Contractor's bid price whether such costs are incurred by Contractor or charged by a utility company.

B. Contractor shall arrange gas service in accordance with utility company regulations and shall pay all applicable fees and costs.

1.8 VIBRATION AND NOISE

A. Each of the various pieces of equipment shall operate without objectionable vibration or noise. All rotating equipment shall be statically and dynamically balanced and shall be mounted, supported, and fastened so that vibration shall not exceed levels specified for the equipment item. The specific type of vibration isolation to be installed shall be submitted to the Engineer for his approval.

B. If, in the opinion of the Engineer or Owner, objectionable vibration or noise or transmission thereof to the building occurs, the Contractor shall execute remedial measures as may be necessary to eliminate such unsatisfactory operating conditions. The work and material thereby required shall be furnished and performed at the Contractor's expense.

1.9 GUARANTEE

A. Each Contractor shall guarantee all labor and materials furnished by him for a period of one year unless otherwise noted. Guarantee period shall extend from the time of final written

acceptance of the installation or upon usage by a written directive from the Owner, whichever occurs first. The guarantee shall cover the repair or replacement, without additional cost to the Owner, of any defective material or faulty workmanship.

B. Additional special guarantees may be specified in individual specification sections or on Drawings.

1.10 SERVICE

A. Provide necessary service of each system, such as adjustment of controls, air distribution, and water balancing valves, mechanical repair of equipment, and other work requiring specialized training, at no cost to the Owner, for a period of one year, concurrent with the warranty period specified above.

1.11 SUBMITTALS

A. Before orders are placed, contractor shall submit specific information on list of equipment and principal materials specified. Contractor shall indicate and/or provide names of manufacturers, catalog and model numbers, cut sheets, and such other supplementary information as necessary for evaluation. Refer to related section in Division 1, Section “Submittals.” Each shall be submitted and shall include all items mentioned by model number and/or manufacturer's name in the specifications or on the drawings, including but not limited to the following:

1. HVAC - All equipment, air devices, insulation, piping, valves, controls and other principal materials.
2. Plumbing Equipment – Water heaters, pumps, tanks, and valves.

B. Submit firestopping design for each type of construction and penetrant before applying it.

C. Requirements - Each submittal shall:

1. Bear a stamp or specific written indication that Contractor has reviewed and approved all submittals prior to submission to Engineer,
2. Be clearly marked as to which specific piece of equipment is being submitted, by use of a permanent marker, stamp, etc., so as to distinguish it from other pieces of equipment that may occur on the same page,
3. Be clearly marked as to which available options are being submitted that are associated with a piece of equipment, and
4. Be complete with respect to quantities, dimensions, specific performance, materials, and similar data to enable Engineer to review the proposed equipment.
5. Omission by Contractor of any of the above requirements for submittals will subject submittal to automatic rejection without review.
6. Any submittals received by Engineer that were not requested shall be returned without review of any kind.

D. Substitutions

1. By submitting substitute equipment, contractor is affirming that it will fit, connect and function properly, and be maintainable for the purpose(s) intended and in the space available. The Contractor's submittal for acceptance of the substitute shall include a written statement of whether or not such acceptance would require any subsequent or

associated changes to the drawings or specifications. Any such changes shall be described in writing, briefly but completely.

2. The Contractor shall be responsible for the cost of any such modifications due to substitution of materials or equipment for that which was specified or scheduled. The cost shall be complete; that is, it shall include the costs effect on any and all other trades.
3. The Engineer may require shop drawings of mechanical rooms or systems of the substituted equipment.

1.12 SAFETY

A. Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work, and Contractor shall comply with all laws governing safety, specifically the "Occupational Safety and Health Standards" and the "Safety and Health Regulations for Construction", state and federal.

1.13 COORDINATION

A. Each Contractor's bid shall include the necessary detail and interconnection work to coordinate his work with the work of other trades. Failure on the part of the Contractor to coordinate with all other trades resulting in interference shall be sufficient reason to require the Contractor to replace or rebuild the work involved at no extra charge.

1.14 STORAGE OF MATERIALS

A. Each Contractor shall provide temporary storage facilities suitable for equipment stored at the job site. Storage facilities shall be rain-proof and lockable as required. Materials or equipment stored on site but not in a lockable, rain-proof storage facility shall be stored above ground or above slab. Contractor shall take necessary precautions to prevent entry of and/or damage from dirt, trash, water, or vermin. Equipment not properly stored and protected shall be, at the discretion of the Engineer, replaced at no cost to Owner. Roofs are not acceptable storage areas unless specifically allowed in writing by the Engineer.

1.15 LABELING

A. Each device for which an independent testing authority has established a standard shall have affixed a label indicating its compliance and listing. Such independent testing authorities shall include, but not be limited to, the following:

1. A.D.C. Air Diffusion Council
2. A.G.A. American Gas Association
3. A.M.C.A. Air Movement and Control Association
4. A.N.S.I. American National Standards Institute
5. A.R.I. Air-Conditioning and Refrigeration Institute
6. A.S.H.R.A.E. American Society of Heating, Refrigerating, and Air-Conditioning Engineers
7. A.S.M.E. American Society of Mechanical Engineers
8. A.S.P.E. American Society of Plumbing Engineers
9. A.S.S.E. American Society of Sanitary Engineers
10. A.S.T.M. American Society for Testing and Materials
11. A.W.W.A. American Water Works Association

12. C.T.I. Cooling Tower Institute
13. F.M. Factory Mutual
14. I.A.P.M.O. International Association of Plumbing and Mechanical Officials
15. M.S.S. Manufacturers Standardization Society of the Valve and Fittings Industry
16. N.A.P.H.C.C. National Association of Plumbing, Heating, Cooling Contractors
17. N.B.S. National Bureau of Standards
18. N.E.B.B. National Environmental Balancing Bureau
19. N.F.P.A. National Fire Protection Association
20. P.D.I. Plumbing and Drainage Institute
21. S.B.C.C.I. Southern Building Code Congress International
22. S.M.A.C.N.A. Sheet Metal and Air Conditioning Contractors' National Association
23. T.I.M.A. Thermal Insulation Manufacturers Association
24. U.L. Underwriters Laboratory

1.16 SITE VISIT REPORTS

A. During the course of the job, the Engineer's Office Project Manager will observe work in progress and will subsequently prepare a written site visit report which will be sent for distribution to the owner and to whomever else the Engineer desires.

1.17 CUTTING, PATCHING, AND PENETRATIONS

A. No joists, beams, girders, columns, slabs, or other structural elements shall be cut, drilled, or altered in any way by the Contractor without first obtaining written permission and instructions from the Engineer.

B. Where cutting any non-structural element(s) of walls, floors or ceilings is necessary to permit the installation of any work under this contract, or to repair any defects that may appear up to the expiration of the guarantee, such cutting shall be done by Contractor with as little damage as reasonably possible to the element being cut, to adjacent elements, or to the work of other trades.

C. After the necessary work has been completed, the damage shall be repaired by the Contractor, who shall pay all costs of such cutting and patching. All patching or sealing of cuts, penetrations, etc., including final appearance of same, shall be done to the approval of the Engineer.

D. Where a penetration or cutting of a ceiling, wall, or other building membrane is required or made, each such penetration or cut shall be made neatly with a cutting tool such as a saw, sharp knife, etc., and not with an impact tool such as a hammer, screwdriver, wrench, crowbar, etc. Each such penetration or cut shall be no larger than reasonably necessary, and penetrations in occupied or publicly accessible spaces shall have a chrome-plated escutcheon installed large enough to cover the entire opening.

1.18 FIRESTOPPING

A. Where a penetration is made in a fire-rated building assembly (wall, floor, ceiling, floor-ceiling, roof-ceiling, etc.) or in a membrane of a fire-rated assembly, install an appropriate firestopping assembly.

B. Select and apply firestop materials according to a design certified by a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

C. Submit firestopping design for each type of construction and penetrant before applying it.

1.19 HOUSEKEEPING PADS

A. Contractor shall construct housekeeping pads for floor-mounted mechanical and electrical equipment including, but not limited to, the following:

1. Air handling units, storage tanks and water heaters, boilers, pumps, chemical feeders.

B. Pads shall be made 3½ - 6 inches thick (reference plans), of concrete with reinforcing such as welded wire screen, and with beveled edges. Contractor shall paint each pad with a masonry conditioner such as Sherwin-Williams A5V2 and then with a gray (or other color at Owner's request) industrial enamel such as Sherwin-Williams B-54 series.

1.20 OPERATING TESTS

A. General

1. After all mechanical and electrical systems have been completed and put into operation, Contractor shall subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation. All associated costs of such tests, including labor, fuel, apparatuses, piping, etc., shall be borne by the Contractor.
2. Contractor shall make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. The Contractor shall return to the project during the first year and in the opposite season from which the system was initially operated and shall check the proper operation of the mechanical and electrical systems. Contractor shall perform any adjustments or corrective procedures required for the proper operation of all systems.

B. Notification

1. Contractor shall give the Engineer seven days prior notification of any test so that the Engineer will have time to be present if he/she so desires.

C. Reports

1. After each test is performed, the Contractor who performed the test shall prepare and issue a report to include the following information:
2. Project name and location, date of the report,

3. Contractor's name, address, and telephone number; if the Contractor performing the test is a Subcontractor, indicate also for whom the test is being performed, their name, address, telephone number, and a contact person's name,
4. the date, or range of dates, of the test,
5. the name of the Contractor's employee who was responsible for performing or for overseeing the performing of the test,
6. a brief description of the system being tested,
7. a brief description of the testing procedure,
8. a summary of the test result(s),
9. a brief assertion that the system was tested as stated and that the system complied with the requirements of the contract documents or those of the Authority Having Jurisdiction, whichever is the most stringent, and
10. a hand-written date and signature of someone who has authority or responsibility from the company that performed test(s), and a hand-written brief note stating that the above information is true and accurate.
11. If the tested system is tested in parts, then one report may be made after the last part is tested.
12. The report shall be issued to the Engineer within five working days after the test is completed.
13. Such reports shall be required of all mechanical or electrical systems which require tests for pressure, water tightness, flow, resistance, or conductivity.
14. Services of a Manufacturer's Representative
15. For all major systems or equipment required by subsequent specifications sections to have tests or inspections by a manufacturer's representative, the manufacturer's representative shall prepare a written report to be sent to the Engineer for subsequent distribution to the Engineer, Owner, General Contractor, and to whomever else the Engineer deems necessary. The report shall include at least the following:

    a. Date of the visit, name and title of the representative, name and location of the project
    b. Name and title of any observers
    c. A brief description of the equipment being inspected and / or tested
    d. A brief discussion of the quality of the installation including any important items (in the manufacturer’s experience) that were done correctly, as well as any items that were done incorrectly or not to recommendations
    e. A list of test and / or inspections performed and the results of same
    f. A brief statement of whether the installation conforms to manufacturer’s recommendations and/or requirements, and if not what is required to bring the installation into conformance

D. Deficiencies and Defects

1. Contractor shall be responsible for providing all labor and materials, at no cost to anyone except Contractor, to correct any deficiencies or defects reported by manufacturer's representative.
2. If, in the opinion of the manufacturer's representative, the deficiencies and defects are sufficiently serious, then Contractor shall arrange for, and bear all costs of, another inspection by manufacturer's representative after corrective work is complete.
3. The above process shall continue until the manufacturer's representative approves the installation.

1.21 TEMPORARY FACILITIES

A. Jobsite office facilities: Refer to Architect's documents.

B. Temporary storage facilities: Refer to Architect's documents.

C. Sanitary facilities for workmen: Refer to Architect's documents.

D. Temporary utilities: Refer to Architect's documents.

1. The Contractor shall pay the cost of all water, gas, and electricity used during construction.
2. Each contractor will pay for his portion of the works required permits, meter taps and any other charge by the City. The temporary and/or permanent meters will be entered in the Contractor's name for payment until the facilities are accepted by the Owner.
3. Temporary Water Service:

    a. The Plumbing Contractor shall install a permanent water supply line from the nearest water main to the project, and shall maintain and protect it until completion of the project and acceptance by the Owner.
    b. The Plumbing Contractor shall provide, protect and maintain a adequate water supply for the use of all contractors on the project, for construction purposes, either by means of the permanent water supply line or by installing a temporary water line. This water supply shall be made available within fifteen (15) days after written request has been made to the Plumbing Contractor by the contractor requiring it, with copies of the request being submitted to all interested parties, including the Engineer.
    c. The Plumbing Contractor shall install a meter and a temporary water line to a point approximately ten (10) feet from the building. The exact point to which the water line is installed shall be indicated by the General Contractor. From this point, each contractor shall install, valve, maintain and protect such water supply lines that he might need to execute the work of his contract.

4. Temporary heat:

    a. Heating required after enclosure of the building shall be classified as "temporary heat". The building shall be considered enclosed when the roof and walls are weatherproof, and windows, doors and other openings are closed sufficiently to provide reasonable heat retention.
    b. The Mechanical Contractor shall provide temporary heat, and shall furnish, at his own expense, such labor and supervision as is necessary for efficient, safe operation until acceptance of the Project by the Owner.
    c. A minimum temperature of 60 degrees F and maximum of 80 degrees F shall be maintained in the building during and after installation of any materials or finishes that are affected by temperature or humidity. More strenuous requirements may apply to specific products or processes.
    d. At all times after the building is enclosed, the temperature in all interior parts of the building shall be kept above freezing.

E. Operation of equipment:

1. When heating, air conditioning, ventilating, exhaust or other items of electrical or other equipment are installed, it shall be the responsibility of the contractor installing such equipment to operate it for a satisfactory period of time, as required by the Engineer for

proper testing of the equipment and for proper instruction of the Owner's operating personnel.

2. All other items of equipment, testing meters, testing instruments and incidentals required for proper testing of the equipment and for proper instructing of the Owner's operating personnel, shall be provided by the contractor providing and installing the equipment.

F. When any temporary facility is no longer needed for the proper conduct of the work, as determined by the Engineer, the Owner or the contractor who installed such temporary facilities, the contractor shall completely remove it from the project and shall repair or replace any material, equipment and finished surface damaged in installation, use or removal of the temporary facility.

PART 2 - PRODUCTS AND WORKMANSHIP

2.1 MATERIALS

A. All materials shall be new and of the quality specified. Materials shall be free from defects. Where manufacturers' names are mentioned in these specifications or on the plans, it has been done in order to establish a standard of quality and construction.

B. Contractor will be responsible for transportation of his materials to and on the job, and will be responsible for the storage and protection of his materials and work until the final acceptance of the job. At the end of each work day, each Contractor is responsible for covering or protecting his work or materials that may be susceptible to damage even if such damage is the result of unforeseen causes, e.g. an overnight thunderstorm. Failure to do so will be sufficient cause for rejection of any item in question, and any such item shall be replaced at Contractor's expense.

C. Contractor shall verify that all pieces of equipment will fit through available openings in building and that all equipment can be installed without modification of building structure.

2.2 WORKMANSHIP

A. The workmanship shall, in all respects, be of the highest grade, and all construction shall be done according to the best practices of the trade. Piping, ducting and conduit shall be concealed unless otherwise noted, and installed square to the building lines. Any work not meeting this requirement shall be replaced or rebuilt without extra expense to the Owner.

2.3 ROOF PENETRATIONS, EQUIPMENT AND PIPING SUPPORTS

A. Roof supports for equipment, piping, conduits, ductwork, etc. shall be provided and installed by an Owner approved Roofing Contractor and shall be provided under this Contract. The Mechanical, Electrical, and Plumbing Contractor shall coordinate and communicate closely with the Roofing Contractor as to locations of supports, sizes and weights of devices or equipment being supported, etc.

2.4 ACCESSIBILITY

A. Access Panels - Access panels shall be provided wherever necessary for possible future replacement, adjustment, or maintenance of operating devices such as machinery, valves, dampers, switches, relays, etc., or to other critical non-operating devices such as pull boxes, inspection parts, gauges, etc. Such access panels shall be provided and installed by Contractor, whether or not shown on drawings, and shall be brought to the attention of Engineer for his approval of type, color, etc.. Where access is provided in rated members, the access panels shall be of a type that maintains the integrity of the member penetrated.

B. Access to Equipment

1. All pipes, tubing, conduit, etc., including, but not limited to, domestic cold water and hot water piping, waste and vent piping, drain piping of any type, electrical conduit, wiring not in conduit, and pneumatic control tubing shall be installed in such a way so as not to prevent and/or not to make unreasonably difficult the removal, operation, use, or maintenance of equipment, access panels or doors, pathways (especially in attics or crawl spaces), observation ports, measurement or balancing devices, junction boxes, etc..
2. If access for these purposes is prevented or made unreasonably difficult in the opinion of the Engineer, then the Contractor shall make modifications or repairs at no cost to anyone except the Contractor. Such modifications or repairs shall be considered neither complete nor adequate until the Engineer is satisfied that access for the above purposes is achieved.

PART 3 - RECORDS AND SERVICES FOR THE OWNER

3.1 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Contractor shall prepare and provide three copies of operating and maintenance manuals. Contractor shall deliver these four bound sets to the Engineer for approval. Each manual shall be in a ring binder and shall be indexed with dividers for each section. Delivery of required documents is a condition of final acceptance.

B. Each manual shall contain at least the following:

1. Certificates of acceptance from inspecting authorities,
2. Waiver of all liens,
3. For each piece of equipment:
    a. Operating and safety instructions, service manuals, and parts lists applicable to each item of equipment furnished (Contractor shall clearly distinguish in the manual between information that pertains to the particular equipment and information which does not.)
    b. Nameplate data and design parameters for equipment
    c. Name, phone number, and address of vendor, manufacturer's representative, and warrantee provider,
4. Both paper copies and electronic files in format specified and approved by the Owner shall be provided for the following:
    a. All shop drawings and as-built drawings.
    b. All approved submittals.

c. Operating and safety instructions, service manuals, and parts lists applicable to each item of equipment furnished (Contractor shall clearly distinguish in the manual between information that pertains to the particular equipment and information which does not.),

5. Names, phone numbers and addresses of all subcontractors, vendors, manufacturer's representatives, and warrantee providers,
6. Acceptance letter from each Contractor with blanks for date of acceptance and date of expiration of warranties and guarantees.

3.2 INSTRUCTIONS FOR OWNER

A. Contractor shall instruct the Owner's operating personnel in the operation and maintenance of all mechanical equipment. Contractor shall furnish any special servicing tools required for maintenance.

B. Provide training as specified in each Section and/or on the Drawings. Training arrangements must be coordinated with, and approved by, the Owner.

3.3 DEMONSTRATION

A. Contractor shall conduct a demonstration of the installation upon completion of the work. Prior to this, all work shall have been completed, tested, balanced, and placed in operation. Qualified persons must be present at demonstration to operate all systems and prove the performance of the equipment. The schedule for this demonstration shall be coordinated with the Engineer.

END OF SECTION 220000

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING 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. Sleeves.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Comply with fire resistive penetration seal requirements, if applicable.

B. Steel Pipe Sleeves: Schedule 20 to 40, zinc coated; hot dip galvanized if either end is in damp location.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
3. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

C. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces, except where extension beyond surface is needed for selected fire sealing method.
2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Seal penetrations in exterior building envelope fully against water, insect and vermin intrusion.
2. As detailed on Drawings.

B. Interior Partitions:

1. Piping Smaller than NPS 6 (DN 150): If not otherwise detailed on Drawings, steel pipe sleeves, except as required for fire rated penetrations.

C. Exterior Walls:

1. Piping Smaller than NPS 6 (DN 150): If not otherwise detailed on Drawings or required for fire rating, galvanized steel pipe sleeves.
2. For penetrations below grade, provide water-resistant compression seals with stainless steel bolts. Use “Link Seal” or approved equal.

D. Roofs:

1. Any penetration through the roof shall be coordinated with the Architect and the Owner's roofing advisor to ensure that it is water-proof, visually acceptable, and structurally sound.
2. Piping and Wiring Groups: For two or more penetrants in one area, unless otherwise detailed on the drawings, provide a sheetmetal entry cover of essentially gooseneck form, flashed into the roof or set on a roof curb. The outer end of the gooseneck shall face no greater than 45 degrees from straight down. Provide a pair of overlapping custom-cut split escutcheon plates at the outer end, and seal water tight around each penetrant. Provide fiberglass insulation inside assembly at the plane of the roof insulation and secured in place.

3. Piping Smaller than NPS 6 (DN 150): If not otherwise detailed on Drawings or required for roof warranty or fire rating, steel pipe sleeves extending 4" above roof surface. Install UV-resistant elastomeric boot over top of sleeve, constricted and sealed to penetrating item.

END OF SECTION 220517

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

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. Section Includes:

1. Bronze angle valves.
2. Brass ball valves.
3. Bronze ball valves.
4. Bronze swing check valves.
5. Bronze gate valves.
6. Bronze globe valves.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
2. Handwheel: For valves other than quarter-turn types.
3. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller except plug valves.

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE ANGLE VALVES

A. Class 125, Bronze Angle Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Hammond Valve.
   b. Milwaukee Valve Company.
2. Description:
   a. Standard: MSS SP-80, Type 1.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
   d. Ends: Threaded.
   e. Stem and Disc: Bronze.
   f. Packing: Asbestos free.
   g. Handwheel: Malleable iron.

B. Class 125, Bronze Angle Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. American Valve, Inc.
   b. NIBCO INC.
2. Description:
   a. Standard: MSS SP-80, Type 2.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.

d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

C. Class 150, Bronze Angle Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Stockham Division.
b. Kitz Corporation.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron.

D. Class 150, Bronze Angle Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Powell Valves.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

2.3 BRASS BALL VALVES

A. One-Piece, Reduced-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Kitz Corporation.

2. Description:

    a. Standard: MSS SP-110.
    b. CWP Rating: 400 psig (2760 kPa).
    c. Body Design: One piece.
    d. Body Material: Forged brass.
    e. Ends: Threaded.
    f. Seats: PTFE or TFE.
    g. Stem: Brass.
    h. Ball: Chrome-plated brass.
    i. Port: Reduced.

B. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. DynaQuip Controls.
    d. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
    e. Hammond Valve.
    f. Jamesbury; a subsidiary of Metso Automation.
    g. Jomar International, LTD.
    h. Kitz Corporation.
    i. Legend Valve.
    j. Marwin Valve; a division of Richards Industries.
    k. Milwaukee Valve Company.
    l. NIBCO INC.
    m. Red-White Valve Corporation.
    n. RuB Inc.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig (1035 kPa).
    c. CWP Rating: 600 psig (4140 kPa).
    d. Body Design: Two piece.
    e. Body Material: Forged brass.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Brass.
    i. Ball: Chrome-plated brass.
    j. Port: Full.

C. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
    d. Hammond Valve.
    e. Jamesbury; a subsidiary of Metso Automation.
    f. Kitz Corporation.
    g. Marwin Valve; a division of Richards Industries.
    h. Milwaukee Valve Company.
    i. RuB Inc.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig (1035 kPa).
    c. CWP Rating: 600 psig (4140 kPa).
    d. Body Design: Two piece.
    e. Body Material: Forged brass.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Stainless steel.
    i. Ball: Stainless steel, vented.
    j. Port: Full.

D. Two-Piece, Regular-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Hammond Valve.
    b. Jamesbury; a subsidiary of Metso Automation.
    c. Legend Valve.
    d. Marwin Valve; a division of Richards Industries.
    e. Milwaukee Valve Company.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig (1035 kPa).
    c. CWP Rating: 600 psig (4140 kPa).
    d. Body Design: Two piece.
    e. Body Material: Forged brass.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Brass.
    i. Ball: Chrome-plated brass.
    j. Port: Regular.

E. Two-Piece, Regular-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Jamesbury; a subsidiary of Metso Automation.
    b. Marwin Valve; a division of Richards Industries.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig (1035 kPa).
    c. CWP Rating: 600 psig (4140 kPa).
    d. Body Design: Two piece.
    e. Body Material: Brass or bronze.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Stainless steel.
    i. Ball: Stainless steel, vented.
    j. Port: Regular.

F. Three-Piece, Full-Port, Brass Ball Valves with Brass Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Jomar International, LTD.
    b. Kitz Corporation.
    c. Red-White Valve Corporation.
    d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig (1035 kPa).
    c. CWP Rating: 600 psig (4140 kPa).
    d. Body Design: Three piece.
    e. Body Material: Forged brass.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Brass.
    i. Ball: Chrome-plated brass.
    j. Port: Full.

G. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Jomar International, LTD.
    b. Kitz Corporation.
    c. Marwin Valve; a division of Richards Industries.
    d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Three piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.4 BRONZE BALL VALVES

A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 400 psig (2760 kPa).
c. Body Design: One piece.
d. Body Material: Bronze.
e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Bronze.
h. Ball: Chrome-plated brass.
i. Port: Reduced.

B. One-Piece, Reduced-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig (4140 kPa).
c. Body Design: One piece.
d. Body Material: Bronze.

e. Ends: Threaded.
f. Seats: PTFE or TFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Reduced.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Hammond Valve.
e. Lance Valves; a division of Advanced Thermal Systems, Inc.
f. Legend Valve.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
k. .

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

D. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Hammond Valve.
d. Lance Valves; a division of Advanced Thermal Systems, Inc.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

E. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. DynaQuip Controls.
f. Hammond Valve.
g. Lance Valves; a division of Advanced Thermal Systems, Inc.
h. Milwaukee Valve Company.
i. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Regular.

F. Two-Piece, Regular-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Hammond Valve.
d. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Regular.

G. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. DynaQuip Controls.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Red-White Valve Corporation.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Three piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

H. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).

d. Body Design: Three piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.5 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; Stockham Division.
f. DeZurik Water Controls.
g. Flo Fab Inc.
h. Hammond Valve.
i. Kitz Corporation.
j. Legend Valve.
k. Milwaukee Valve Company.
l. NIBCO INC.
m. Norriseal; a Dover Corporation company.
n. Red-White Valve Corporation.
o. Spence Strainers International; a division of CIRCOR International, Inc.
p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

B. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.

c. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
d. Crane Co.; Crane Valve Group; Jenkins Valves.
e. Crane Co.; Crane Valve Group; Stockham Division.
f. DeZurik Water Controls.
g. Flo Fab Inc.
h. Hammond Valve.
i. Kitz Corporation.
j. Legend Valve.
k. Milwaukee Valve Company.
l. NIBCO INC.
m. Norriseal; a Dover Corporation company.
n. Red-White Valve Corporation.
o. Spence Strainers International; a division of CIRCOR International, Inc.
p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Aluminum bronze.

C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. American Valve, Inc.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
e. Crane Co.; Crane Valve Group; Center Line.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Flo Fab Inc.
i. Hammond Valve.
j. Kitz Corporation.
k. Legend Valve.
l. Milwaukee Valve Company.
m. Mueller Steam Specialty; a division of SPX Corporation.
n. NIBCO INC.
o. Norriseal; a Dover Corporation company.
p. Spence Strainers International; a division of CIRCOR International, Inc.
q. Sure Flow Equipment Inc.
r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nickel-plated[**or -coated**] ductile iron.

D. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Ductile-Iron Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. American Valve, Inc.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
e. Crane Co.; Crane Valve Group; Center Line.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Flo Fab Inc.
i. Hammond Valve.
j. Kitz Corporation.
k. Legend Valve.
l. Milwaukee Valve Company.
m. Mueller Steam Specialty; a division of SPX Corporation.
n. NIBCO INC.
o. Norriseal; a Dover Corporation company.
p. Spence Strainers International; a division of CIRCOR International, Inc.
q. Sure Flow Equipment Inc.
r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Nickel-plated[**or -coated**] ductile iron.

E. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
b. American Valve, Inc.

c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. DeZurik Water Controls.
h. Flo Fab Inc.
i. Hammond Valve.
j. Kitz Corporation.
k. Legend Valve.
l. Milwaukee Valve Company.
m. Mueller Steam Specialty; a division of SPX Corporation.
n. NIBCO INC.
o. Norriseal; a Dover Corporation company.
p. Red-White Valve Corporation.
q. Spence Strainers International; a division of CIRCOR International, Inc.
r. Sure Flow Equipment Inc.
s. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
g. Disc: Stainless steel.

F. 200 CWP, Iron, Single-Flange Butterfly Valves with NBR Seat and Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ABZ Valves and Controls; A div. of ABZ Manufacturing, Inc.
b. American Valve, Inc.
c. Conbraco Industries, Inc.; Apollo Valves.
d. Cooper Cameron Valves; A div. of Cooper Cameron Corp.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Div.
g. DeZurik Water Controls.
h. Flo Fab Inc.
i. Hammond Valve.
j. Kitz Corporation.
k. Legend Valve.
l. Milwaukee Valve Company.
m. Mueller Steam Specialty; a division of SPX Corporation.
n. NIBCO INC.
o. Norriseal; a Dover Corporation company.
p. Red-White Valve Corporation.
q. Spence Strainers International; a division of CIRCOR International, Inc.

r. Sure Flow Equipment Inc.
s. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: NBR.
f. Stem: One- or two-piece stainless steel.
g. Disc: Stainless steel.

2.6 IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Kennedy Valve; a division of McWane, Inc.
b. Shurjoint Piping Products.
c. Tyco Fire Products LP; Grinnell Mechanical Products.
d. Victaulic Company.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 175 psig (1200 kPa).
c. Body Material: Coated, ductile iron.
d. Stem: Two-piece stainless steel.
e. Disc: Coated, ductile iron.
f. Seal: EPDM.

B. 300 CWP, Iron, Grooved-End Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Anvil International, Inc.
b. Kennedy Valve; a division of McWane, Inc.
c. Mueller Steam Specialty; a division of SPX Corporation.
d. NIBCO INC.
e. Shurjoint Piping Products.
f. Tyco Fire Products LP; Grinnell Mechanical Products.
g. Victaulic Company.

2. Description:

a. Standard: MSS SP-67, Type I.

b. NPS 8 (DN 200) and Smaller CWP Rating: 300 psig (2070 kPa).
c. NPS 10 (DN 250) and Larger CWP Rating: 200 psig (1380 kPa).
d. Body Material: Coated, ductile iron.
e. Stem: Two-piece stainless steel.
f. Disc: Coated, ductile iron.
g. Seal: EPDM.

2.7 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 125, Lift Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Flo Fab Inc.
b. Hammond Valve.
c. Kitz Corporation.
d. Milwaukee Valve Company.
e. Mueller Steam Specialty; a division of SPX Corporation.
f. NIBCO INC.
g. Red-White Valve Corporation.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: NBR, PTFE, or TFE.

2.8 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. American Valve, Inc.
   b. Crane Co.; Crane Valve Group; Crane Valves.
   c. Crane Co.; Crane Valve Group; Jenkins Valves.
   d. Crane Co.; Crane Valve Group; Stockham Division.
   e. Hammond Valve.
   f. Kitz Corporation.
   g. Milwaukee Valve Company.
   h. NIBCO INC.
   i. Powell Valves.
   j. Red-White Valve Corporation.
   k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   l. Zy-Tech Global Industries, Inc.

2. Description:

   a. Standard: MSS SP-80, Type 3.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B 62, bronze.
   e. Ends: Threaded.
   f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Crane Co.; Crane Valve Group; Stockham Division.
   d. Hammond Valve.
   e. Kitz Corporation.
   f. Milwaukee Valve Company.
   g. NIBCO INC.
   h. Red-White Valve Corporation.
   i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

   a. Standard: MSS SP-80, Type 4.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Design: Horizontal flow.
   d. Body Material: ASTM B 62, bronze.
   e. Ends: Threaded.

f. Disc: PTFE or TFE.

C. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Kitz Corporation.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Red-White Valve Corporation.
i. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

D. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

2.9 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Crane Co.; Crane Valve Group; Stockham Division.
    d. Hammond Valve.
    e. Kitz Corporation.
    f. Legend Valve.
    g. Milwaukee Valve Company.
    h. NIBCO INC.
    i. Powell Valves.
    j. Red-White Valve Corporation.
    k. Sure Flow Equipment Inc.
    l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    m. Zy-Tech Global Industries, Inc.

2. Description:

    a. Standard: MSS SP-71, Type I.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Design: Clear or full waterway.
    d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    e. Ends: Flanged.
    f. Trim: Bronze.
    g. Gasket: Asbestos free.

B. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Stockham Division.

2. Description:

    a. Standard: MSS SP-71, Type I.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Design: Clear or full waterway.
    d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    e. Ends: Flanged.
    f. Trim: Composition.
    g. Seat Ring: Bronze.
    h. Disc Holder: Bronze.
    i. Disc: PTFE or TFE.
    j. Gasket: Asbestos free.

C. Class 250, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Crane Co.; Crane Valve Group; Stockham Division.
    d. Hammond Valve.
    e. Milwaukee Valve Company.
    f. NIBCO INC.
    g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-71, Type I.
    b. CWP Rating: 500 psig (3450 kPa).
    c. Body Design: Clear or full waterway.
    d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    e. Ends: Flanged.
    f. Trim: Bronze.
    g. Gasket: Asbestos free.

2.10 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. NIBCO INC.

2. Description:

    a. Standard: MSS SP-71, Type I.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Design: Clear or full waterway.
    d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    e. Ends: Flanged.
    f. Trim: Bronze.
    g. Gasket: Asbestos free.
    h. Closure Control: Factory-installed, exterior lever and spring.

B. Class 125, Iron Swing Check Valves with Lever- and Weight-Closure Control:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Crane Co.; Crane Valve Group; Stockham Division.
    d. Hammond Valve.

e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-71, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.
h. Closure Control: Factory-installed, exterior lever and weight.

2.11 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP, Iron, Grooved-End Swing Check Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Anvil International, Inc.
b. Shurjoint Piping Products.
c. Tyco Fire Products LP; Grinnell Mechanical Products.
d. Victaulic Company.

2. Description:

a. CWP Rating: 300 psig (2070 kPa).
b. Body Material: ASTM A 536, ductile iron.
c. Seal: EPDM.
d. Disc: Spring-operated, ductile iron or stainless steel.

2.12 IRON, CENTER-GUIDED CHECK VALVES

A. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Anvil International, Inc.
b. APCO Willamette Valve and Primer Corporation.
c. Crispin Valve.
d. DFT Inc.
e. Flo Fab Inc.
f. GA Industries, Inc.
g. Hammond Valve.
h. Metraflex, Inc.
i. Milwaukee Valve Company.

j. Mueller Steam Specialty; a division of SPX Corporation.
k. NIBCO INC.
l. Spence Strainers International; a division of CIRCOR International, Inc.
m. Sure Flow Equipment Inc.
n. Val-Matic Valve & Manufacturing Corp.
o. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 126, gray iron.
d. Style: Compact wafer.
e. Seat: Bronze.

B. Class 125, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Flomatic Corporation.
e. Hammond Valve.
f. Metraflex, Inc.
g. Milwaukee Valve Company.
h. Mueller Steam Specialty; a division of SPX Corporation.
i. NIBCO INC.
j. Spence Strainers International; a division of CIRCOR International, Inc.
k. Sure Flow Equipment Inc.
l. Val-Matic Valve & Manufacturing Corp.
m. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 126, gray iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: Bronze.

C. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. Val-Matic Valve & Manufacturing Corp.

2. Description:

   a. Standard: MSS SP-125.
   b. CWP Rating: 300 psig (2070 kPa).
   c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
   d. Style: Compact wafer.
   e. Seat: Bronze.

D. Class 150, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. APCO Willamette Valve and Primer Corporation.
   b. Crispin Valve.
   c. Val-Matic Valve & Manufacturing Corp.

2. Description:

   a. Standard: MSS SP-125.
   b. CWP Rating: 300 psig (2070 kPa).
   c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
   d. Style: Globe, spring loaded.
   e. Ends: Flanged.
   f. Seat: Bronze.

E. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. APCO Willamette Valve and Primer Corporation.
   b. Crispin Valve.
   c. DFT Inc.
   d. Flo Fab Inc.
   e. Hammond Valve.
   f. Metraflex, Inc.
   g. Milwaukee Valve Company.
   h. NIBCO INC.
   i. Sure Flow Equipment Inc.
   j. Val-Matic Valve & Manufacturing Corp.

2. Description:

   a. Standard: MSS SP-125.
   b. CWP Rating: 400 psig (2760 kPa).
   c. Body Material: ASTM A 126, gray iron.
   d. Style: Compact wafer, spring loaded.
   e. Seat: Bronze.

F. Class 250, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. APCO Willamette Valve and Primer Corporation.
    b. Crispin Valve.
    c. DFT Inc.
    d. Flomatic Corporation.
    e. Hammond Valve.
    f. Metraflex, Inc.
    g. Milwaukee Valve Company.
    h. Mueller Steam Specialty; a division of SPX Corporation.
    i. NIBCO INC.
    j. Val-Matic Valve & Manufacturing Corp.

2. Description:

    a. Standard: MSS SP-125.
    b. CWP Rating: 400 psig (2760 kPa).
    c. Body Material: ASTM A 126, gray iron.
    d. Style: Globe, spring loaded.
    e. Ends: Flanged.
    f. Seat: Bronze.

G. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. APCO Willamette Valve and Primer Corporation.
    b. Crispin Valve.
    c. Val-Matic Valve & Manufacturing Corp.

2. Description:

    a. Standard: MSS SP-125.
    b. CWP Rating: 500 psig (3450 kPa).
    c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
    d. Style: Compact wafer, spring loaded.
    e. Seat: Bronze.

H. Class 300, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. APCO Willamette Valve and Primer Corporation.
    b. Crispin Valve.
    c. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 500 psig (3450 kPa).
c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: Bronze.

I. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Flo Fab Inc.
e. Hammond Valve.
f. Milwaukee Valve Company.
g. NIBCO INC.
h. Spence Strainers International; a division of CIRCOR International, Inc.
i. Sure Flow Equipment Inc.
j. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 126, gray iron.
d. Style: Compact wafer.
e. Seat: EPDM or NBR.

J. Class 125, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Anvil International, Inc.
b. APCO Willamette Valve and Primer Corporation.
c. Crispin Valve.
d. DFT Inc.
e. GA Industries, Inc.
f. Hammond Valve.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Sure Flow Equipment Inc.
j. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig (1380 kPa).

c. Body Material: ASTM A 126, gray iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: EPDM or NBR.

K. Class 150, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
d. Style: Compact wafer.
e. Seat: EPDM or NBR.

L. Class 150, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: EPDM or NBR.

M. Class 250, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Flo Fab Inc.
e. Hammond Valve.

f. Milwaukee Valve Company.
g. NIBCO INC.
h. Sure Flow Equipment Inc.
i. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 400 psig (2760 kPa).
c. Body Material: ASTM A 126, gray iron.
d. Style: Compact wafer, spring loaded.
e. Seat: EPDM or NBR.

N. Class 250, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. DFT Inc.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 400 psig (2760 kPa).
c. Body Material: ASTM A 126, gray iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: EPDM or NBR.

O. Class 300, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. APCO Willamette Valve and Primer Corporation.
b. Crispin Valve.
c. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 500 psig (3450 kPa).
c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
d. Style: Compact wafer, spring loaded.

P. Class 300, Iron, Globe, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. APCO Willamette Valve and Primer Corporation.
    b. Crispin Valve.
    c. Val-Matic Valve & Manufacturing Corp.

2. Description:

    a. Standard: MSS SP-125.
    b. CWP Rating: 500 psig (3450 kPa).
    c. Body Material: ASTM A 395/A 395M or ASTM A 536, ductile iron.
    d. Style: Globe, spring loaded.
    e. Ends: Flanged.
    f. Seat: EPDM or NBR.

2.13 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. American Valve, Inc.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Crane Co.; Crane Valve Group; Stockham Division.
    e. Hammond Valve.
    f. Kitz Corporation.
    g. Milwaukee Valve Company.
    h. NIBCO INC.
    i. Powell Valves.
    j. Red-White Valve Corporation.
    k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    l. Zy-Tech Global Industries, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 1.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    d. Ends: Threaded.
    e. Stem: Bronze.
    f. Disc: Solid wedge; bronze.
    g. Packing: Asbestos free.
    h. Handwheel: Malleable iron.

B. Class 125, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. American Valve, Inc.
    b. Crane Co.; Crane Valve Group; Crane Valves.
    c. Crane Co.; Crane Valve Group; Jenkins Valves.
    d. Crane Co.; Crane Valve Group; Stockham Division.
    e. Hammond Valve.
    f. Kitz Corporation.
    g. Milwaukee Valve Company.
    h. NIBCO INC.
    i. Powell Valves.
    j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    k. Zy-Tech Global Industries, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 2.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    d. Ends: Threaded.
    e. Stem: Bronze.
    f. Disc: Solid wedge; bronze.
    g. Packing: Asbestos free.
    h. Handwheel: Malleable iron.

C. Class 150, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Hammond Valve.
    b. Kitz Corporation.
    c. Milwaukee Valve Company.
    d. NIBCO INC.
    e. Powell Valves.
    f. Red-White Valve Corporation.
    g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 1.
    b. CWP Rating: 300 psig (2070 kPa).
    c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
    d. Ends: Threaded.
    e. Stem: Bronze.
    f. Disc: Solid wedge; bronze.
    g. Packing: Asbestos free.
    h. Handwheel: Malleable iron.

D. Class 150, RS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Stockham Division.
    c. Hammond Valve.
    d. Kitz Corporation.
    e. Milwaukee Valve Company.
    f. NIBCO INC.
    g. Powell Valves.
    h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    i. Zy-Tech Global Industries, Inc.

2. Description:

    a. Standard: MSS SP-80, Type 2.
    b. CWP Rating: 300 psig (2070 kPa).
    c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
    d. Ends: Threaded.
    e. Stem: Bronze.
    f. Disc: Solid wedge; bronze.
    g. Packing: Asbestos free.
    h. Handwheel: Malleable iron.

2.14 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Crane Co.; Crane Valve Group; Stockham Division.
    d. Flo Fab Inc.
    e. Hammond Valve.
    f. Kitz Corporation.
    g. Legend Valve.
    h. Milwaukee Valve Company.
    i. NIBCO INC.
    j. Powell Valves.
    k. Red-White Valve Corporation.
    l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    m. Zy-Tech Global Industries, Inc.

2. Description:

    a. Standard: MSS SP-70, Type I.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    d. Ends: Flanged.

e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

B. Class 125, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Crane Co.; Crane Valve Group; Stockham Division.
d. Flo Fab Inc.
e. Hammond Valve.
f. Kitz Corporation.
g. Legend Valve.
h. Milwaukee Valve Company.
i. NIBCO INC.
j. Powell Valves.
k. Red-White Valve Corporation.
l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
m. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

C. Class 250, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. NIBCO INC.

2. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 500 psig (3450 kPa).
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

D. Class 250, OS&Y, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Powell Valves.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 500 psig (3450 kPa).
c. Body Material: ASTM A 126, gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

2.15 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. Hammond Valve.
d. Kitz Corporation.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Powell Valves.
h. Red-White Valve Corporation.
i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
j. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded.
e. Stem and Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron.

B. Class 125, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Division.
c. NIBCO INC.
d. Red-White Valve Corporation.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

C. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Hammond Valve.
c. Kitz Corporation.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Powell Valves.
g. Red-White Valve Corporation.
h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
i. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig (2070 kPa).
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

2.16 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Crane Co.; Crane Valve Group; Stockham Division.
    d. Hammond Valve.
    e. Kitz Corporation.
    f. Milwaukee Valve Company.
    g. NIBCO INC.
    h. Powell Valves.
    i. Red-White Valve Corporation.
    j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    k. Zy-Tech Global Industries, Inc.

2. Description:

    a. Standard: MSS SP-85, Type I.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    d. Ends: Flanged.
    e. Trim: Bronze.
    f. Packing and Gasket: Asbestos free.

B. Class 250, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Crane Co.; Crane Valve Group; Crane Valves.
    b. Crane Co.; Crane Valve Group; Jenkins Valves.
    c. Crane Co.; Crane Valve Group; Stockham Division.
    d. Hammond Valve.
    e. Milwaukee Valve Company.
    f. NIBCO INC.
    g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

    a. Standard: MSS SP-85, Type I.
    b. CWP Rating: 500 psig (3450 kPa).
    c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    d. Ends: Flanged.
    e. Trim: Bronze.
    f. Packing and Gasket: Asbestos free.

2.17 LUBRICATED PLUG VALVES

A. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Nordstrom Valves, Inc.

2. Description:

    a. Standard: MSS SP-78, Type II.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
    d. Pattern: Regular or short.
    e. Plug: Cast iron or bronze with sealant groove.

B. Class 125, Regular-Gland, Lubricated Plug Valves with Flanged Ends:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Nordstrom Valves, Inc.

2. Description:

    a. Standard: MSS SP-78, Type II.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
    d. Pattern: Regular or short.
    e. Plug: Cast iron or bronze with sealant groove.

C. Class 125, Cylindrical, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Homestead Valve; a division of Olson Technologies, Inc.
    b. Milliken Valve Company.
    c. R & M Energy Systems; a unit of Robbins & Myers, Inc.

2. Description:

    a. Standard: MSS SP-78, Type IV.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
    d. Pattern: Regular or short.
    e. Plug: Cast iron or bronze with sealant groove.

D. Class 125, Cylindrical, Lubricated Plug Valves with Flanged Ends:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Homestead Valve; a division of Olson Technologies, Inc.
    b. Milliken Valve Company.
    c. R & M Energy Systems; a unit of Robbins & Myers, Inc.

2. Description:

    a. Standard: MSS SP-78, Type IV.
    b. CWP Rating: 200 psig (1380 kPa).
    c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
    d. Pattern: Regular or short.
    e. Plug: Cast iron or bronze with sealant groove.

E. Class 250, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Nordstrom Valves, Inc.

2. Description:

    a. Standard: MSS SP-78, Type II.
    b. CWP Rating: 400 psig (2760 kPa).
    c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
    d. Pattern: Regular or short.
    e. Plug: Cast iron or bronze with sealant groove.

F. Class 250, Regular-Gland, Lubricated Plug Valves with Flanged Ends:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Nordstrom Valves, Inc.

2. Description:

    a. Standard: MSS SP-78, Type II.
    b. CWP Rating: 400 psig (2760 kPa).
    c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
    d. Pattern: Regular or short.
    e. Plug: Cast iron or bronze with sealant groove.

G. Class 250, Cylindrical, Lubricated Plug Valves with Threaded Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Homestead Valve; a division of Olson Technologies, Inc.
    b. Milliken Valve Company.
    c. R & M Energy Systems; a unit of Robbins & Myers, Inc.

2. Description:

    a. Standard: MSS SP-78, Type IV.
    b. CWP Rating: 400 psig (2760 kPa).
    c. Body Material: ASTM A 48/A 48M or ASTM A 126, cast iron with lubrication-sealing system.
    d. Pattern: Regular or short.
    e. Plug: Cast iron or bronze with sealant groove.

H. Class 250, Cylindrical, Lubricated Plug Valves with Flanged Ends:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Homestead Valve; a division of Olson Technologies, Inc.
    b. Milliken Valve Company.
    c. R & M Energy Systems; a unit of Robbins & Myers, Inc.

2. Description:

    a. Standard: MSS SP-78, Type IV.
    b. CWP Rating: 400 psig (2760 kPa).
    c. Body Material: ASTM A 48/A 48M or ASTM A 126, Grade 40 cast iron with lubrication-sealing system.
    d. Pattern: Regular or short.
    e. Plug: Cast iron or bronze with sealant groove.

2.18 CHAINWHEELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries.
3. Trumbull Industries.

B. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to valve stems.
3. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve.
4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for valves NPS 4 (DN 100) and larger and more than 96 inches (2400 mm) above floor. Extend chains to 60 inches (1520 mm) above finished floor.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly , or gate valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.

3. Throttling Service: Ball, or butterfly valves.
4. Pump-Discharge Check Valves:

    a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze disc.
    b. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided check valves.
    c. NPS 2-1/2 (DN 65) and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG (1035 kPa) OR LESS)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: Three piece, full port, brass or bronze with brass, bronze or stainless-steel trim.
3. Bronze Lift Check Valves: Class 125, bronze disc.
4. Bronze Swing Check Valves: Class 125 , disc.
5. Bronze Gate Valves: Class 125 , .

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, aluminum-bronze disc.
3. Iron, Grooved-End Butterfly Valves: 175 CWP.
4. Iron Swing Check Valves: Class 125 , metal seats.
5. Iron, Grooved-End Swing Check Valves: 300 CWP.
6. Iron, Center-Guided Check Valves: Class 125 , compact-wafer , metal seat.
7. Iron Gate Valves: Class 125 .

3.6 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG (1035 TO 1380 kPa))

A. Pipe NPS 2 (DN 50) and Smaller:

1. Ball Valves: [Three] piece, [full] port, brass or bronze with brass, bronze or stainless-steel trim.
2. Bronze Lift Check Valves: Class 125, bronze disc.
3. Bronze Swing Check Valves: Class 125 disc.
4. Bronze Gate Valves: Class 125.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, disc.
3. Iron, Grooved-End Butterfly Valves: 175 CWP.
4. Iron Swing Check Valves: Class 125 , metal seats.
5. Iron, Grooved-End Swing Check Valves: 300 CWP.
6. Iron, Center-Guided Check Valves: Class 125 , compact-wafer seat.
7. Iron, Plate-Type Check Valves: Class 125 plate; metal seat.
8. Iron Gate Valves: Class 125 .

3.7 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE – N/A

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Angle Valves: Class 125 , bronze disc.
2. Ball Valves: Three piece, full port, brass or bronze with brass, bronze or stainless-steel trim.
3. Bronze Swing Check Valves: Class 125 , bronze disc.
4. Bronze Gate Valves: Class 125 .
5. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves: Class 150.
3. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.
4. Iron, Grooved-End Butterfly Valves: 175 CWP.
5. Iron Swing Check Valves: Class 125, metal seats.
6. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
7. Iron, Grooved-End Swing Check Valves: 300 CWP.
8. Iron, Center-Guided Check Valves: Class 125, compact-wafer , metal seat.
9. Iron, Plate-Type Check Valves: Class 125; single plate; metal seat.
10. Iron Gate Valves: [**Class 125**] [**Class 250**], [**NRS**] [**OS&Y**].

11. Iron Globe Valves: [**Class 125**] [**Class 250**].

3.8 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125, bronze disc.
3. Ball Valves: Three piece, full port, brass or bronze with brass, bronze or stainless-steel trim.
4. Bronze Swing Check Valves: Class 125, bronze disc.
5. Bronze Gate Valves: Class 125.
6. Bronze Globe Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): May be provided with threaded ends instead of flanged ends.
2. Iron Ball Valves: Class 150.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
5. Iron, Grooved-End Swing Check Valves: 300 CWP.
6. Iron Gate Valves: Class 125.
7. Iron Globe Valves: Class 125.
8. Lubricated Plug Valves: Class 125, [regular gland], threaded.

END OF SECTION 220523

SECTION 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. Section Includes:

1. Metal pipe hangers and supports.
2. Metal framing systems.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe stands.
6. Equipment supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC 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.

B. Wind-Restraint Loading: Equipment attachment points, supports and anchors shall be suitable for the following wind conditions, where exposed to wind loading:

1. Basic Wind Speed: 90 MPH.
2. Occupancy Classification: II.
3. Exposure Condition C.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Metal framing systems.
2. Pipe stands.
3. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

1.8 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.
c. Flex-Strut Inc.
d. GS Metals Corp.
e. Thomas & Betts Corporation.

f. Unistrut Corporation; Tyco International, Ltd.
g. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with in-turned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating, Outdoors: Hot-dipped galvanized.
8. Metallic Coating, Indoors: Electroplated zinc.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig (862-kPa) minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. 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.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Select support materials and finishes suitable for the environments in which they will be installed. Conform to at least the following:

1. Identified high-corrosion areas: Material and finish specifically approved for the environment. If not otherwise stated, stainless steel of grade not less than Type 304
2. High chlorine environment, such as swimming pool areas: Aluminum or aluminum-plated steel.
3. Moist areas such as crawl spaces, unconditioned mechanical rooms and areas around cooling towers: Hot-dipped galvanized steel, with any cuts or fabrication damage covered with zinc-rich paint demonstrated to be equivalent to hot dip galvanizing.
4. Conditioned indoor space: Electro-galvanized, cadmium plated, passivated spring steel or phosphatized steel.
5. Other materials and finishes specifically approved for the application by the design team.

B. Metal 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 the building structure.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. 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.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

I. 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.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. 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 (DN 65) and larger and at changes in direction of piping.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. 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.

N. Insulated Piping:

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 allowed by 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 (DN 100) 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 (DN 100) 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 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 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.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for piping 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.

3.4 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 1/2 inch (13 mm). Provide cap nuts or other suitable protection over ends of rods where likely to be contacted by people.

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 a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: 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.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Conform to hanger and support details on drawings, where applicable.

C. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

D. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

E. Use copper or nonmetallic coatings on metal attachments for electrolytic protection where attachments are in direct contact with copper tubing.

F. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. 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 noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
3. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
5. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

6. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

I. 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 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

J. 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 (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

K. 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. C-Clamps (MSS Type 23): For structural shapes.
6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
8. 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 (340 kg).

L. 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.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).

N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

O. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 220529

SECTION 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. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 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.

1.5 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 EXISTING STYLES

A. Where suitable existing labeling and marking systems are already established, provide new labels and marking consistent with the existing systems. Conform to existing color, pattern, material, attachment, text size and other features except as necessary to conform to any code requirement or request from the Owner to use the new features specified below instead of existing features.

B. Equipment and piping system labeling patterns, numbering, and other serial labeling shall be rational extensions of the Owner's established patterns, and be approved by Owner prior to creation.

2.2 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) 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 (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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 rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. 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.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.3 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch ((1.6 mm)) 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 (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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 rivets or 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.

2.4 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially or fully cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. 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 ((38 mm) high).

2.6 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches (32 mm) for ducts; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, alkyd or acrylic enamel, black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, alkyd or acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.7 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 (75 by 133 mm) minimum.

2. Fasteners: Brass grommet and wire.
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 encapsulants.

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 Section "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1 (unless owner has another established color coding system), 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 30 feet (9 m) along each run. Reduce intervals to 15 feet (4.5 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

Retain first paragraph below only if stenciled labels are permitted.

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

SECTION 220719 – PLUMBING PIPING 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 insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Sanitary waste piping exposed to freezing conditions.
5. Storm-water piping exposed to freezing conditions.
6. Roof drains and rainwater leaders.
7. Condensate piping.
8. Supplies and drains for handicap-accessible lavatories and sinks.

C. Related Sections:

1. Division 23 Section "Duct Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Environmental Submittals, Product Data: For adhesives and sealants, documentation including printed statement of VOC content.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to 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 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.

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 sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping 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.

1.8 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," and "Outdoor, Aboveground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products for use indoors or with metal jacket: Subject to compliance with requirements, provide one of the following or an approved equal:

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

2. Products for use indoors or outdoors if no metal jacket is specified: Subject to compliance with requirements, provide one of the following or an approved equal:

a. Armacell LLC; Armaflex Shield, available only in seamless slip-on form.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied ASJ or FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, provide the following or approved equal:

a. Ramco Insulation, Inc.; Super-Stik.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, provide the following or approved equal:

a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 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.

❖ Polyisocyanurate Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide the following:

a. Aeroflex USA, Inc.; Aeroseal.
b. Armacell LLC; Armaflex 520 Adhesive.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. 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 the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide the following:

a. Dow Corning Corporation; 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; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide the following, or approved equal:
   a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
   b. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
   b. Eagle Bridges - Marathon Industries; 550.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
   d. Mon-Eco Industries, Inc.; 55-50.
   e. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide the following:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
   b. Eagle Bridges - Marathon Industries; 405.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
   d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following, or approved equal:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide the following:

    a. Johns Manville; Zeston.
    b. P.I.C. Plastics, Inc.; FG Series.
    c. Proto Corporation; LoSmoke.
    d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.

3. Color: White.

4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Metal Jacket:

1. Products: Subject to compliance with requirements, provide the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
    b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
    c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

    a. Sheet and roll stock ready for shop or field sizing, or factory cut and rolled to size.
    b. Finish and thickness are indicated in field-applied jacket schedules.
    c. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper, or 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper, or 2.5-mil- (0.063-mm-) thick polysurlyn.
    d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper or 2.5-mil- (0.063-mm-) thick polysurlyn.
    e. Factory-Fabricated Fitting Covers:

        1) Same material, finish, and thickness as jacket.
        2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.

8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Self-Adhesive Outdoor Jacket: 60-mil- (1.5-mm-) thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with aluminum-foil facing.

1. Products: Subject to compliance with requirements, provide the following, or approved equal:

a. Polyguard Products, Inc.; Alumaguard 60.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide the following:

a. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide the following:

a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.
d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.

c. Venture Tape; 1506 CW NS.

2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide the following:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.9 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide the following, or approved equal:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.080-inch (2.0-mm) nickel-copper alloy, or 0.062-inch (1.6-mm) soft-annealed, stainless steel, or 0.062-inch (1.6-mm) soft-annealed, galvanized steel.

2.10 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Engineered Brass Company.
b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
c. McGuire Manufacturing.
d. Plumberex.
e. Truebro; a brand of IPS Corporation.
f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Truebro; a brand of IPS Corporation.
b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Provide section of special insulation to comply with fire resistance rating, if required.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and

unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.9 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 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.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:

a. Flexible Elastomeric: 1/2 inch (13 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.

2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch (25 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch (25 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2” thick.

C. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 3/4 inch (19 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.

3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction Piping:

1. All Pipe Sizes: Insulation shall be Elastomeric Foam: 2 inches (50 mm) thick.

B. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch (13 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (13 mm) thick.

2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 1/2 inch (25 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 1/2inch (25 mm) thick.

3.13 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. Elbows and fittings:

1. Fitted PVC fitting covers, 20 mil. For cold piping, provide vapor seal using field-applied FSK or ASJ or other approved method prior to final covering.

D. Exposed Elastomeric Insulation: Apply PVC jacket or ASJ over UV-protective paint-on coating.

3.14 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. Aluminum, Stucco Embossed, with Z-shaped locking seam: 0.024 inch (0.61 mm) thick.

D. Elastomeric Insulation: Apply Self-Adhesive Outdoor Jacket over UV-protective paint-on coating.

END OF SECTION 220719

SECTION 221112 - WATER DISTRIBUTION PIPING

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. This Section includes water distribution piping from locations indicated to fixtures and equipment inside building.

B. Related Sections include the following:

1. Division 2 Section "Water Systems" for exterior water service piping and water meters. (Ref: Civil plans & specifications.) Coordinate with Civil and Electrical work to insure that at least 20 feet (20') (6.1 m) of bare copper pipe is installed at least 30" below grade between any utility meter and the building entry point, and that it is accessible for electrical connection as a grounding electrode within five feet (5') (1.6 m) of the point of entry into the building.
2. Division 22 Section "Plumbing Specialties" for water distribution piping specialties.

1.3 DEFINITIONS

A. Service Entrance Piping: Water piping at entry into building between water service piping and water distribution piping.

B. Water Distribution Piping: Water piping inside building that conveys water to fixtures and equipment throughout the building.

C. The following are industry abbreviations for plastic piping materials:

1. CPVC: Chlorinated polyvinyl chloride.
2. NP: Nylon.
3. PB: Polybutylene.
4. PE: Polyethylene.
5. PP: Polypropylene.
6. PVC: Polyvinyl chloride.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Combined Fire-Protection and Domestic, Service Entrance Piping: 250 psig (1725 kPa).
2. Service Entrance Piping: 160 psig (1100 kPa).

3. Water Distribution Piping: 125 psig (860 kPa).

1.5 SUBMITTALS

A. Water Samples, Test Results, and Reports: Specified in "Field Quality Control" and "Cleaning" articles.

1.6 QUALITY ASSURANCE

A. Provide listing/approval stamp, label, or other marking on piping made to specified standards.

B. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

C. Comply with NSF 61, "Drinking Water System Components--Health Effects," Sections 1 through 9 for potable-water piping and components.

PART 2 - PRODUCTS

2.1 PIPES AND TUBES

A. General: Applications of the following pipe and tube materials are indicated in Part 3 "Piping Applications" Article.

B. Soft Copper Tube: ASTM B 88, Types K and L (ASTM B 88M, Types A and B), water tube, annealed temper.

C. Hard Copper Tube: ASTM B 88, Types L and M (ASTM B 88M, Types B and C), water tube, drawn temper.

2.2 PIPE AND TUBE FITTINGS

A. General: Applications of the following pipe and tube fitting materials are indicated in Part 3 "Piping Applications" Article.

B. Copper, Solder-Joint Pressure Fittings: ASME B16.18 cast-copper alloy or ASME B16.22 wrought copper.

C. Copper Unions: ASME B16.18, cast-copper-alloy, hexagonal-stock body with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends. Include threads conforming to ASME B1.20.1 on threaded ends.

D. Swage Fittings: Press-on Wrought-Copper Fittings

1. Fittings with integral, captive gasket, for application with compatible pressing tool as directed by the tool and fitting manufacturer(s) to achieve the specified piping system purpose and design test pressures and temperatures.

2. 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. Nibco
   b. Propress

2.3 JOINING MATERIALS

A. General: Applications of the following piping joining materials are indicated in Part 3 "Piping Applications" Article.

B. Solder: ASTM B 32, Alloy Sn95, Sn94, or E; lead free.

C. Brazing Filler Metal: AWS A5.8, BCuP, copper phosphorus or BAg, silver classification.

D. Copper, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

E. Transition Couplings: Coupling or other manufactured fitting same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

2.4 VALVES

A. Refer to Division 220523 Section "General Duty Valves for Plumbing Piping" for general-duty valves.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, as required if acceptable by AHJ.

o Fitting Option: Mechanically formed tee-branch outlets and brazed joints may be used on aboveground copper tubing.

C. Underground, Service Entrance Piping: Do not use flanges or valves underground. Use the following:

1. 2-Inch NPS (DN50) and Smaller: Soft copper tube, Type K (Type A); copper, solder-joint pressure fittings; and soldered joints.
2. 2-Inch NPS (DN50) and Smaller: Soft copper tube, Type L (Type B); copper, solder-joint pressure fittings; and soldered joints.

3. 2-1/2- to 3-1/2-Inch NPS (DN65 to DN90): Hard copper tube, Type L (Type B) or Type K (Type A); copper, solder-joint fittings; and soldered joints.

D. Aboveground, Water Distribution Piping: Use the following:

1. 2-Inch NPS (DN50) and smaller: Hard copper tube, Type L (Type B) or Type K (Type A); copper, solder-joint fittings; and soldered joints.
2. 2-1/2- to 3-1/2-Inch NPS (DN65 to DN90): Hard copper tube, Type L (Type B) or Type K (Type A);; copper, solder-joint fittings; and soldered joints.
4. 4- to 6-Inch NPS (DN100 to DN150): Hard copper tube, Type L (Type B) or Type K (Type A); with grooved ends; copper, grooved-end fittings; and copper, keyed couplings.
5. 8-Inch NPS (DN200): Hard copper tube, Type L (Type B) or Type K (Type A); with grooved ends; copper, grooved-end fittings; and copper, keyed couplings.

E. Underground, Water Distribution Piping: Do not use flanges or valves underground. Use the following:

1. 2-Inch NPS (DN50) and Smaller: Soft copper tube, Type L (Type B) or Type K (Type A);; wrought-copper, solder-joint pressure fittings; and soldered joints.
2. 2-Inch NPS (DN50) and Smaller: Hard copper tube, Type L (Type B) or or Type K (Type A);; wrought-copper, solder-joint pressure fittings; and soldered joints.
3. 2-1/2- to 4-Inch NPS (DN65 to DN100): Hard copper tube, Type L (Type B) or or Type K (Type A); wrought-copper, solder-joint pressure fittings; and soldered joints.

F. Non-Potable-Water Piping: Use the following:

1. 3-1/2-Inch NPS (DN90) and Smaller: Hard copper tube, Type L (Type B) or Type K (Type A);; solder-joint pressure fittings; and soldered joints.
2. 2- to 3-Inch NPS (DN50 to DN80): Hard copper tube, Type L (Type B) with grooved ends; copper, grooved-end fittings; and copper, keyed couplings.
3. 4- to 6-Inch NPS (DN100 to DN150): Hard copper tube, Type L (Type B) or Type K (Type A); with grooved ends; copper, grooved-end fittings; and copper, keyed couplings.
4. 8-Inch NPS (DN200): Hard copper tube, Type L (Type B) or Type K (Type A); with grooved ends; copper, grooved-end fittings; and copper, keyed couplings.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use gate, ball, or butterfly valves.
2. Throttling Duty: Use globe, ball, or butterfly valves.

B. Grooved-end butterfly valves may be used with grooved-end piping.

3.4 PIPING INSTALLATION, GENERAL

A. Refer to Division 22 Section "General Requirements for Plumbing Work" for basic piping installation.

3.5 SERVICE ENTRANCE PIPING INSTALLATION

A. Extend service entrance piping to exterior water service piping in sizes and locations indicated for service entrances into building. Refer to Division 2 Section "Water Systems" for water service piping.

B. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each service entrance pipe.

C. Install water-pressure regulators (if any) downstream from shutoff valves. Refer to Division 15 Section "Plumbing Specialties" for water-pressure regulators.

D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service entrance pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping" for sleeves and sleeve seals.

3.6 WATER DISTRIBUTION PIPING INSTALLATION

A. Install piping with 0.25 percent slope downward toward drain.

3.7 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

3.8 VALVE INSTALLATION

A. Sectional Valves: Install sectional valves close to main on each branch and riser serving plumbing fixtures or equipment, and where indicated. Use gate or ball valves for piping 2-inch NPS (DN50) and smaller. Use gate or butterfly valves for piping 2-1/2-inch NPS (DN65) and larger.

B. Shutoff Valves: Install shutoff valve on each water supply to equipment, on each supply to plumbing fixtures without supply stops, and where indicated. Use gate or ball valves for piping 2-inch NPS (DN50) and smaller. Use gate or butterfly valves for piping 2-1/2-inch NPS (DN65) and larger.

C. Drain Valves: Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.

D. Balancing Valves: Install in each hot-water circulation return branch, discharge side of each pump and circulator, and where indicated. Use ball valve for piping 2-inch NPS (DN50) and smaller and butterfly valve for piping 2-1/2-inch NPS (DN65) and larger. Refer to Division 15 Section "Plumbing Specialties" for balancing valves.

3.9 HANGER AND SUPPORT INSTALLATION

A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:

1. Riser clamps, MSS Type 8 or Type 42, for vertical runs.
2. Adjustable steel clevis hangers, MSS Type 1, for individual, straight, horizontal runs 100 feet (30 m) and less.

B. Install supports according to Division 15 Section "Hangers and Supports."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

E. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:

MAX. PIPE SIZE	MAX. HORIZ. SPACING	MIN. ROD DIAMETER	MAX. VERT. SPACING
3/4"(DN20)	60” (1500 mm)	3/8” (10 mm)	10’ (3 m)
1” (DN25)	72” (1800 mm)	3/8” (10 mm)	10’ (3 m)
1-1/4” (DN32)	72” (1800 mm)	3/8” (10 mm)	10’ (3 m)
2” (DN50)	96” (2400 mm)	1/2"(13 mm)	10’ (3 m)
2-1/2” (DN65	108” (2700 mm)	1/2"(13 mm)	10’ (3 m)
3” (DN80)	10’ (3 m)	1/2"(13 mm)	10’ (3 m)
3-1/2” (DN90)	10’ (3 m)	1/2"(13 mm)	10’ (3 m)
5” (DN125)	10’ (3 m)	1/2"(13 mm)	10’ (3 m)
6” (DN150)	10’ (3 m)	5/8"(16 mm)	10’ (3 m)
8” (DN200)	10’ (3 m)	3/4"(19 mm)	10’ (3 m)

F. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.10 CONNECTIONS

A. Connect service entrance piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.

B. Connect water distribution piping to service entrance piping at shutoff valve, and extend to and connect to the following:

1. Water Heaters: Connect cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Connect hot- and cold-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
3. Equipment: Connect hot- and cold-water supply piping as indicated. Provide shutoff valve and union for each connection. Use flanges instead of unions for connections 2-1/2-inch NPS (DN65) and larger.

3.11 FIELD QUALITY CONTROL

A. Inspect water distribution piping as follows:

B. Inspect service entrance piping and water distribution piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. 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.
    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 for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Test water distribution piping as follows:

D. Test service entrance piping and water distribution piping 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 water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
3. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.12 CLEANING

A. Clean and disinfect service entrance piping and water distribution piping as follows:

1. Purge new piping and parts of existing water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, procedure described in either AWWA C651 or AWWA C652 or as 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 (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for 3 hours.

c. Flush system with clean, potable water until chlorine is no longer in water coming from system after the standing time.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows contamination.

B. Prepare and submit reports for purging and disinfecting activities.

C. Clean interior of piping system. Remove dirt and debris as work progresses.

3.13 TESTING AND ADJUSTING

A. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

B. Perform the following steps before putting into 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. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.

C. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

D. Check plumbing specialties and verify proper settings, adjustments, and operation.

1. Water-Pressure Regulators: Set outlet pressure at 80 psig (550 kPa) maximum, unless otherwise indicated.
2. Recirculation Balancing Valves: Adjust to specified flow rate, or if not specified, to rate that results in approximately 5°F temperature drop from source to farthest fixture during zero-use conditions.

E. Energize pumps and verify proper operation.

END OF SECTION 15411

SECTION 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.

1.2 SUMMARY

A. Section Includes:
1. Strainers.
2. Flexible connectors.
3. Dielectric Unions
4. Hub drains
5. Cleanouts
6. Backflow preventers
7. Expansion tanks
8. Water hammer arrestors
9. Pressure regulating valves
10. Pressure relief valves
11. Grease traps

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product scheduled on drawings or specified hereinafter.

B. Shop Drawings: For domestic water piping specialties.
1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa) unless otherwise indicated.

2.3 SCHEDULES ON DRAWINGS

A. Refer to schedules on drawings for items specified in this section. Nothing in this section shall be interpreted as reducing scheduled requirements. Additional and more rigorous requirements herein supplement the requirements in the schedules.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:
1. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
   a. Strainers NPS 2 (DN 50) and Smaller: 0.020 inch (0.51 mm) .
   b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 inch (1.14 mm).
   c. Strainers NPS 5 (DN 125) and Larger: 0.10 inch (2.54 mm).
6. Drain: [Pipe plug] [or Factory-installed, hose-end drain valve].

2.5 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
1. Working-Pressure Rating: Minimum [250 psig (1725 kPa)].
2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

B. 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 (1380 kPa)
2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined. **All wetted materials shall be lead free and ANSI/NSF-61 certified for use in potable water piping.**

B. Dielectric Flanges:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Capitol Manufacturing Company.
      b. Central Plastics Company.
      c. Matco-Norca, Inc.
      d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
      e. Wilkins; a Zurn company.
   2. Description:
      a. Standard: ASSE 1079. ANSI/NSF-61
      b. Factory-fabricated, bolted, companion-flange assembly.
      c. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
      d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

C. Dielectric-Flange Insulating Kits:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Advance Products & Systems, Inc.
      b. Central Plastics Company.
      c. Pipeline Seal and Insulator, Inc.
   2. Description:
      a. Nonconducting materials for field assembly of companion flanges.
      b. Pressure Rating: 150 psig (1035 kPa).
      c. Gasket: EPDM full faced
      d. Bolt Sleeves: Phenolic or polyethylene.
      e. Washers: Phenolic with steel backing washers.

D. Dielectric Nipples:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Elster Perfection.
      b. Grinnell Mechanical Products.
      c. Matco-Norca, Inc.
      d. Precision Plumbing Products, Inc.
      e. Victaulic Company.
   2. Description:
      a. Standard: IAPMO PS 66
      b. Electroplated steel nipple. complying with ASTM F 1545.
      c. Pressure Rating: 150 psig (2070 kPa) at 225 deg F (107 deg C).
      d. End Connections: Male threaded or grooved.
      e. Lining: Inert and noncorrosive, propylene.

2.7 CLEANOUTS

A. At each change in direction greater than 45 degrees, at the end of each continuous waste line, at the foot of each riser in the building and at 50' intervals in long horizontal runs, of lines of four inch (4") size and smaller, and not more than 95' intervals for larger lines, cleanouts shall be placed in soil and waste lines, and any additional locations required by the plumbing code The size of the cleanouts shall be identical with the size of the soil or waste line in which they are placed for four inch (4") and smaller lines. The size of cleanouts in lines larger than four inches (4") shall be six inches (6") in all cases. All cleanouts shall be placed to be easily accessible for servicing. Where they occur in pipe chases, they shall be placed above the floor in such a location so they will be easily accessible through access doors, or they shall be brought through the walls and be provided with covers. All horizontal soil and waste lines shall have a cleanout placed in the end of the line by the use of a wye and a 1/8 bend, or by a combination teewye and made easily accessible by extending the cleanout through the wall and be covered as described above. The screw plug of all cleanouts shall be of cast brass.

B. The bodies of floor cleanouts shall be tapped for iron pipe threads. The brass tap screws shall have flange caps with raised nuts. Wherever such cleanouts occur in finished floor slabs or terminate in finished walls, they shall be provided with scoriated nickel bronze cleanout covers of such a size as to make the plugs over which they are installed readily accessible. These cleanouts shall be cast iron floor cleanout with cutoff ferrule, tapered brass plug with eight inch (8") round screwed brass access cover with three eighths inches (3/8") diameter Allen Head Screw.

C. All cleanouts shall be manufactured by Wade, Zurn, J.R. Smith, Mi-Fab or Josam. The specified manufactures and model number is the basis of design and the other listed manufacturers may be used, but must be equivalent to specification.

D. Finished Floors and Concrete Floors, Round Top. Primer coated cast iron floor cleanout with SV hub outlet, taper thread bronze plug, threaded adjustable housing and ferrule, membrane flange, secured/vandal proof, round-heavy duty satin-finished nickel bronze scoriated top that adjusts to finished floor after concrete has set. For cleanouts located under carpet floors provide an integral carpet marker to indicate location after floor carpeting is installed. Reference Architectural drawings for areas with carpet floors. Wade No. 6000-Z-1-75-Threaded/Machined for Clamp Device (-CM, where applicable, or approved equal. Set top of floor cleanouts such that top is flush with finished floor.

E. Outside Areas, Round Top. Primer coated cast iron, extra heavy traffic duty floor cleanout with taper thread bronze plug, threaded adjustable housing with flanged ferrule, secured/vandal proof, round, extra heavy duty, gasketed satin finished nickel bronze scoriated top that adjusts to finished grade in field after installation. Cast cleanouts flush in a 16" by 16" by 6" thick concrete pad. Concrete pad and cleanout shall be installed such that the top of pad and cleanout top are both set

with top flush with finished grade. Wade No. 6000-Z-1-755 or approved equal. Set top of exterior floor cleanouts such that top is flush with finished grade.

F. Finished Walls. Primer coated cast iron cleanout tee with countersunk head, taper treaded bronze plug, No-Hub connections and 6-inch diameter-smooth-stainless steel secured access cover with secured/vandal proof screw. Manufactured by, Wade W-8460, or approved equal. Wall cleanouts connected to above floor horizontal waste lines shall be secured and supported from cleanout fittings to concrete floor.

G. Unfinished Areas. Primer coated cast iron cleanout tee with countersunk head, taper thread bronze plug and No-Hub connections. Wade W-8560-MODIFIED for No-Hub connections-D. approved equal.

2.8 BACKFLOW PREVENTERS

A. Reduced Pressure Backflow Preventer (RPZ): Size as indicated on Drawings, bronze construction, rated for 175 psi, and shall include strainer, gate or ball valves based on size, pressure differential relief valve, check valves, test cocks, and relief vent and funnel drain. Unit shall meet the requirements of ASSE 1013, and AWWA, University of Southern California tested and approved. Manufactured by Watts Regulator No. 909, or by Wilkins or Conbraco (Apollo).

2.9 EXPANSION TANKS:

A. ASME coded pre-charged hydro pneumatic steel expansion tank, constructed with a maximum working pressure of 150 psig. Internal wetted parts shall be compliant with FDA regulations and approvals. Internal butyl diaphragm isolating water from air. Tank volume, dimensions and connections as specified in the drawings schedules. Manufactured by Amtrol “Therm-X-Trol”, or Watts, or Taco.

2.10 WATER HAMMER ARRESTORS:

A. Provide hydraulic shock water hammer arrestors in domestic cold water and domestic hot water lines to each individual plumbing fixture or battery of fixtures, and at each automatic solenoid operated or quick closing valve serving equipment. Shock water hammer arrestors shall be of seamless type “K” copper body construction or type 304 stainless steel body with stainless steel bellows, nitrogen and helium gas pre-charged. Shock arrestors shall be certified to ASSE 1010-2004 Standard and listed with IAPMO, completely sealed and operating free of casing. Size all units according to water hammer arrestors standard PDH-WH-201. The shock arrestors shall be designed to provide continuous protection without maintenance allowing the shock arrestor to be installed without an access panel. Manufactured by Sioux Chief “Hydra-Rester”, Wade or Jay. R. Smith.

2.11 PRESSURE REGULATING VALVES:

A. For sizes 2-inch and less: Lead free, automatic in operation, adjustable, rated for pressure up to 300 psi, replaceable engineered polymer seat, copper silicone alloy body, adjustable from 25-75 psi outlet pressure, with replaceable stainless steel strainer screen, with high pressure range gauge, ASSE Standard 1003 compliant, manufactured by Watts No. LF25AUB-Z3-HP, or approved equal.

B. For sizes over 2-inch: Lead free, automatic in operation, adjustable, rated for pressure up to 300 psi, replaceable stainless steel alloy seat, copper silicone alloy body, adjustable from 25-75 psi outlet pressure, with replaceable stainless steel strainer screen, with high pressure range gauge, ASSE Standard 1003 compliant, manufactured by Watts No. LFN223S-HP, or approved equal.

2.12 RELIEF VALVES:

A. Lead free temperature and pressure relief valve, consisting of CSA listed and ASME rated, ANSI Z21,22 certified, copper alloy body, stainless steel spring, test lever, thermostat, relief at 210 degrees F and 150 psig, manufactured by Watts No. LF100XL, or approved equal.

2.13 GREASE TRAP:

A. Provide pre-engineered, pre-cast Class 2 concrete with design strength of 4500 psi at 28 days. Unit shall be of monolithic construction at floor, grade 60 reinforced, with steel rebar conforming to ASTM A615 on required centers, based on size per manufacturer's recommendations. Complete with grey cast iron or ductile iron air tight manhole cover and frame conforming to ASTM A48-76 Class 30, with normal 24" diameter manhole for H20 loading. Refer to drawings for size and capacity manufactured by Park Equipment Company "GT" Series or approved equal. Provide concrete sampling well with manhole covers (H20 loading), as specified for grease interceptor, unit as manufactured by Park Equipment or approved equal.

2.14 HUB DRAINS (H.D.):

A. Hub drains (H.D.) located at, or near, Owner furnished equipment shall be cast iron soil pipe hubs or hub adaptors set flush with finished floor. Install in all such hubs or hub adaptors a Wade WL8450R cast iron cleanout ferrule with slotted head plug and round stainless steel access cover, or approved equal. Each hub drain shall be provided with a Ptrap.

Hub drains for other services shall be cast iron soil pipe hubs or hub adaptors set with top of hub onehalf inch (1/2") above finished floor. Each hub drain shall be provided with a Ptrap.

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 unacceptable for this application.
   3. Do not install bypass piping around backflow preventers.

B. Install balancing valves in locations where they can easily be adjusted.

C. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
   1. Install cabinet-type units recessed in or surface mounted on wall as specified.

D. Install Y-pattern strainers for water on supply side of each control valve, water temperature requlating valve and pump.

E. Install water-hammer arresters in water piping according to PDI-WH 201.

F. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

G. 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.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

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:

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 Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

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

SECTION 221316 - SANITARY WASTE AND VENT PIPING

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. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

B. Related Sections:

1. Division 2 Section "Sanitary Sewage" for sanitary sewage piping and structures outside the building.

1.3 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 (30 kPa).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ANACO-Husky.
b. Dallas Specialty & Mfg. Co.
c. Fernco Inc.
d. Matco-Norca, Inc.
e. MIFAB, Inc.
f. Mission Rubber Company; a division of MCP Industries, Inc.
g. Stant.
h. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Cast-Iron, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. MG Piping Products Company.

2. Standard: ASTM C 1277.
3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.

2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

3. Unshielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Dallas Specialty & Mfg. Co.
2) Fernco Inc.
3) Mission Rubber Company; a division of MCP Industries, Inc.
4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.

b. Standard: ASTM C 1173.

c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

d. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cascade Waterworks Mfg. Co.
2) Mission Rubber Company; a division of MCP Industries, Inc.

b. Standard: ASTM C 1460.

c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 2 Section "Earthwork."

3.2 PIPING INSTALLATION

A. 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.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. 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.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. 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 two 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.

K. 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.

L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Horizontal Sanitary Drainage Piping: Downward in direction of flow at 2 percent (1/4”/Ft) for piping NPS 2.5 (DN 60) and smaller;1 percent (1/8”/Ft) for NPS 4 to NPS 6, and 1/2% (1/16”/Ft) for NPS 8 (DN 200) and larger piping.

○

2. Vent Piping: Down toward vertical fixture vent or toward vent stack at 1/2% percent.

M. 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/A 21.5.

N. Install steel piping according to applicable plumbing code.

O. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.

P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

Q. Install aboveground ABS piping according to ASTM D 2661.

R. Install aboveground PVC piping according to ASTM D 2665.

S. Install underground PVC piping according to ASTM D 2321.

T. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Sovent Drainage System: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

U. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."

V. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Plastic, Nonpressure-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. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Unshielded, nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:

a. NPS 1-1/2 (DN 40) and Smaller: Fitting-type transition couplings.
b. NPS 2 (DN 50) and Larger: Pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for [NPS 2 (DN 50)] and Smaller: Use dielectric nipples.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges or nipples.
4. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:
    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
7. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, valve, and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) 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 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm) rod.
6. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
5. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.

6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
7. NPS 6 and NPS 8 (DN 150 and DN 200): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
8. NPS 10 and NPS 12 (DN 250 and DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.

H. Install supports for vertical steel piping every 15 feet (4.5 m).

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
4. NPS 3 and NPS 5 (DN 80 and DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
6. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.

J. Install supports for vertical copper tubing every 10 feet (3 m).

K. Install hangers forPVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
5. NPS 10 and NPS 12 (DN 250 and DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

L. Install supports for vertical PVC piping every 48 inches (1200 mm).

M. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 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. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. 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 (DN 65) and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.8 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. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

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 (30 kPa). 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 (250 Pa). 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.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. Cap and subject piping to static-water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

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.

D. Exposed PVC Piping: Protect plumbing vents exposed to daylight with two coats of water-based latex paint.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 8 (DN 200) and smaller shall be any of the following, except as indicated on the Project Drawings:

1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Aboveground, vent piping NPS 8 (DN 200) and smaller shall be any of the following:

1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

D. Underground, soil, waste, and vent piping NPS 12 (DN 300) and smaller shall be any of the following:

~~1. Service class, cast-iron soil piping; gaskets; and gasketed joints.~~
~~2. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; and coupled joints.~~
3. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
~~4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.~~

E. Underground, soil and waste piping NPS 12 (DN 300) and larger shall be any of the following:

~~1. Service class, cast-iron soil piping; gaskets; and gasketed joints.~~
~~2. Hubless, cast-iron soil pipe and fittings; CISPI cast-iron hubless-piping couplings; and coupled joints.~~
3. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
~~4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.~~

END OF SECTION 221316

DIVISION 23

MECHANICAL

SECTION 230101 - GENERAL REQUIREMENTS FOR MECHANICAL WORK

PART 1 - GENERAL

1.1 SCOPE

A. This project involves construction of a facility titled “BCCSF – BASTROP COUNTY COMBINED SERVICES FACILITY” as shown on the plans and described herein.

1.2 DRAWINGS

A. Do not scale from the Drawings; contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements. Contractor shall determine exact locations from field measurements. Refer also to all architectural, structural, etc., drawings. The lack of specific detail of all offsets, transitions, etc., shall not relieve the Contractor of responsibility to provide such necessary elements to coordinate his work with building construction and with other trades.

1.3 BIDDING

A. All bids must be based only on the equipment and materials as scheduled on the drawings and as specified or on equivalent equipment and materials from a pre approved alternative manufacturer. No bids may be based on a substitute or other alternative without specific written prior approval from the Engineer. Any Contractor who assumes equivalence of products and who bases his bid on that assumption does so at his own risk.

B. A listing of approved alternative manufacturers does not mean that all products of a particular alternative manufacturer are acceptable alternatives to the scheduled items; it merely means that for bidding prior approval is not required. All fixtures and devices must still be submitted according to the prescribed procedures. In addition, some items that have an important visual affect, e.g. electric water coolers, may be required to receive Engineer's or Owner's approval also.

1.4 INTENT

A. All equipment, materials and labor that may be necessary to complete work in accordance with the intent of these plans and specifications shall be furnished by the Contractor without additional cost.

B. All systems represented in the documents shall, unless specifically noted to the contrary, be provided and installed complete with all necessary components to form a complete and functioning system. Submission of bids will be considered confirmation that complete and functional systems have been included in the bids.

C. If any discrepancy or confusion is perceived in the documents, the Contractor shall call such to the attention of the Engineer for clarification of the documents prior to bidding or construction. If any inconsistencies or contradictions within the construction documents are discovered after

the construction contracts are awarded, the Engineer and/or Engineer shall determine the intent and correct interpretation of the construction documents.

D. Contractor shall supervise and direct the work competently and efficiently and in accordance with the drawings and specifications. Contractor shall be responsible for using construction means, methods, techniques, sequences, and procedures as are compatible with the project's requirements and will result in a project completed in accordance with the requirements of the drawings and specifications.

1.5 CODES, PERMITS AND FEES

A. Contractor shall comply with all local, state and national codes and shall pay for all applicable costs, fees and permits.

1.6 EXAMINATION OF SITE

A. Each contractor submitting proposal(s) for this work shall examine the site and shall take into consideration conditions that may affect the work. No information given on the plans shall relieve the Contractor of this responsibility. Submission of a bid shall be considered as compliance with the site examination requirements.

B. Contractor shall verify location, size, elevation, pressure, and any other pertinent data of existing utilities. Additional costs incurred due to a failure to verify such data and to coordinate associated work with respective utility providers shall not be the Owner's responsibility but shall be borne by Contractor.

C. Excavate by hand and with caution to locate all utilities prior to machine excavation. Should any service be interrupted, Contractor shall repair it immediately and at no cost to the Owner.

1.7 CONNECTION TO UTILITIES

A. All costs associated with providing utilities including, but not limited to, connection fees, boring under roads, etc., shall be included in the Contractor's bid price whether such costs are incurred by Contractor or charged by a utility company.

B. Contractor shall arrange gas service in accordance with utility company regulations and shall pay all applicable fees and costs.

1.8 VIBRATION AND NOISE

A. Each of the various pieces of equipment shall operate without objectionable vibration or noise. All rotating equipment shall be statically and dynamically balanced and shall be mounted, supported, and fastened so that vibration shall not exceed levels specified for the equipment item. The specific type of vibration isolation to be installed shall be submitted to the Engineer for his approval.

B. If, in the opinion of the Engineer or Owner, objectionable vibration or noise or transmission thereof to the building occurs, the Contractor shall execute remedial measures as may be

necessary to eliminate such unsatisfactory operating conditions. The work and material thereby required shall be furnished and performed at the Contractor's expense.

1.9 GUARANTEE

1.10 Each Contractor shall guarantee all labor and materials furnished by him for a period of one year unless otherwise noted. Guarantee period shall extend from the time of final written acceptance of the installation or upon usage by a written directive from the Owner, whichever occurs first. The guarantee shall cover the repair or replacement, without additional cost to the Owner, of any defective material or faulty workmanship.

1.11 SERVICE

A. All necessary service of each system, such as adjustment of controls, air distribution, and water balancing valves, mechanical repair of equipment, and other work requiring specialized training, shall be furnished by the Contractor, at no cost to the Owner, for a period of one year, concurrent with the warranty period specified above.

1.12 SUBMITTALS

A. Before orders are placed, contractor shall submit specific information on list of equipment and principal materials specified. Contractor shall indicate and/or provide names of manufacturers, catalog and model numbers, cut sheets, and such other supplementary information as necessary for evaluation. Refer to related section in Division 1, Section “Submittals.” Each shall be submitted and shall include all items mentioned by model number and/or manufacturer's name in the specifications or on the drawings, including but not limited to the following:

1. HVAC - All equipment, air devices, insulation, piping, valves, controls and other principal materials.

B. Requirements - Each submittal shall:

1. Bear a stamp or specific written indication that Contractor has reviewed and approved all submittals prior to submission to Engineer,
2. Be clearly marked as to which specific piece of equipment is being submitted, by use of a permanent marker, stamp, etc., so as to distinguish it from other pieces of equipment that may occur on the same page,
3. Be clearly marked as to which available options are being submitted that are associated with a piece of equipment, and
4. Be complete with respect to quantities, dimensions, specific performance, materials, and similar data to enable Engineer to review the proposed equipment.
5. Omission by Contractor of any of the above requirements for submittals will subject submittal to automatic rejection without review.
6. Any submittals received by Engineer that were not requested shall be returned without review of any kind.

C. Substitutions

1. No substitution is allowable without Engineer's written approval ten days prior to bid due date unless the manufacturer is listed on the Drawings or in the specifications as being a

pre approved alternative manufacturer. Any submittal received without such written approval or prior approval is subject to unqualified rejection.

2. Contractor's responsibility shall be to verify that submitted substitute equipment will fit in the space available. The Contractor's submittal for acceptance of the substitute shall include a written statement of whether or not such acceptance would require any subsequent or associated changes to the drawings or specifications. Any such changes shall be described in writing, briefly but completely.
3. The Contractor shall be responsible for the cost of any such modifications due to substitution of materials or equipment for that which was specified or scheduled. The cost shall be complete, that is, it shall include the costs affect on any and all other trades.
4. The Engineer may request shop drawings of mechanical rooms or systems of the substituted equipment.

1.13 SAFETY

A. Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work, and Contractor shall comply with all laws governing safety, specifically the "Occupational Safety and Health Standards" and the "Safety and Health Regulations for Construction", state and federal.

1.14 COORDINATION

A. Each Contractor's bid shall include the necessary detail and interconnection work to coordinate his work with the work of other trades. Failure on the part of the Contractor to coordinate with all other trades resulting in interference shall be sufficient reason to require the Contractor to replace or rebuild the work involved at no extra charge.

1.15 STORAGE OF MATERIALS

A. Each Contractor shall provide temporary storage facilities suitable for equipment stored at the job site. Storage facilities shall be rain-proof and lockable as required. Materials or equipment stored on site but not in a lockable, rain-proof storage facility shall be stored above ground or above slab. Contractor shall take necessary precautions to prevent entry of and/or damage from dirt, trash, water, or vermin. Equipment not properly stored and protected shall be, at the discretion of the Engineer, replaced at no cost to Owner. Roofs are not acceptable storage areas unless specifically allowed in writing by the Engineer.

1.16 LABELING

A. Each device for which an independent testing authority has established a standard shall have affixed a label indicating its compliance and listing. Such independent testing authorities shall include, but not be limited to, the following:

1.	A.D.C.	Air Diffusion Council
2.	A.G.A.	American Gas Association
3.	A.M.C.A.	Air Movement and Control Association
4.	A.N.S.I.	American National Standards Institute
5.	A.R.I.	Air-Conditioning and Refrigeration Institute
6.	A.S.H.R.A.E.	American Society of Heating, Refrigerating, and Air-Conditioning Engineers

7.	A.S.M.E.	American Society of Mechanical Engineers
8.	A.S.P.E.	American Society of Plumbing Engineers
9.	A.S.S.E.	American Society of Sanitary Engineers
10.	A.S.T.M.	American Society for Testing and Materials
11.	A.W.W.A.	American Water Works Association
12.	C.T.I.	Cooling Tower Institute
13.	F.M.	Factory Mutual
14.	I.A.P.M.O.	International Association of Plumbing and Mechanical Officials
15.	M.S.S.	Manufacturers Standardization Society of the Valve and Fittings Industry
16.	N.A.P.H.C.C.	National Association of Plumbing, Heating, Cooling Contractors
17.	N.B.S.	National Bureau of Standards
18.	N.E.B.B.	National Environmental Balancing Bureau
19.	N.F.P.A.	National Fire Protection Association
20.	P.D.I.	Plumbing and Drainage Institute
21.	S.B.C.C.I.	Southern Building Code Congress International
22.	S.M.A.C.N.A.	Sheet Metal and Air Conditioning Contractors' National Association
23.	T.I.M.A.	Thermal Insulation Manufacturers Association
24.	U.L.	Underwriters Laboratory

1.17 SITE VISIT REPORTS

A. During the course of the job, the Engineer's Office Project Manager will observe work in progress and will subsequently prepare a written site visit report which will be sent for distribution to the owner and to whomever else the Engineer desires.

1.18 CUTTING, PATCHING, AND PENETRATIONS

A. No joists, beams, girders, columns, slabs, or other structural elements shall be cut, drilled, or altered in any way by the Contractor without first obtaining written permission and instructions from the Engineer.

B. Where cutting any non-structural element(s) of walls, floors or ceilings is necessary to permit the installation of any work under this contract, or to repair any defects that may appear up to the expiration of the guarantee, such cutting shall be done by Contractor with as little damage as reasonably possible to the element being cut, to adjacent elements, or to the work of other trades.

C. After the necessary work has been completed, the damage shall be repaired by the Contractor, who shall pay all costs of such cutting and patching. All patching or sealing of cuts, penetrations, etc., including final appearance of same, shall be done to the approval of the Engineer.

D. Where a penetration or cutting of a ceiling, wall, or other building membrane is required or made, each such penetration or cut shall be made neatly with a cutting tool such as a saw, sharp knife, etc., and not with an impact tool such as a hammer, screwdriver, wrench, crowbar, etc. Each such penetration or cut shall be no larger than reasonably necessary, and penetrations in occupied or publicly accessible spaces shall have a chrome-plated escutcheon installed large enough to cover the entire opening.

1.19 FIRESTOPPING

A. Where a penetration is made in a fire-rated building assembly (wall, floor, ceiling, floor-ceiling, roof-ceiling, etc.) or in a membrane of a fire-rated assembly, install an appropriate firestopping assembly.

B. Select and apply firestop materials according to a design certified by a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

C. Submit firestopping design for each type of construction and penetrant before applying it.

1.20 HOUSEKEEPING PADS

A. Contractor shall construct housekeeping pads for floor-mounted mechanical and electrical equipment including, but not limited to, the following:

1. Air handling units
2. Storage tanks
3. Water heaters
4. Boilers
5. Pumps
6. Chemical feeders.

B. Pads shall be made 3½ - 6 inches thick (reference plans), of concrete with reinforcing such as welded wire screen, and with beveled edges. Contractor shall paint each pad with a masonry conditioner such as Sherwin-Williams A5V2 and then with a gray (or other color at Owner's request) industrial enamel such as Sherwin-Williams B-54 series.

1.21 OPERATING TESTS

A. General

1. After all mechanical and electrical systems have been completed and put into operation, Contractor shall subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation. All associated costs of such tests, including labor, fuel, apparatuses, piping, etc., shall be borne by the Contractor.
2. Contractor shall make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. The Contractor shall return to the project during the first year and in the opposite season from which the system was initially operated and shall check the proper operation of the mechanical and electrical systems. Contractor shall perform any adjustments or corrective procedures required for the proper operation of all systems.

B. Notification

1. Contractor shall give the Engineer seven days prior notification of any test so that the Engineer will have time to be present if he/she so desires.

C. Reports

1. After each test is performed, the Contractor who performed the test shall prepare and issue a report to include the following information:
2. Project name and location, date of the report,
3. Contractor's name, address, and telephone number; if the Contractor performing the test is a Subcontractor, indicate also for whom the test is being performed, their name, address, telephone number, and a contact person's name,
4. the date, or range of dates, of the test,
5. the name of the Contractor's employee who was responsible for performing or for overseeing the performing of the test,
6. a brief description of the system being tested,
7. a brief description of the testing procedure,
8. a summary of the test result(s),
9. a brief assertion that the system was tested as stated and that the system complied with the requirements of the contract documents or those of the Authority Having Jurisdiction, whichever is the most stringent, and
10. a hand-written date and signature of someone who has authority or responsibility from the company that performed test(s), and a hand-written brief note stating that the above information is true and accurate.
11. If the tested system is tested in parts, then one report may be made after the last part is tested.
12. The report shall be issued to the Engineer within five working days after the test is completed.
13. Such reports shall be required of all mechanical or electrical systems which require tests for pressure, water tightness, flow, resistance, or conductivity.
14. Services of a Manufacturer's Representative
15. For all major systems or equipment required by subsequent specifications sections to have tests or inspections by a manufacturer's representative, the manufacturer's representative shall prepare a written report to be sent to the Engineer for subsequent distribution to the Engineer, Owner, General Contractor, and to whomever else the Engineer deems necessary. The report shall include at least the following:

    a. Date of the visit, name and title of the representative, name and location of the project
    b. Name and title of any observers
    c. A brief description of the equipment being inspected and / or tested
    d. A brief discussion of the quality of the installation including any important items (in the manufacturer’s experience) that were done correctly, as well as any items that were done incorrectly or not to recommendations
    e. A list of test and / or inspections performed and the results of same
    f. A brief statement of whether the installation conforms to manufacturer’s recommendations and/or requirements, and if not what is required to bring the installation into conformance

D. Deficiencies and Defects

1. Contractor shall be responsible for providing all labor and materials, at no cost to anyone except Contractor, to correct any deficiencies or defects reported by manufacturer's representative.
2. If, in the opinion of the manufacturer's representative, the deficiencies and defects are sufficiently serious, then Contractor shall arrange for, and bear all costs of, another inspection by manufacturer's representative after corrective work is complete.

3. The above process shall continue until the manufacturer's representative approves the installation.

1.22 TEMPORARY FACILITIES

A. Jobsite office facilities: Refer to Architect's documents.

B. Temporary storage facilities: Refer to Architect's documents.

C. Sanitary facilities for workmen: Refer to Architect's documents.

D. Temporary utilities: Refer to Architect's documents.

1. The Contractor shall pay the cost of all water, gas, and electricity used during construction.
2. Each contractor will pay for his portion of the works required permits, meter taps and any other charge by the City. The temporary and/or permanent meters will be entered in the Contractor's name for payment until the facilities are accepted by the Owner.
3. Temporary Water Service:

    a. The Plumbing Contractor shall install a permanent water supply line from the nearest water main to the project, and shall maintain and protect it until completion of the project and acceptance by the Owner.
    b. The Plumbing Contractor shall provide, protect and maintain a adequate water supply for the use of all contractors on the project, for construction purposes, either by means of the permanent water supply line or by installing a temporary water line. This water supply shall be made available within fifteen (15) days after written request has been made to the Plumbing Contractor by the contractor requiring it, with copies of the request being submitted to all interested parties, including the Engineer.
    c. The Plumbing Contractor shall install a meter and a temporary water line to a point approximately ten (10) feet from the building. The exact point to which the water line is installed shall be indicated by the General Contractor. From this point, each contractor shall install, valve, maintain and protect such water supply lines that he might need to execute the work of his contract.

4. Temporary heat:

    a. Heating required after enclosure of the building shall be classified as "temporary heat". The building shall be considered enclosed when the roof and walls are weatherproof, and windows, doors and other openings are closed sufficiently to provide reasonable heat retention.
    b. The Mechanical Contractor shall provide temporary heat, and shall furnish, at his own expense, such labor and supervision as is necessary for efficient, safe operation until acceptance of the Project by the Owner.
    a. A minimum temperature of 60 degrees F and maximum of 80 degrees F shall be maintained in the building during and after installation of any materials or finishes that are affected by temperature or humidity. More strenuous requirements may apply to specific products or processes.
    b. At all times after the building is enclosed, the temperature in all interior parts of the building shall be kept above freezing.

E. Operation of equipment:

1. When heating, air conditioning, ventilating, exhaust or other items of electrical or other equipment are installed, it shall be the responsibility of the contractor installing such equipment to operate it for a satisfactory period of time, as required by the Engineer for proper testing of the equipment and for proper instruction of the Owner's operating personnel.
2. All other items of equipment, testing meters, testing instruments and incidentals required for proper testing of the equipment and for proper instructing of the Owner's operating personnel, shall be provided by the contractor providing and installing the equipment.

F. When any temporary facility is no longer needed for the proper conduct of the work, as determined by the Engineer, the Owner or the contractor who installed such temporary facilities, the contractor shall completely remove it from the project and shall repair or replace any material, equipment and finished surface damaged in installation, use or removal of the temporary facility.

PART 2 - PRODUCTS AND WORKMANSHIP

2.1 MATERIALS

A. All materials shall be new and of the quality specified. Materials shall be free from defects. Where manufacturers' names are mentioned in these specifications or on the plans, it has been done in order to establish a standard of quality and construction.

B. Contractor will be responsible for transportation of his materials to and on the job, and will be responsible for the storage and protection of his materials and work until the final acceptance of the job. At the end of each work day, each Contractor is responsible for covering or protecting his work or materials that may be susceptible to damage even if such damage is the result of unforeseen causes, e.g. an overnight thunderstorm. Failure to do so will be sufficient cause for rejection of any item in question, and any such item shall be replaced at Contractor's expense.

C. Contractor shall verify that all pieces of equipment will fit through available openings in building and that all equipment can be installed without modification of building structure.

2.2 WORKMANSHIP

A. The workmanship shall, in all respects, be of the highest grade, and all construction shall be done according to the best practices of the trade. Piping, ducting and conduit shall be concealed unless otherwise noted, and installed square to the building lines. Any work not meeting this requirement shall be replaced or rebuilt without extra expense to the Owner.

2.3 ROOF PENETRATIONS, EQUIPMENT AND PIPING SUPPORTS

A. Roof supports for equipment, piping, conduits, ductwork, etc. shall be provided and installed by an Owner approved Roofing Contractor and shall be provided under this Contract. The Mechanical, Electrical, and Plumbing Contractor shall coordinate and communicate closely with the Roofing Contractor as to locations of supports, sizes and weights of devices or equipment being supported, etc.

2.4 ACCESSIBILITY

A. Access Panels - Access panels shall be provided wherever necessary for possible future replacement, adjustment, or maintenance of operating devices such as machinery, valves, dampers, switches, relays, etc., or to other critical non-operating devices such as pull boxes, inspection parts, gauges, etc. Such access panels shall be provided and installed by Contractor, whether or not shown on drawings, and shall be brought to the attention of Engineer for his approval of type, color, etc.. Where access is provided in rated members, the access panels shall be of a type that maintains the integrity of the member penetrated.

B. Access to Equipment

1. All pipes, tubing, conduit, etc., including, but not limited to, domestic cold water and hot water piping, waste and vent piping, drain piping of any type, electrical conduit, wiring not in conduit, and pneumatic control tubing shall be installed in such a way so as not to prevent and/or not to make unreasonably difficult the removal, operation, use, or maintenance of equipment, access panels or doors, pathways (especially in attics or crawl spaces), observation ports, measurement or balancing devices, junction boxes, etc..
2. If access for these purposes is prevented or made unreasonably difficult in the opinion of the Engineer, then the Contractor shall make modifications or repairs at no cost to anyone except the Contractor. Such modifications or repairs shall be considered neither complete nor adequate until the Engineer is satisfied that access for the above purposes is achieved.
3. Provide elevated walking surfaces over floor- or roof-mounted ducts, conduit or piping that interfere with normal access and maintenance. At the least, any single run or band of conduit and/or piping over 18” wide or high shall be considered a walking obstacle.

PART 3 - RECORDS AND SERVICES FOR THE OWNER

3.1 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Contractor shall prepare and provide three copies of operating and maintenance manuals. Contractor shall deliver these four bound sets to the Engineer for approval. Each manual shall be in a ring binder and shall be indexed with dividers for each section. Delivery of required documents is a condition of final acceptance.

B. Each manual shall contain at least the following:

1. Certificates of acceptance from inspecting authorities,
2. Waiver of all liens,
3. For each piece of equipment:

    a. operating and safety instructions, service manuals, and parts lists applicable to each item of equipment furnished (Contractor shall clearly distinguish in the manual between information that pertains to the particular equipment and information which does not.),
    b. nameplate data and design parameters for equipment,
    c. name, phone number, and address of vendor, manufacturer's representative, and warrantee provider,

4. Copies of all shop drawings and as-built drawings (as-built drawings shall be on a reproducible vellum as produced by a Xerox or photographic process),

5. Copies of all approved submittals,
6. Mechanical system warranties, which begin on date of beneficial occupancy:
    a. This project incorporates systems which must be completed in sequential order. Certain systems must be completed for use by the Contractor, without Owner having beneficial use of these systems.
    b. Substantial completion and acceptance of each system by the Owner, signifies the system is acceptable, without further inspection. Custody of these systems remains with the Contractor.
    c. Beneficial occupancy will occur when the systems are integrated and the Owner is receiving the benefit of these systems. The Owner assumes custody of the systems and the Warranty period begins.
    d. The manufacturers' Warranty of equipment shall be noted with the start dates, coinciding with the beneficial occupancy date, and the end dates coinciding with the Manufacturers' warranty period.
    e. All equipment warranty start dates shall be submitted in writing to the owner and the engineer for their approval.
7. Names, phone numbers and addresses of all subcontractors, vendors, manufacturer's representatives, and warrantee providers,
8. Acceptance letter from each Contractor with blanks for date of acceptance and date of expiration of warranties and guarantees.

3.2 INSTRUCTIONS FOR OWNER

A. Contractor shall instruct the Owner's operating personnel in the operation and maintenance of all mechanical equipment. Contractor shall furnish any special servicing tools required for maintenance.

3.3 DEMONSTRATION

3.4 Contractor shall conduct a demonstration of the installation upon completion of the work. Prior to this, all work shall have been completed, tested, balanced, and placed in operation. Qualified persons must be present at demonstration to operate all systems and prove the performance of the equipment. The schedule for this demonstration shall be coordinated with the Engineer.

END OF SECTION 230101

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC 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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

1.4 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warranty nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. 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.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: **Premium Efficiency**, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Separate winding for each speed.

E. Rotor: Squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. 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.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. 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.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. 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.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors:

a. Class F temperature rise; Class H insulation.

b. For 20 HP and larger, provide shaft grounding rings, either internal or external to the motor case.
c. For 60 HP and larger, provide shaft grounding rings integral with the motor.

4. Thermal Protection: For 40 HP and larger, comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Motors 1/20 HP and Smaller: Shaded-pole type.

C. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

D. Bearings:

1. 1.5 HP and above: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
2. 1/4 HP to 1 HP: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
3. Under 1/4 HP: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

E. Thermal Protection: 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.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 15058

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC 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. Sleeves.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Comply with fire resistive penetration seal requirements, if applicable.

B. Steel Pipe Sleeves: Schedule 20 to 40, zinc coated; hot dip galvanized if either end is in damp location.

C. PVC Pipe Sleeves: Schedule 40 PVC; sunlight (UV) resistant where exposed.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
3. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

C. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces, except where extension beyond surface is needed for selected fire sealing method.
2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

D. Install PVC sleeves for fuel gas piping that passes under or through impervious cover such as concrete or asphalt paving. Provide vents and drains for sleeves as required by local code and as indicated on the drawings.

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

3.2 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Seal penetrations in exterior building envelope fully against water, insect and vermin intrusion. Comply with any specific details or other directives on the drawings.
2. Interior Partitions:
    a. Piping Smaller than NPS 6 (DN 150): If not otherwise detailed on Drawings, steel pipe sleeves, except as required for fire rated penetrations.
3. Exterior Walls:
    a. Piping Smaller than NPS 6 (DN 150): If not otherwise detailed on Drawings or required for fire rating, galvanized steel pipe sleeves.
    b. For penetrations below grade, provide water-resistant compression seals with stainless steel bolts. Use “Link Seal” or approved equal.
4. Roofs:
    a. Any penetration through the roof shall be coordinated with the Architect and the Owner's roofing advisor to ensure that it is waterproof, visually acceptable, and structurally sound.
    b. Piping and Wiring Groups: For two or more penetrants in one area, unless otherwise detailed on the drawings, provide a sheetmetal entry cover of essentially gooseneck form, flashed into the roof or set on a roof curb. The outer end of the gooseneck shall face no greater than 45 degrees from straight down. Provide a set of overlapping custom-cut split escutcheon plates at the outer end, and seal water

tight around each penetrant. Provide fiberglass insulation inside assembly at the plane of the roof insulation and secured in place.

c. Piping Smaller than NPS 6 (DN 150): If not otherwise detailed on Drawings or required for roof warranty or fire rating, steel pipe sleeves extending 4" above roof surface. Install UV-resistant elastomeric boot over top of sleeve, constricted and sealed to penetrating item.

END OF SECTION 230517

SECTION 230518 - ESCUTCHEONS FOR HVAC 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. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 ESCUTCHEONS

A. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

B. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

C. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

1.5 FLOOR PLATES

A. Split-Casting Floor Plates: Cast brass with concealed hinge.

1.6 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - EXECUTION

2.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.

2. Escutcheons for Existing Piping:

a. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Existing Piping: Split-casting, floor-plate type.

END OF SECTION 230518

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC 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. Metal pipe hangers and supports.
2. Metal framing systems.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe stands.
6. Equipment supports.

B. Related Sections:

1. Division 23 Section "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC 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.

B. Wind-Restraint Loading: Equipment attachment points, supports and anchors shall be suitable for the following wind conditions, where exposed to wind loading:

1. Basic Wind Speed: 90 MPH.
2. Occupancy Classification: II.
3. Exposure Condition C.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Metal framing systems.
2. Pipe stands.
3. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

1.8 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Allied Tube & Conduit.
    b. Cooper B-Line, Inc.
    c. Flex-Strut Inc.
    d. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut Corporation; Tyco International, Ltd.
    g. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating, Outdoors: Hot-dipped galvanized.
8. Metallic Coating, Indoors: Electroplated zinc.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig (688-kPa) minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. 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.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal 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 the building structure.

B. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

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.

E. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. 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 (DN 65) and larger and at changes in direction of piping.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. 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.

M. Insulated Piping:

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 allowed by 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 (DN 100) 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 (DN 100) 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 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 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.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for piping 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.

3.4 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 1/2 inch (13 mm). Provide cap nuts or other suitable protection over ends of rods where likely to be contacted by people.

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 a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: 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.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Conform to hanger and support details on drawings, where applicable.

C. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

D. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

E. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

F. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. 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 noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
3. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
5. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

6. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

I. 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 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

J. 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 (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

K. 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. C-Clamps (MSS Type 23): For structural shapes.
6. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
7. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
8. 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 (340 kg).

L. 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.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).

N. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

O. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548 - VIBRATION CONTROLS FOR HVAC 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:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Spring isolators.
5. Housed spring mounts.
6. Elastomeric hangers.
7. Spring hangers.
8. Pipe riser resilient supports.

1.3 DEFINITIONS

A. IBC: International Building Code.

1.4 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Basic Wind Speed: 90 MPH.
2. Occupancy Classification: II.
3. Exposure Condition C.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

1.8 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern, and cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the 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.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Provide sizes and thicknesses of elastomeric pads to satisfy recommended loadings and deflections for equipment with internal vibration isolation and balanced rotating parts. Select and size pads for maximum loading of 60 psi, minimum deflection of 0.1”.

B. Utilize elastomeric or spring hangers where supporting piping connected to resiliently mounted equipment, or where hung from structure supporting rigidly mounted equipment above such as cooling towers. Travel range shall be no less than 150% of the equipment mount movement range.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).

3.4 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 230548

SECTION 230553 - IDENTIFICATION FOR HVAC 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. Duct labels.
5. Stencils.
6. Valve tags.
7. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 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.

1.5 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 EXISTING STYLES

A. Where suitable existing labeling and marking systems are already established, provide new labels and marking consistent with the existing systems. Conform to existing color, pattern, material, attachment, text size and other features except as necessary to conform to any code requirement or request from the Owner to use the new features specified below instead of existing features.

B. Equipment and piping system labeling patterns, numbering, and other serial labeling shall be rational extensions of the Owner's established patterns, and be approved by Owner prior to creation.

2.2 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) 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 (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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 rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. 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.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.3 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch ((1.6 mm)) 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 (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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 rivets or 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.

2.4 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially or fully cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. 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 ((38 mm) high).

2.5 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch ((1.6 mm)) thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Black.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), 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 rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches ((38 mm) high).

2.6 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches (32 mm) for ducts; and minimum letter height of 3/4 inch (19 mm) for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, alkyd or acrylic enamel, black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, alkyd or acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.7 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 (75 by 133 mm) minimum.
2. Fasteners: Brass grommet and wire.
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 encapsulants.

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 Section "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels with painted, color-coded bands or rectangles, complying with ASME A13.1 (unless owner has another established color coding system), 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 30 feet (9 m) along each run. Reduce intervals to 15 feet (4.5 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.4 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
3. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.

C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING

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. Balancing Air Systems:

a. Constant-volume air systems.

b. Variable-air-volume systems.

~~2. Balancing Hydronic Piping Systems:~~

~~a. Constant-flow hydronic systems.~~
~~b. Variable-flow hydronic systems.~~
~~c. Primary-secondary hydronic systems.~~

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 45 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Certified TAB reports.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC NEBB or TABB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC NEBB or TABB as a TAB technician.

B. TAB Conference: Meet with Owner and Commissioning Authority on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Commissioning Authority.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner will occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Division 23 Section "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

L. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Coordinate TAB work with commissioning agent and controls contractor to avoid the need to repeat the following functions for their various needs.

B. Perform testing and balancing procedures on each system according to the procedures contained in either AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" (or in another acceptable standard such as ASHRAE 111 or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing") and in this Section.

C. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23Section "Air Duct Accessories."

3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "HVAC Insulation."

D. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

E. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Division 23 Section "Metal Ducts."

3.5 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.

2. Measure fan static pressures as follows to determine actual static pressure:

a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
b. Measure static pressure directly at the fan outlet or through the flexible connection.
c. 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.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. 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.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.

5. 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.

6. Comply with requirements in Division 23 Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. 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, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. 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.

3.6 ADDITIONAL PROCEDURES FOR VARIABLE-SPEED AIRHANDLERS

A. Test and adjust thermostatically self-modulating air outlets to insure airflows and range of operation requirements on the drawings.

B. Coordinate TAB work with commissioning agent and controls contractor to minimize the need to repeat tests and measurements.

1. Assist the control contractor in determining setpoints and relations, including at least:

a. Minimum fan speeds for fresh air and heating conditions.
b. Maximum fan speeds for design airflow at 100% return air.
c. RA damper stroke relation to fan speed that will assure ability to attain design fresh air flow at any fan speed from 20% to 100%. Verify at 25%, 50%, 75% and 100% speed.

2. Assist with calibration of airflow measurement devices.

C. Verify smooth operation of fan over full range of speeds.

3.7 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Coordinate TAB work with commissioning agent and controls contractor to avoid the need to repeat the following functions for their various needs.

B. 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 a 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 terminal units near the fan for the reduced-airflow.

C. Pressure-Independent, Variable-Air-Volume Systems:

1. Coordinate work with commissioning agent and controls contractor to avoid the need to repeat the following functions for various purposes.
2. Program EMS (BAS) with maximum and minimum airflows at inlets to terminal units served by the system.
3. Operate the system supply fan(s) with duct pressure regulation and static pressure reset active, and with supply air temperature(s) so moderate that all terminal units on the system are operating at peak design airflow.

a. If any terminal units on a system are supplied by more than one supply fan, operate one supply fan at a time to verify correct airflow through each TU inlet.
b. Calibrate each terminal unit inlet airflow sensor against air outlet readings.
c. Operate all supply fans serving each terminal unit.

1) Record each required supply duct static pressure.
2) Balance the air through each downstream outlet.
3) Measure and record total fan airflow and static pressure for each supply air system. Submit design operating point on fan curve with TAB report.

4. Verify accuracy of minimum airflow if one is scheduled.
5. Verify and record duct static pressure at sensor location. Calibrate or replace sensor if necessary.

6. Record (trend log) duct static pressure and fraction open of most-open valve for each supply air system. Verify that duct static pressure modulates smoothly to setpoint, and that the most-open terminal unit damper stabilizes at the design setpoint for duct pressure reset. Tune and calibrate
7. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
8. Record final fan-performance data.

~~3.8 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS~~

~~A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.~~

~~B. Prepare schematic diagrams of systems' "as-built" piping layouts.~~

~~C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:~~

~~1. Open all manual valves for maximum flow.~~
~~2. Check liquid level in expansion tank.~~
~~3. Check makeup water-station pressure gage for adequate pressure for highest vent.~~
~~4. Check flow-control valves for specified sequence of operation, and set at indicated flow.~~
~~5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.~~
~~6. Set system controls so automatic valves are wide open to heat exchangers.~~
~~7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.~~
~~8. Check air vents for a forceful liquid flow exiting from vents when manually operated.~~

~~3.9 PROCEDURES FOR CONSTANT-SPEED CENTRIFUGAL PUMPING SYSTEMS~~

~~A. Monitor motor performance during procedures and do not operate motors in overload conditions.~~

~~B. Check system resistance.~~

~~1. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.~~
~~2. Measure water flow at pumps using discharge flow meter or calibrated balancing valve.~~
~~3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.~~
~~4. Report flow rates that are not within plus or minus 10 percent of design.~~
~~5. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for~~

differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.

a. Compute the diameter of impeller that will result in design head at design flow and speed.
b. If impeller size is not between 100% and 105% of the computed requirement, contact Engineer. If impeller trimming is required, comply with requirements in Div 23 section "Hydronic Pumps."

C. Set calibrated balancing valves, if installed, at calculated presettings.

D. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

E. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

F. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

G. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.

H. Check settings and operation of each safety valve. Record settings.

3.10 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Coordinate TAB work with commissioning agent and controls contractor to avoid the need to repeat the following functions for their various needs.

B. Balancing Valve Adjustments

1. Prove-up balance is to show that pumps can deliver the design flow to all loads simultaneously. In this sense, design flow is the design pump flow. If the sum of the design flows of individual loads is greater than the pumping system design load, diversity must be simulated by reducing flow to the nearest loads, then restricting the farther loads while the near valve are adjusted. Record and temporarily mark the setting of each balancing valve when it is flowing design flow during full design pump flow. Report that setting with the related Cv, and a higher setting for normal operation. The higher setting shall 100% open or shall result in a Cv increase equal to 2.5% of the pumping system (or pressure-regulated sub-zone if one is present) design flow in GPM. Adjust each valve to the higher setting and permanently mark it.
2. Under maintenance and operating conditions, valves should remain at their permanently marked positions, except as follows:

a. Valves may be restricted temporarily to achieve more accurate flow measurements if the flow reading is corrected for the reduced resistance that will be present when the valve is re-opened.

C. Pressure-Dependent, Variable-Flow Hydronic Systems:

1. This process applies to systems with automatic differential pressure regulation through pump speed control, automatic differential pressure reset through monitoring the most-open valve, hydronic coil control valves without pressure-independent features, and leaving air temperature as the dominant hydronic coil valve control parameter.

2. Test the capacity of the pumps to deliver design flow to any part of the system. Trend log the pump speed, the differential pressure, the most-open valve position, the hydronic system differential temperature and the system flow rate for the entire test.

a. Begin only when automatic controls on hydronic loads are fully operational, differential pressure regulation by pump speed is functional, and differential pressure reset by most-open valve is functional. Refer to Sequence of Operation on the drawings and/or in Div 23 Section "Sequence of Operation."
b. Perform this test while hydronic system load is significant, and/or after the system has been off long enough to result in full load on airhandlers when they are enabled.
c. Operate hydronic system at design leaving water temperature and operate airhandlers with leaving air temperature setpoints at design.
d. Operate pump(s) (all pumps in a parallel set) under automatic differential pressure control, with reset by most-open valve, per Sequence of Operation.
e. Begin test by limiting pump speed to 50% (or less if necessary) of design until the majority of airhandler valves are nearing 100% open and VAV fans are approaching full speed.
f. Restrict flow through airhandlers near the pump if necessary to keep system flow below the system design flow.
g. As quickly as practical, iteratively increase the pump speed and reduce the number of enabled AHU's (working from hydraulically near units to hydraulically far units) until the system head and flow are both within 5% of design.

3. Submit test records to Engineer and include in TAB report.

3.11 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.12 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.13 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.14 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.

c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches (mm), and bore.
    i. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.

3. Test Data (Indicated and Actual Values):

    a. Total air flow rate in cfm (L/s).
    b. Total system static pressure in inches wg (Pa).

c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Filter static-pressure differential in inches wg (Pa).
f. Preheat-coil static-pressure differential in inches wg (Pa).
g. Cooling-coil static-pressure differential in inches wg (Pa).
h. Heating-coil static-pressure differential in inches wg (Pa).
i. Outdoor airflow in cfm (L/s).
j. Return airflow in cfm (L/s).
k. Outdoor-air damper position.
l. Return-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch (mm) o.c.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm (L/s).
b. Average face velocity in fpm (m/s).
c. Air pressure drop in inches wg (Pa).
d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig (kPa).
j. Refrigerant suction temperature in deg F (deg C).

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches (mm), and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).

g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F (deg C).
d. Duct static pressure in inches wg (Pa).
e. Duct size in inches (mm).
f. Duct area in sq. ft. (sq. m).
g. Indicated air flow rate in cfm (L/s).
h. Indicated velocity in fpm (m/s).
i. Actual air flow rate in cfm (L/s).
j. Actual average velocity in fpm (m/s).
k. Barometric pressure in psig (Pa).

I. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.15 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Verify that balancing devices are marked with final balance position.
e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Owner and Commissioning Authority.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Owner and Commissioning Authority.
3. Owner and Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.16 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713 - DUCT 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 insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

B. Related Sections:

1. Division 23 Section "HVAC Equipment Insulation."
2. Division 23 Section "HVAC Piping Insulation."
3. Division 23 Section "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance, thickness, and jackets (both factory- and field-applied if any).

~~B. LEED Submittals: For adhesives and sealants, documentation including printed statement of VOC content.~~

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

1.5 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. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing 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 agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.6 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.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 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.

1.9 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ or with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following:

a. CertainTeed Corp.; Commercial Board.
b. Fibrex Insulations Inc.; FBX.
c. Johns Manville; 800 Series Spin-Glas.
d. Knauf Insulation; Insulation Board.
e. Manson Insulation Inc.; AK Board.
f. Owens Corning; Fiberglas 700 Series.

2.2 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. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Adhesive, and FSK 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 the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide the following:

a. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide the following:

a. ABI, Ideal Tape Division; 491 AWF FSK.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
c. Compac Corporation; 110 and 111.

d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide the following:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.7 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, 3/4 inch (19 mm) wide with wing seal or closed seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) or 0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated.

a. Products: Subject to compliance with requirements, provide the following:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) or 0.135-inch- (3.5-

mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.

a. Products: Subject to compliance with requirements, provide the following:

1) AGM Industries, Inc.; CHP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, provide the following:

1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.

c. Spindle: Copper- or zinc-coated, low-carbon steel, Aluminum or Stainless steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel, aluminum or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

a. Products: Subject to compliance with requirements, provide the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.080-inch (2.0-mm) nickel-copper alloy, 0.062-inch (1.6-mm) soft-annealed, stainless steel, or 0.062-inch (1.6-mm) soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. C & F Wire.

2.8 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for smoke- or fire-rated wall and partition penetrations. Externally insulate damper sleeves (unless pre-insulated) to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm). Comply with all damper installation instructions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping"firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for not less than 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions, except that adhesive may be omitted from top surface of rectangular horizontal ducts.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.

f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-(150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for a least 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions, except that adhesive may be omitted from top surface of rectangular horizontal ducts.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
   b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-(150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.6 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.7 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
3. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Outside-air and Supply-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

B. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be one of the following:

1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

C. Return-air duct and plenum insulation shall be one of the following:

1. Ducts: Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.
2. Ducts or Plenums: Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

A. Supply-air duct insulation outside the building thermal envelope shall be one of the following:

1. Mineral-Fiber Blanket: 2 inches (50 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 2 inches (50 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

B. Supplement the insulation of internally lined return-air ducts and plenums outside the building thermal envelope with one of the following:

1. Ducts: Mineral-Fiber Blanket: 1 inch (25 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.
2. Ducts or Plenums: Mineral-Fiber Board: 1 inch (25 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING 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 insulating the following HVAC piping systems:

1. Condensate drain piping.
2. Refrigerant suction piping.

B. Related Sections:

1. Division 23 Section "HVAC Equipment Insulation."
2. Division 23 Section "Duct Insulation."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Environmental Submittals, Product Data: For adhesives and sealants, documentation including printed statement of VOC content.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to 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 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.

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 sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping 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.

1.8 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," and "Outdoor, Aboveground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide the following:

    a. Aeroflex USA, Inc.; Aerocel.
    b. Armacell LLC; AP Armaflex.
    c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied ASJ or FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following:

    a. CertainTeed Corp.; SoftTouch Duct Wrap.
    b. Johns Manville; Microlite.
    c. Knauf Insulation; Friendly Feel Duct Wrap.
    d. Manson Insulation Inc.; Alley Wrap.
    e. Owens Corning; SOFTR All-Service Duct Wrap.

H. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide the following:

    a. Fibrex Insulations Inc.; Coreplus 1200.
    b. Johns Manville; Micro-Lok.
    c. Knauf Insulation; 1000-Degree Pipe Insulation.
    d. Manson Insulation Inc.; Alley-K.
    e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ or FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. (40 kg/cu. m) or more. Thermal conductivity (k-value) at 100 deg F (55 deg C) is 0.29 Btu x in./h x sq. ft. x deg F (0.042 W/m x K) or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide the following:

    a. CertainTeed Corp.; CrimpWrap.
    b. Johns Manville; MicroFlex.
    c. Knauf Insulation; Pipe and Tank Insulation.
    d. Manson Insulation Inc.; AK Flex.
    e. Owens Corning; Fiberglas Pipe and Tank Insulation.

J. Polyisocyanurate: Unfaced, preformed, rigid cellular polyisocyanurate material intended for use as thermal insulation.

1. Products: Subject to compliance with requirements, provide the following:

    a. Dow Chemical Company (The); Trymer 2000 XP.
    b. Duna USA Inc.; Corafoam.

c. Dyplast Products; ISO-25.
d. Elliott Company of Indianapolis; Elfoam.

2. Comply with ASTM C 591, Type I or Type IV, except thermal conductivity (k-value) shall not exceed 0.19 Btu x in./h x sq. ft. x deg F (0.027 W/m x K) at 75 deg F (24 deg C) after 180 days of aging.
3. Flame-spread index shall be 25 or less, and smoke-developed index shall be 50 or less for thickness up to 1 inch (25 mm) as tested by ASTM E 84.
4. Fabricate shapes according to ASTM C 450 and ASTM C 585.
5. Factory-Applied Jacket: Requirements are specified in "Factory-Applied Jackets" Article.

a. Pipe Applications: ASJ or ASJ-SSL.

2.2 ADHESIVES

A. Comply with VOC and other requirements specified in Section 018113 – Sustainable Construction Requirements.

B. 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.

C. Polyisocyanurate Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).

1. Products: Subject to compliance with requirements, provide the following or approved equal:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-96.
b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-33.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide the following:

a. Aeroflex USA, Inc.; Aeroseal.
b. Armacell LLC; Armaflex 520 Adhesive.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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 the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have 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 the following:

a. Dow Corning Corporation; 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; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Comply with VOC and other requirements specified in Section 018113 – Sustainable Construction Requirements.

B. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide the following, or approved equal:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

D. 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 Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.4 SEALANTS

A. Comply with VOC and other requirements specified in Section 018113 – Sustainable Construction Requirements.

B. Joint Sealants:

1. Joint Sealants for Cellular-Glass, Phenolic, and Polyisocyanurate Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following, or approved equal:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide the following:

a. Johns Manville; Zeston.
b. P.I.C. Plastics, Inc.; FG Series.
c. Proto Corporation; LoSmoke.

d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.

3. Color: White.

4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Metal Jacket:

1. Products: Subject to compliance with requirements, provide the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing, or factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper, or 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper, or 2.5-mil- (0.063-mm-) thick polysurlyn.
d. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper or 2.5-mil- (0.063-mm-) thick polysurlyn.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.
8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Self-Adhesive Outdoor Jacket: 60-mil- (1.5-mm-) thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with aluminum-foil facing.

1. Products: Subject to compliance with requirements, provide the following, or approved equal:

a. Polyguard Products, Inc.; Alumaguard 60.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide the following:

   a. ABI, Ideal Tape Division; 428 AWF ASJ.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
   c. Compac Corporation; 104 and 105.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide the following:

   a. ABI, Ideal Tape Division; 491 AWF FSK.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   c. Compac Corporation; 110 and 111.
   d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide the following:

   a. ABI, Ideal Tape Division; 370 White PVC tape.
   b. Compac Corporation; 130.
   c. Venture Tape; 1506 CW NS.

2. Width: 2 inches (50 mm).
3. Thickness: 6 mils (0.15 mm).
4. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide the following:

   a. ABI, Ideal Tape Division; 488 AWF.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.

c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.

2. Width: 2 inches (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.8 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide the following, or approved equal:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.
3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.080-inch (2.0-mm) nickel-copper alloy, or 0.062-inch (1.6-mm) soft-annealed, stainless steel, or 0.062-inch (1.6-mm) soft-annealed, galvanized steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
~~*3.*~~ Proceed with installation only after unsatisfactory conditions have been corrected. ~~*Please note, where project has indoor condenser loop piping, which is not insulated, new insulation only required where indicated on the plans.*~~

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. If insulation is installed in multiple layers, stagger longitudinal and end seams.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
    a. For below-ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Provide section of special insulation to comply with fire resistance rating, if required.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF POLYISOCYANURATE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with tape or bands and tighten without deforming insulation materials. Orient longitudinal joints between half sections in 3- and 9-o'clock positions on the pipe.
2. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
3. All insulation shall be tightly butted and free of voids and gaps at all joints. Vapor barrier must be continuous. Before installing jacket material, install vapor-barrier system.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, same thickness of adjacent pipe insulation, not to exceed 1-1/2-inch (38-mm) thickness.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyisocyanurate block insulation of same thickness as pipe insulation.

C. Insulation Installation on Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of polyisocyanurate insulation to valve body.

2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.10 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.11 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.

3.12 INDOOR AND CRAWL SPACE PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 3/4 inch (19 mm) thick.

B. Refrigerant suction piping (including all lines from expansion device to evaporator coil):

1. All Pipe Sizes: Flexible Elastomeric: 1 inch (25 mm) thick.

~~C. Chilled Water and Brine, 40°F-50°F **(N/A This Project)** Insulation shall be Mineral-Fiber, preformed with factory jacket for at least straight sections (blanket or preformed with seal and PVC jacket allowed for fittings), to meet or exceed current IECC requirements, and of at least the following thicknesses:~~

~~1. NPS 1-1/2 (DN 35) and Smaller: 1-1/2" thick.~~
~~2. NPS 2 (DN 50) and Larger: 2" thick.~~

~~D. Heating-Hot-Water Supply and Return, 105°F-200° F (N/A This Project) Insulation shall be Mineral-Fiber, preformed with factory jacket for at least straight sections (blanket or preformed with PVC jacket allowed for fittings), with thermal resistance to meet or exceed current IECC requirements, and of at least the following thicknesses:~~

~~1. NPS 1-1/2 (DN 35) and Smaller: 1-1/2" thick.~~
~~2. NPS 2 (DN 50) and Larger: 2" thick.~~

3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. For UV-resistant PVC pipe, no insulation is required.
2. All Pipe Sizes: Insulation shall be one of the following:

   a. Flexible Elastomeric: 3/4 inch (19 mm) thick.

A. Refrigerant Piping:

1. Liquid lines: Insulation shall be Elastomeric Foam, 3/4 inch (19 mm) thick.
2. Suction lines (temperature above 40 Deg F (5 Deg C)): Insulation shall be Elastomeric Foam (fire smoke rated) , 1" (25 mm) thick.

B. Chilled Water (N/A This Project):

1. All Pipe Sizes: Insulation shall be Polyisocyanurate with thermal resistance to meet or exceed current IECC requirements, and at least 2 inches (50 mm) thick.

3.14 INDOOR AND CRAWL SPACE 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. Exposed Elastomeric Insulation: Apply PVC jacket or ASJ over UV-protective paint-on coating.

D. Mineral Fiber Insulation: Elbows and fittings: Fitted PVC fitting covers, 20 mil. For cold piping, provide vapor seal using field-applied FSK or ASJ or other approved method prior to final covering.

3.15 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. Mineral Fiber Insulation: Aluminum, Stucco Embossed, with Z-shaped locking seam: 0.024 inch (0.61 mm) thick.

D. Polyisocyanurate Insulation: Aluminum, Stucco Embossed, with Z-shaped locking seam: 0.024 inch (0.61 mm) thick.

E. Elastomeric Insulation: Aluminum, Stucco Embossed, with Z-shaped locking seam: 0.024 inch (0.61 mm) thick.

END OF SECTION 230719

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including **Uniform General Conditions & Supplementary General Conditions (UGC & SGC)** and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. *This Section includes refrigerant piping used for HVAC & refrigeration applications, including pipes, tubing, fittings, and specialties; special-duty valves; and refrigerants. Contractor to forward equipment proximity locations (distances) to the manufacturer to ensure full working system.*

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 23 Section "HVAC Identification" for labeling and identifying refrigerant piping.
2. Division 23 Section "Piping Insulation" for pipe insulation.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each valve type and refrigerant piping specialty specified.

C. Shop Drawings showing layout of refrigerant piping, specialties, and fittings, including pipe and tube sizes, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and equipment.

1. Refrigerant piping indicated is schematic only. Size and design the layout and installation of the piping, including oil traps, double risers, specialties, and pipe and tube sizes, to ensure proper operation and conformance with warranties of connected equipment.

D. Maintenance data for refrigerant valves and piping specialties to include in the operation and maintenance manual specified in Division 1 Sections and Division 23 Section "General Requirements for Mechanical Work."

1.4 QUALITY ASSURANCE

A. ASME Compliance: Qualify brazing and welding processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications."

B. Regulatory Requirements: Comply with provisions of the following codes:

1. ASME B31.5, "Refrigeration Piping."
2. ASHRAE 15, "Safety Code for Mechanical Refrigeration."

C. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

D. Listing and Labeling: Provide products specified in this Section that are UL listed and labeled.

1.5 SEQUENCING AND SCHEDULING

A. Coordinate the installation of housekeeping pads, equipment supports, and penetrations

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Refrigerants:

a. Allied Signal Inc.; Genetron Refrigerants.
b. DuPont Company; Fluorochemicals Div.
c. Elf Atochem North America, Inc.
d. ICI Americas Inc.; Fluorochemicals Bus.

2. Refrigerant Valves and Specialties:

a. Danfoss Electronics, Inc.
b. Eaton Corporation; Industrial Control Div.
c. Emerson Electric Company; Alco Controls Div.
d. Henry Valve Company.
e. Parker-Hannifin Corp.; Refrigeration & Air Conditioning Division.
f. Sporlan Valve Company.

2.2 PIPES AND TUBES

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), drawn temper.

2.3 PIPE AND TUBE FITTINGS

A. Copper Fittings: ASME B16.22, wrought-copper streamlined pattern.

2.4 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (Silver).

2.5 VALVES

A. Service Valves: 500-psig (3450-kPa) pressure rating, forged-brass body with copper stubs, brass caps, removable valve core, integral ball check valve, with solder-end connections.

B. Solenoid Valves: Conform to ARI 760; 250 deg F (121 deg C) temperature rating, 400-psig (2760-kPa) working pressure; forged brass, with PTFE valve seat, 2-way straight-through pattern, and solder-end connections; manual operator; with NEMA 250, Type 1 solenoid enclosure with 1/2-inch (13-mm) conduit adapter, and 24-V normally closed holding coil.

2.6 REFRIGERANT PIPING SPECIALTIES

A. Moisture/Liquid Indicators: 500-psig (3450-kPa) operating pressure, 200 deg F (93 deg C) operating temperature; forged-brass body, with replaceable, polished, optical viewing window with color-coded moisture indicator, and solder-end connections.

B. Permanent Filter-Dryer: 350-psig (2140-kPa) maximum operating pressure, 225 deg F (107 deg C) maximum operating temperature; steel shell, and wrought-copper fittings for solder-end connections; molded-felt core surrounded by desiccant.

C. Flexible Connectors: 500-psig (3450-kPa) operating pressure; seamless tin-bronze or stainless-steel core, high-tensile bronze-braid covering, solder-end connections, and synthetic covering; dehydrated, pressure tested, minimum 7 inches (180 mm) long.

2.7 REFRIGERANT

A. As indicated on drawings and by the selected manufacturer approved for the equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for compliance with requirements for installation tolerances and other conditions affecting performance of refrigerant piping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Aboveground, within Building: Type L (Type B) drawn-copper tubing.

3.3 INSTALLATION

A. Install refrigerant piping according to ASHRAE 15.

B. Install piping in short and direct arrangement, with minimum number of joints, elbows, and fittings.

D. Arrange piping to allow normal inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.

E. Install piping with adequate clearance between pipe and adjacent walls and hangers, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

F. Insulate suction lines. Insulate outdoor above ground liquid & suction line.

1. Do not install insulation until system testing has been completed and all leaks have been eliminated.

G. Install branch lines to parallel compressors of equal length, and pipe identically and symmetrically.

H. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.

I. Slope refrigerant piping as follows (or per manufacturer recommendations for the application, whichever is greater):

1. Install horizontal suction lines with a uniform slope of 0.4 percent downward to compressor.
2. Install traps and double risers where indicated and where required to entrain oil in vertical runs.
3. Liquid lines may be installed level.

J. Use fittings for changes in direction and branch connections.

K. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

L. Reduce pipe sizes using eccentric reducer fittings installed with level side down.

M. Install unions to allow removal of solenoid valves, pressure-regulating valves, expansion valves, and at connections to compressors and evaporators.

N. Install flexible connectors at the inlet and discharge connection, at right angles to axial movement of compressor, parallel to crankshaft.

O. Install refrigerant valves according to manufacturer's written instructions.

P. When brazing, remove solenoid-valve coils; remove sight glasses; and remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties. Do not apply heat near bulb of expansion valve.

Q. Electrical wiring for solenoid valves is specified in Division 26 Sections. Coordinate electrical requirements and connections.

R. Mount thermostatic expansion valves in any position, close to evaporator.

1. Where refrigerant distributors are used, mount directly on expansion-valve outlet.
2. Install valve so diaphragm case is warmer than bulb.
3. Secure bulb to clean, straight, horizontal section of suction line using 2 bulb straps. Do not mount bulb in a trap or at the bottom of the line.
4. Where external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

S. Charge and purge systems, after testing, and dispose of refrigerant following ASHRAE 15 procedures.

T. Charge system as follows:

1. Evacuate refrigerant system with vacuum pump, until temperature of 35 deg F (1.7 deg C) is indicated on vacuum dehydration indicator.
2. Maintain vacuum for a minimum of 5 hours.
3. Break vacuum with refrigerant gas and charge to 2 psig (14 kPa).

3.4 HANGERS AND SUPPORTS

A. Pipe rollers for multiple horizontal runs as shown.

B. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes. Tube sizes are nominal or standard tube sizes as expressed in ASTM B 88 (ASTM B 88M).

1. 1/2 Inch (15 mm): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.3 mm).
2. 5/8 Inch (18 mm): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.3 mm).
3. 1 Inch (28 mm): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.3 mm).
4. 1-1/4 Inches (35 mm): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.3 mm).
5. 1-1/2 Inches (42 mm): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
6. 2 Inches (54 mm): Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm).
7. 2-1/2 Inches (67 mm): Maximum span, 108 inches (2700 mm); minimum rod size, 3/8 inch (9.5 mm).

C. Support vertical runs at each floor.

3.5 PIPE JOINT CONSTRUCTION

A. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent formation of scale.

3.6 VALVE INSTALLATIONS

A. Install refrigerant valves according to manufacturer's written instructions.

B. Install refrigerant-charging (packed-angle) valve in liquid line between receiver shutoff valve and expansion valve.

C. Mount thermostatic expansion valves per manufacturer’s instruction, close to evaporator.

1. Where refrigerant distributors are used, mount directly on expansion-valve outlet.
2. Install valve so diaphragm case is warmer than bulb.
3. Secure bulb to clean, straight, horizontal section of suction line using 2 bulb straps. Do not mount bulb in a trap or at the bottom of the line.
4. Where external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

3.7 SPECIALTIES APPLICATION AND INSTALLATION

A. Install liquid indicators in liquid line leaving condenser, in liquid line leaving receiver, and on leaving side of liquid solenoid valves.

B. Install moisture-liquid indicators in liquid lines between filter-dryers and thermostatic expansion valves and in liquid line to receiver.

C. Install permanent filter-dryers in low-temperature systems, in systems using hermetic compressors, and before each solenoid valve.

3.8 CONNECTIONS

A. Electrical: Conform to applicable requirements of Division 23 Sections for electrical connections.

3.9 FIELD QUALITY CONTROL

A. Inspect and test refrigerant piping according to ASME B31.5, Chapter VI.

1. Pressure test with nitrogen to 200 psig (1380 kPa). Perform final tests at 27-psig (186-kPa) vacuum and 200 psig (1380 kPa) using halide torch or electronic leak detector. Test to no leakage.

B. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.

C. Repair leaks using new materials; retest.

3.10 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

3.11 CLEANING

A. Before installation of copper tubing, clean tubing and fittings with trichloroethylene.

3.12 COMMISSIONING

A. Charge system using the following procedures:

1. Evacuate refrigerant system with vacuum pump until temperature of 35 deg F (1.67 deg C) is indicated on vacuum dehydration indicator.
2. During evacuation, apply heat to pockets, elbows, and low spots in piping.
3. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
4. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
5. Complete charging of system, using new filter-dryer core in charging line. Provide full-operating charge.

END OF SECTION 232300

SECTION 233113 - METAL DUCTS

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. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.

- and flat-ovalSheet metal materials.

4. Sealants and gaskets.
5. Hangers and supports.
6. Duct liner.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Sealants and gaskets.

B. Environmental Submittals:

1. Product Data: Documentation indicating that duct systems comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
2. Product Data: Documentation indicating that duct systems comply with ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
3. Leakage Test Report: Documentation of work performed for compliance with ASHRAE/IESNA 90.1, Section 6.4.4.2.2 - "Duct Leakage Tests."
4. Duct-Cleaning Test Report: Documentation of work performed for compliance with ASHRAE 62.1, Section 7.2.4 - "Ventilation System Start-up."
5. Product Data: For adhesives and sealants, documentation including printed statement of VOC content.
6. Laboratory Test Reports: For adhesives and sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings:

1. Penetrations through fire-rated and other partitions.
2. Equipment installation based on equipment being used on Project.
3. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

1.6 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Comply with sealing requirements in IMC.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Comply with sealing requirements in IMC.

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. McGill AirFlow LLC.
2. Sheet Metal Connectors, Inc.

B. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Comply with sealing requirements in IMC.

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Comply with sealing requirements in IMC.

F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
2. Coat insulation with antimicrobial coating.
3. Cover insulation with polyester film complying with UL 181, Class 1.

G. Inner Duct: Minimum 0.028-inch (0.7-mm) [perforated galvanized sheet steel having 3/32-inch- (2.4-mm-) diameter perforations, with overall open area of 23 percent] [or solid sheet steel].

H. Formed-on Transverse Joints (Flanges): Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Traverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Comply with sealing requirements in IMC.

I. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Comply with sealing requirements in IMC.

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Lindab Inc.
b. McGill AirFlow LLC.
c. SEMCO Incorporated.
d. Sheet Metal Connectors, Inc.
e. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Comply with sealing requirements in IMC and IECC.

1. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Comply with sealing requirements in IMC and IECC.

1. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials

involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 DOUBLE-WALL ROUND DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Lindab Inc.
2. McGill AirFlow LLC.
3. SEMCO Incorporated.
4. Sheet Metal Connectors, Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

   a. Transverse Joints in Ducts Larger Than **60 Inches (1524 mm)** in Diameter: Flanged.

2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

   a. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
   b. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.

3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Inner Duct: Minimum 0.028-inch (0.7-mm) perforated galvanized sheet steel having 3/32-inch- (2.4-mm-) diameter perforations, with overall open area of 23 percent.

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: **0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K)** at 75 deg F (24 deg C) mean temperature.

2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

2.5 SHEET METAL MATERIALS

A. General Material Requirements: 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.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 (Z180).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. 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).

~~2.6 DUCT LINER~~

~~A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."~~

~~1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:~~

~~a. CertainTeed Corporation; Insulation Group.~~
~~b. Johns Manville.~~
~~c. Knauf Insulation.~~
~~d. Owens Corning.~~

~~2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.~~

~~3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.~~

~~a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).~~

~~B. Insulation Pins and Washers:~~

~~1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) or 0.135-inch- (3.5-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.~~

~~2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick [galvanized steel] [aluminum] [stainless steel]; with beveled edge sized as~~

~~required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.~~

~~C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."~~

~~1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.~~
~~2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.~~
~~3. Butt transverse joints without gaps, and coat joint with adhesive.~~
~~4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.~~
~~5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.~~

2.7 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Tapes or mastics used for duct sealing shall conform to UL 181A or 181B.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.8 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Comply with IMC and IECC duct system fabrication standards.

D. Install round ducts in maximum practical lengths.

E. Install ducts with fewest possible joints.

F. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

G. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

I. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

J. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

K. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

L. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

M. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

   a. Comply with sealing requirements in IMC and IECC.

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

   1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   2. Outdoor, Supply-Air Ducts: Seal Class A.
   3. Outdoor, Exhaust Ducts: Seal Class C.
   4. Outdoor, Return-Air Ducts: Seal Class C.
   5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.

6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.
13. New exhaust ducts and attachments to existing ducts within Return-Air Shaft or Plenum: Seal Class A

C. Tapes or mastics used for duct sealing shall conform to UL 181A or 181B.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Refer to Division 23 Section 230529 – “Hangers and Supports for Hvac Piping and Equipment.”

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

    a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

C. Duct system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Notify owner upon discovery of existing fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.9 START UP

A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.

B. Supply Ducts:

1. Pressure Class: Positive 2-inch wg (500 Pa).

C. Return Ducts:

1. Pressure Class: Positive or negative 1-inch wg (250 Pa).

E. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Positive or Negative 1-inch wg (250 Pa).

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg (500 Pa).

F. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Pressure Class: Positive or negative 1-inch wg (250 Pa).

G. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

H. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Standing seam.

I. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - DUCT 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. Adjustable barometric dampers.
3. Manual volume dampers.
4. Control dampers.
5. Combination fire and smoke dampers.
6. Flange connectors.
7. Turning vanes.
8. Duct-mounted access doors.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.

B. Related Sections:

1. Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Division 26 Section "Fire Detection and Alarm" for duct-mounted fire and smoke detectors.

1.3 ACTION SUBMITTALS

A. Environmental Submittals:

1. Documentation indicating that units comply with ASHRAE 62.1 Section 5 - "Systems and Equipment."
2. Documentation indicating that duct insulation R-values comply with tables in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."

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. 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.

1.4 INFORMATIONAL SUBMITTALS

A. 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.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MATERIALS MAINTENANCE 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. Fusible Links: Furnish quantity equal to [10] percent of amount installed.

1.7 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.

1.8 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. 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.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 (Z180).
2. Exposed-Surface Finish: Mill phosphatized.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. 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. Basis of Design: Project is designed around the characteristics of Greenheck BR-30 Series. Subject to compliance with requirements, other manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Ruskin Company.
4. Vent Products Company, Inc.

B. Description: Counterbalanced.

C. Maximum Air Velocity: 2500 fpm (10 m/s).

D. Maximum System Pressure: 4-inch wg (0.5 kPa).

E. Frame: 0.125-inch- (3.2-mm-) thick extruded aluminum or 16 gage galvanized steel with welded corners. Provide with integral mounting flange or other mounting or attachment provisions appropriate to application.

F. Blades: Multiple single-piece blades, maximum 6-inch (150-mm) width, 0.060-inch- (1.6-mm-) thick extruded aluminum or 16 gage formed steel with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Extruded PVC, neoprene or vinyl, mechanically locked.

I. Blade Axles:

1. Material: Plated, galvanized or stainless steel.

J. Tie Bars and Brackets: Plated, galvanized or stainless steel.

K. Bearings: Steel ball or synthetic pivot bushings.

L. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Screen Material: Galvanized steel or aluminum.
4. Screen Type: Insect.
5. 90-degree stops.

2.3 ADJUSTABLE BAROMETRIC DAMPERS

A. Basis of Design: Project is designed around the characteristics of Ruskin CBD4. Subject to compliance with requirements, other manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Ruskin Company.
4. Vent Products Company, Inc.

B. Description: Counterbalanced.

C. Maximum Air Velocity: 2500 fpm (10 m/s).

D. Maximum System Pressure: 4-inch wg (0.5 kPa).

E. Frame: 4 inches x 1 inch x minimum 0.081 inch (102 x 25 x minimum 2.1 mm) 6063-T5 extruded aluminum channel with front flanges and rear flanges and galvanized steel braces at mitered corners.

F. Blades:

1. Style: Single-piece, close within frame.
2. Action: Parallel.
3. Orientation: Horizontal.
4. Material: Minimum 0.070 inch (1.8 mm) 6063-T5 extruded aluminum.
5. Width: Maximum 6 inches (152 mm).

G. Bearings: Dustproof ball bearings pressed into hole in frame.

H. Blade Seals: Extruded vinyl, mechanically attached to blade edge.

I. Linkage: Minimum 1/2 inch (13 mm) aluminum tie bar with stainless steel pivot pins mounted on blades.

J. Axles: Corrosion-resistant, long-life, synthetic, locked to blade.

K. Counterbalances: Adjustable zinc plated steel weights mechanically attached to blade enabling damper to operate over wide range of pressures.

L. Mounting: Select for flow orientation to fit the application.

M. Finish: Mill aluminum.

N. Performance Data:

1. Temperature Rating: Withstand -40 to 200 degrees F (-40 to 93 degrees C).
2. Capacity: Demonstrate capacity of damper to withstand HVAC system operating conditions.
3. Closed Position: Maximum back pressure of 16 inches w.g. (4 kPa).
4. Open Position: Maximum air velocity of 2,500 feet per minute (762 m/min).

O. Operation of Blades at Lowest Pressure Adjustment:

1. Start to Open: 0.01 inch w.g. (0.002 kPa).
2. Fully Open: 0.05 inch w.g. (0.01 kPa).

P. Pressure Drop: Maximum 0.15 inch w.g. (0.04 kPa) at 1,500 feet per minute (457 m/min) through 24 inch x 24 inch (610 x 610 mm) damper.

Q. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.

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. McGill AirFlow LLC.
   b. METALAIRE, Inc.
   c. Nailor Industries Inc.
   d. Ruskin Company.
   e. Vent Products Company, Inc.
2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames:
   a. Hat-shaped, galvanized-steel channels, 0.064-inch (1.62-mm) 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-steel, 0.064 inch (1.62 mm) thick.
6. Blade Axles: Galvanized steel, full length of damper blades.
7. Bearings: Molded synthetic, at both ends of operating shaft.
8. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 1-inch (25-mm) diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arrow United Industries; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. McGill AirFlow LLC.
4. METALAIRE, Inc.
5. Nailor Industries Inc.
6. Ruskin Company.
7. Vent Products Company, Inc.
8. Young Regulator Company.

B. Low-leakage rating and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

1. Hat shaped.
2. Galvanized-steel channels, 0.064 inch (1.62 mm) thick.
3. Mitered and welded corners.

D. Blades:

1. Multiple blade with maximum blade width of 8 inches (200 mm).
2. Parallel- and opposed-blade design.
3. Galvanized steel.
4. 0.064 inch (1.62 mm) thick.
5. Blade Edging: Closed-cell neoprene edging.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

E. Blade Axles: 1/2-inch- (13-mm-) diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings; full length of damper blades

1. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).

F. Bearings:

1. Molded synthetic.
2. At both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Air Balance Inc.; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. Nailor Industries Inc.
6. NCA Manufacturing, Inc.
7. Pottorff.
8. Prefco; Perfect Air Control, Inc.
9. Ruskin Company.
10. Vent Products Company, Inc.
11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Type: Static rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 2000 fpm (10-m/s) velocity.

D. Fire Rating: As required for wall rating, but not less than 1-1/2 hours unless specifically noted.

E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.138 inch (3.5 mm) thick, or thicker if indicated on drawings or required to comply with listing requirements provided by manufacturer.
2. Length to suit application and to satisfy listing requirements provided by manufacturer.
3. Where installed in insulated duct, provide with insulated sleeve (whether integral or separate) compatible with the application.
4. Where installed behind a grille, or opening size is otherwise restricted, fire dampers listed for “outside of wall” configuration shall be provided as needed. Provide sleeve (whether integral or separate) compatible with the application.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.024-inch- (0.61-mm) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) rated, fusible links.

2.7 SMOKE DAMPERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Ruskin Model SD60-2M or comparable product by one of the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

1. Dynamic type is required at inlet and outlet of each AHU, since one AHU may operate in a manner that puts pressure on the other AHU's isolation dampers.
2. Provide discharge dampers with modulating damper actuators to allow dampers to regulate duct pressure if fan VFD is in bypass. Provide discharge dampers suitable for 3000 fpm and 4" wg

C. Frame: Hat-shaped, 16 gage, galvanized sheet steel, with welded corners.

D. Blades: Airfoil, 16 gage, galvanized sheet steel.

E. Leakage: Class II.

F. Rated pressure and velocity to exceed design airflow conditions.

G. Damper Motors: Modulating action; coordinate voltage and control with EMS and fire alarm. Damper must modulate under EMS control normally, but be closed by fire alarm regardless of EMS signal.

H. Accessories:

1. Auxiliary switches for fan control or position indication.

2.8 COMBINATION FIRE AND SMOKE DAMPERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Ruskin Model FSD60 or comparable product by one of the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Ruskin Company.

B. Type: Static and dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 4000-fpm (20-m/s) velocity.

D. Fire Rating: 1-1/2 and 3 hours, as required for rating of wall or floor penetrated.

E. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) rated, fusible links.

F. Frame: Multiple-blade type; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.

G. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, galvanized-steel blade connectors.

H. Leakage: Class II.

I. Rated pressure and velocity to exceed design airflow conditions.

J. Mounting Sleeve: Factory-installed, 0.052-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application.

K. Master control panel for use in dynamic smoke-management systems.

L. Damper Motors: Modulating or two-position action.

2.9 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.10 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

2.11 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Flexmaster U.S.A., Inc.
3. Greenheck Fan Corporation.
4. McGill AirFlow LLC.
5. Nailor Industries Inc.
6. Ventfabrics, 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 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - 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 (25-by-25-mm) 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 (300 mm) Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches with outside and inside handles.
   d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.

2.12 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

2.13 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; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

2.14 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.

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.

C. Where used in ducts penetrating the building envelope, install backdraft or control dampers as close as possible to building envelope penetrations.

D. 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.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct security bars. Construct duct security bars from 0.164-inch (4.18-mm) steel sleeve, continuously welded at all joints and 1/2-inch- (13-mm-) diameter steel bars, 6 inches (150 mm) o.c. in each direction in center of sleeve. Weld each bar to steel sleeve and each crossing bar. Weld 2-1/2-by-2-1/2-by-1/4-inch (63-by-63-by-6-mm) steel angle to 4 sides and both ends of sleeve. Connect duct security bars to ducts with flexible connections. Provide 12-by-12-inch (300-by-300-mm) hinged access panel with cam lock in duct in each side of sleeve.

I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. At outdoor-air intakes and mixed-air plenums.
2. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
3. 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.
4. At each change in direction and at maximum 50-foot (15-m) spacing.
5. Upstream from turning vanes.
6. Control devices requiring inspection.
7. Elsewhere as indicated.

J. Install access doors with swing against duct static pressure.

K. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
5. Body Access: 25 by 14 inches (635 by 355 mm).
6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).

L. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors to connect ducts to equipment.

N. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Connect terminal units to supply ducts **without** flexible duct.

P. Connect flexible ducts to metal ducts with adhesive, draw bands and sheet metal screws.

Q. Install duct test holes where required for testing and balancing purposes.

R. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

3.2 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.

END OF SECTION 23300

SECTION 233423 - POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including **Uniform General Conditions & Supplementary General Conditions (UGC & SGC)** and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. **Reference Mechanical drawings for locations, schedules and notes**. This Section includes the following:

1. Centrifugal roof ventilators.
2. In-Line Centrifugal Fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base air ratings on **100 ft** above **sea-level**.

B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material gages and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.

B. 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. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Coordination Drawings: Show roof penetration requirements and reflected ceiling plans drawn to scale and coordinating roof penetrations and units mounted above ceiling. Show the following:

1. Roof framing and support members relative to duct penetrations.

2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Maintenance Data: For power ventilators to include in maintenance manuals specified in Division 1.

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. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.8 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Greenheck Fan Corp.
2. Penn Ventilation Companies, Inc.
3. Loren Cook

2.2 AXIAL ROOF VENTILATORS

A. Description: direct-driven fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; square, one-piece, hinged, aluminum base.

C. Fan Wheel: As per schedule (reference plans).

D. Belt-Driven Drive Assembly (N/A): Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.

E. Accessories:

1. Disconnect Switch: See electrical plan for disconnect mounting location.
2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
4. Speed controller.

F. Roof Curbs: Reference roofing plan for the curb. Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: As per schedule (reference plans).
2. Overall Height: As per schedule (reference plans).
3. Sound Curb: Curb with sound-absorbing insulation matrix.
4. Pitch Mounting: Manufacture curb for roof slope.
5. Metal Liner: Galvanized steel.
6. Hinged Subbase: Galvanized steel hinged arrangement permitting service and maintenance.
7. Mounting Pedestal: Galvanized steel with removable access panel.

2.3 In-Line centrifugal fans

A. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

B. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

C. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

D. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
3. Companion Flanges: For inlet and outlet duct connections.
4. Fan Guards: Mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

E.

2.8 MOTORS

A. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.

B. Enclosure Type: As per schedule (reference plans) drip proof.

2.9 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using As per schedule (reference plans) having a static deflection of As per schedule (reference plans).

C. Install with vibration isolation per manufacturer’s requirements and instructions.

D. Install floor-mounting units on concrete bases.

E. Install floor-mounting units on concrete bases designed to withstand, without damage to equipment, the seismic force required by code.

F. See Roofing plan for roof curb detail. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

G. Support suspended units from structure using threaded steel rods and As per schedule (reference plans).

H. Install units with clearances for service and maintenance.

I. Label units according to requirements specified in Division 23 Section "Mechanical Identification."

3.2 CONNECTIONS

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.

1. Flexible Connector: Factory fabricated with a fabric strip 4 inches (150 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized-steel sheet or 0.032-inch- (0.8-mm-) thick aluminum sheets; select metal compatible with casing.

a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.

1) Fabric Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2) Fabric Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3) Fabric Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment.

D. 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.

3.3 FIELD QUALITY CONTROL

A. Equipment Startup Checks:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Verify lubrication for bearings and other moving parts.
6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
7. Disable automatic temperature-control operators.

B. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.
2. Measure and record motor voltage and amperage.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Shut unit down and reconnect automatic temperature-control operators.

F. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.

G. Replace fan and motor pulleys as required to achieve design airflow.

H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

3.5 CLEANING

A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Review data in maintenance manuals. Refer to Division 1 Section "Closeout Procedures."
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 233423

SECTION 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. Rectangular and square ceiling diffusers.
2. Louver face diffusers.
3. Adjustable bar registers and grilles.

B. Related Sections:

1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

A. 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.

1.4 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

1.5 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warrant nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 AIR DEVICE SCHEDULE

A. Comply with Air Device Schedule on the Drawings.

2.2 CEILING DIFFUSERS

A. Rectangular and Square Ceiling Diffusers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. METALAIRE, Inc.
b. Nailor Industries Inc.
c. Price Industries.
d. Titus.
e. Tuttle & Bailey.

B. Louver Face Diffuser:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. METALAIRE, Inc.
b. Nailor Industries Inc.
c. Price Industries.
d. Titus.
e. Tuttle & Bailey.

2.3 REGISTERS AND GRILLES

A. Adjustable Bar Grille or Register:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. METALAIRE, Inc.
b. Nailor Industries Inc.
c. Price Industries.
d. Titus.
e. Tuttle & Bailey.

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."

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 238126 - SPLIT-SYSTEM AIR-CONDITIONING UNITS

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. This Section includes split-system air-conditioning units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting and may be connected to ducts.

1.3 DEFINITIONS

A. Evaporator-Fan Unit: The part of the split-system air-conditioning unit that contains a coil for cooling (heat rejection for heating operation in heat pump units) and a fan to circulate air to conditioned space.

B. Compressor-Condenser Unit(s): The part of the split-system air-conditioning unit that contains a refrigerant compressor and a coil for condensing refrigerant.

1.4 SUBMITTALS

A. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each type of product indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, electrical characteristics, certified fan-sound power ratings, material gages and finishes, and filters with performance characteristics.

B. Shop Drawings: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring. Detail equipment assemblies and indicate dimensions, weights, loading, required clearances, components and location of utilities.

C. Samples for Initial Selection: Manufacturer's color charts consisting of units of sections of units showing the full range of colors available for units with factory-applied color finishes.

D. Maintenance Data: For split-system air-conditioning units to include in maintenance manuals specified in Division 1, and suitable for IECC requirements.

E. Coordination Drawings, including floor plans and sections drawn to scale. Submit with Shop Drawings. Show mechanical-room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

F. Field test reports indicating and interpreting test results relative to compliance with specified requirements.

G. Maintenance data for central-station air-handling units to include in the operation and maintenance manual specified in Division 1 Sections and Division 23 Section "General Requirements for Mechanical Work"

H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of split-system units and are based on the specific system indicated. Other manufacturers' systems with equal performance characteristics may be considered.

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. NFPA Compliance: Central-station air-handling units and components shall be designed, fabricated, and installed in compliance with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."

D. ARI Certification: Central-station air-handling units and their components shall be factory tested according to the applicable portions of ARI 430, "Central-Station Air-Handling Units," and shall be listed and bear the label of the Air-Conditioning and Refrigeration Institute (ARI).

E. UL and NEMA Compliance: Provide motors required as part of air-handling units that are listed and labeled by UL and comply with applicable NEMA standards.

F. Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.

G. Coordination: Coordinate layout and installation of central-station air-handling units with piping and ductwork and with other installations.

1.6 COORDINATION

A. Coordinate size and location of concrete bases for units. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."

B. Coordinate size, location, and connection details with roof curbs, and equipment supports.

1.7 WARRANTY

A. General Warranty: One year from date of substantial completion (Standard warranty contractor – Labor & material). Special warranty specified in this Article shall not deprive Owner of other rights. Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Extended Warranty: Five years extended warranty. Written warranty, executed by manufacturer agreeing to repair or replace components of split-system air-conditioning units that fail in

materials or workmanship within specified warranty period. Warranty shall include parts, labor, and refrigerant.

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. Filters: One set of filters for each unit.
   2. Fan Belts: One set of belts for each unit.

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, but are not limited to, the following:

B. Manufacturers: Reverence mechanical plans for equipment scheduled. Subject to compliance with requirements, provide products by one of the following:
   1. Trane Co. (The); Commercial Systems Group.
   2. JCI
   3. Carrier
   4. Lennox

2.2 INDOOR UNIT COMPONENTS

A. General Description: Provide indoor-mounted, draw-thru, packaged air handling unit(s). Unit(s) shall be factory-assembled including direct-expansion evaporator coil, expansion valve(s), check valves, condensate drain pan, centrifugal fan assembly with fan motor(s) and mounting bracket sheaves, drives and belts, filters, and electrical controls. Units shall be suitable for either horizontal or vertical airflow configuration and be used with or without ductwork. Provide electric heat where scheduled with single point power for fan and heater.

B. Factory assembled, consisting of fans, motor and drive assembly, coils, plenums, filters, drip pans.
   1. Fan shall be vibration isolated.
   2. Provide field installed and wired condensate float switch with automatic fan shut down (Hardwired).

C. CABINET
   1. Materials: Formed and reinforced galvanized steel panels (cleanable foil faced inner liner), fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
      a. Outside Casing: Steel, 0.0598 inch (1.5 mm).
   2. Insulation: Coated, glass-fiber insulation, complying with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," for insulation
      a. Thickness: 1 inch, 1 ½ pound density, foil-faced.
      b. Location and Application: Factory applied adhesive and mechanical fasteners to the internal surface of section panels downstream from and including the cooling coil section.
   3. Access Panels and Doors: Same materials and finishes as cabinet with gaskets.

a. Fan section shall have access panels located to allow periodic maintenance and inspections.

4. Drain Pans: stainless steel drain pans.
   a. Fabricate pans in sizes and shapes to collect condensate from cooling coils (including coil piping connections and return bends) when units are operating at maximum catalogued face velocity across cooling coil.
   b. ~~Double-Wall Construction: Fill space between walls with foam insulation and seal moisture tight.~~
   c. Drain Connections: One end of pan. Drain pan shall be removable for cleaning, service or replacement.
   d. Provide secondary drain pan for horizontal unit mounted above ceiling. See detail.

D. FAN SECTION
1. EC-motor driven variable speed direct drive where indicated on plans.
2. Fan-Section Construction: centrifugal fans (forward curved), consisting of housing, wheel, fan shaft, bearings, motor ~~and disconnect switch~~, drive assembly, and support structure, equipped with formed-steel channel base for integral mounting of fan, motor, and casing panels. Housings: Fabricate from formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff, spun-metal inlet bell, and access doors or panels to allow entry to internal parts and components.
4. Fan Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and motor power.
   c. Pulleys: Cast iron or steel with split, tapered bushing, dynamically balanced at factory.
   d. Motor Pulleys: Adjustable pitch, selected so pitch adjustment is at middle of adjustment range at fan design conditions.
   e. Belts: Oil resistant, non-sparking, and non-static; matched for multiple belt drives.
   g. Motor Mount: Adjustable for belt tensioning.

E. MOTORS
1. Variable speed EC motors where indicated on plans
2. Torque Characteristics: Sufficient to accelerate driven loads satisfactorily.
3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range.
4. Temperature Rating: 50 deg C maximum temperature rise at 40 deg C ambient for continuous duty at full load (Class A Insulation).
5. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.
6. Motor Construction: NEMA MG-1, general purpose, continuous duty, Design B.
   a. Bases: Adjustable.
7. Enclosure Type: The following features are required:
   a. Open drip-proof motors where satisfactorily housed or remotely located during operation.
8. Overload Protection: Built-in, automatic reset, thermal overload protection.
9. Noise Rating: Quiet.
10. Efficiency: Energy-efficient motors shall have a minimum efficiency as scheduled according to IEEE 112, Test Method B. If efficiency is not specified, motors shall have a higher efficiency than "average standard industry motors" according to IEEE 112, Test Method B.
11. Nameplate: Indicate full identification of manufacturer, ratings, characteristics, construction, and special features.

12. Starters, Electrical Devices, and Wiring: Electrical devices shall be factory installed. Connections are specified in Division 26 Sections.

F. COILS
1. Coil Sections: Common or individual, insulated, galvanized steel casings for heating and cooling coils. Design and construct to facilitate removal and replacement of coil for maintenance and to assure full airflow through coils.
2. Coil Construction: Rigidly supported across full face, pitched to allow drainage. Fins: Aluminum, mechanically bonded to tubes. Coil shall have factory installed expansion valves and factory pressure and leak tested at 375 psig.
   a. Tubes: Seamless copper.
   b. Coil Casing: Galvanized steel.
3. Provide double sloped condensate drain pan constructed of stainless steel (galvanized steel or coated galvanized steel not acceptable) with connections for field piping. The drain pan shall be removable for cleaning.
4. Direct-Expansion Refrigerant Coils: ASHRAE 15, with the following features: Suction Headers and Distributor Tubes: Seamless copper.
   a. Refrigerant Distributor: Design for low pressure drop, for down feed with solder connections, and with maximum of 12 circuits for each distributor. Coil-Performance Tests: Factory-test cooling and heating coils, except sprayed surface coils for rating according to ARI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils."

G. FILTER SECTION
1. Filters: Comply with NFPA 90A.
2. Filter Section: Provide filter media holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Provide ez filter base as per schedule on plan, with access doors.
3. Disposable Filters: 2-inch-thick, viscous-coated fibers encased in fiberboard cell with perforated-metal media support, MERV13.
   a. Provide two inch MERV 13 filters. Provide access located as needed based on the drawings for service clearance.
   b. Provide construction sets as required to protect the unit. Include one clean set installed prior to test and balance and turn one set over to the owner at substantial completion

H. CONTROLS
1. Provide factory installed and wired controls (Not DDC controls) including fan contactor, low voltage terminal strip and single point power entry.
2. Provide unit mounted factory controller on unit as required.

2.3 AIR-COOLED, COMPRESSOR-CONDENSER COMPONENTS (HEAT PUMP)

A. General: Provide self-contained, packaged, factory-assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressor(s), condensing coil and fan(s), integral subcooling circuit(s), filter drier(s), and controls. Provide expansion valve(s) and check valves for split system heat pump unit(s). Unit shall be designed for operation from 45F to 115F cooling capability.

Casing: 18 gage steel, finished with baked enamel (units surface shall be tested 500 hours in salt spray test), with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Single Compressor/Condensing Unit: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
   1. Compressor Type: Scroll.
   2. One direct drive compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch and one centrifugal oil pump.
   3. Two speed where 2 stages indicated.

C. Dual Compressor/Condensing Unit: Hermetically sealed with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
   1. Compressor Type: Scroll.
   2. Two direct drive compressor motors with manual-reset high-pressure switch and automatic-reset low-pressure switch and two centrifugal oil pumps.
   3. Provide 2 stages where indicated.
   4. For heat pump units, provide reversing valve, suction line accumulator, discharge muffler, flow control check valve, and solid-state defrost control utilizing thermistors.

D. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid sub-cooler.
   1. Coils for heat pump units 5 tons and smaller: All Aluminum, spine fin coil that provides low resistance and high energy efficiency.
   2. Coils for heat pump units 6 tons and larger: Aluminum fins mechanically bonded to seamless copper tubing. Provide subcooling circuit(s). Factory leak test in helium chamber, and vacuum dehydrate. Seal with holding charge of nitrogen.
   3. The coils shall be protected on all sides with louvered guards (wire paneling is not acceptable regardless of the configuration of the condenser coil) painted to match the rest of the unit. Maximum opening is 3/4".

E. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

F. Fan: Aluminum-propeller type, directly connected to motor.

G. Motor: Permanently lubricated, with integral thermal-overload protection.

H. Low Ambient Kit: Permits operation down to 45 deg F.

I. Mounting Base: Polyethylene.

2.4 CONDENSING UNITS, AIR COOLED

A. Description: Factory assembled and tested, air cooled; consisting of scroll compressors, condenser coils, fans, motors, refrigerant reservoirs, and operating controls.

B. Compressor: Direct drive hermetic scroll compressor isolated from vibration. External high and low pressure devices shall be provided. Evaporator defrost control provided in the indoor

blower coil shall prevent compressor slugging by temporarily interrupting compressor operation when low evaporator coil temperatures are encountered.

1. Motor: Gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of name plate voltage. Crankcase heater, discharge line thermostat, internal temperature and current sensitive motor overloads shall be included in the maximum protection. Include thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
2. Provide single or multiple compressors as indicated by the Trane model number on the mechanical schedule plans.

C. Condenser: Copper-tube, aluminum-fin coil, with liquid sub-cooler and coil guard.

D. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated fan motor with thermal-overload protection.

E. Accessories include the following:
1. Low ambient kit to permit operation down to 0 dF.
2. Vibration isolation package in either neoprene-in-shear or spring flex types.
3. Anti-Short-Cycle Timer to prevent compressor rapid cycle.
4. Time delay relay to prevent dual compressor unit from coming on line simultaneously.
5. Condenser coil/hail guard.
6. Hot gas reheat where indicated on the plans .
7. Reference plan if united mounted condensate pump is required. Provide power to condensate pump as required).

F. Casing: Steel, finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base.

G. Refer to DDC control sequences for cooling and heat pump sequences.

2.5 ACCESSORIES

A. Reference plan and equipment schedule on plan.

B. Thermostat: Reference plan

D. Automatic-reset timer to prevent rapid cycling of compressor.

E. Condenser coil hand guard. See 2.3.D.3 above

F. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure. Suspend horizontal fan-coil units from structure as per plan and detail. Select vibration isolator for 150% (min) of equipment total weight.

C. Install ground-mounted, compressor-condenser components on 4-inch- (100-mm-) thick, reinforced concrete base; 4 inches (100 mm) larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 3, "Cast-in-Place Concrete." Coordinate anchor installation with concrete base. For roof mounted units reference plans.

D. Install ground-mounted, compressor-condenser components on polyethylene mounting base.

~~E. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch (25 mm). Refer to Division Section "Mechanical Vibration Controls for HVAV Piping and Equipment."~~ Install compressor-condenser components on restrained, neoprene isolators.

F. Refrigerant piping size as per equipment manufacturer instructions. ~~Connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit~~.

3.2 Manufacturer's services: All mechanical equipment shall require participation by the manufacturer's technical representative, as follows:

A. Pre-installation: Awarded contractor shall schedule a pre-installation meeting with the equipment manufacturer's representative. The meeting requires attendance by all trades that have installation duties associated with the equipment. Manufacturer's representative shall review all aspects of the installation including water, gas, electrical, venting, condensing, and controls. Provide a written record of the pre-installation meeting including dates and names of attendees to the Owner's Commissioning Authority prior to start-up.

B. Start-up: Start-up of all mechanical equipment is required by a manufacturer's technical representative who will provide a written certification that the installation meets the manufacturer's requirements. Start-up by an installing contractor who is authorized to conduct start-up on behalf of the manufacturer is not acceptable.

C. Commissioning: Manufacturer's technical representative shall set aside a minimum of one day to coordinate field-commissioning tasks with the control's contractor. Technical representative shall set aside a minimum of one day to participate in functional testing with Owner's third-party commissioning agent. Technical representative shall issue a written report stating the systems are operational and controlled in accordance with manufacturer's requirements.

D. Warranty service: Manufacturer's technical representative shall inspect all systems installed with a frequency of no less than once every 6 months for the duration of the standard warranty period (1 year). Manufacturer's technical representative shall issue a written and signed observation report at the time of each visit, stating any deficiencies that require correction and attention by maintenance personnel, and indicating items requiring connections by the manufacturer under the terms of the warranty.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Unless otherwise indicated, connect piping with unions and shutoff valves to allow units to be disconnected without draining piping. Refer to piping system Sections for specific valve and specialty arrangements.

D. Ground equipment.
   1. 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.

3.4 FIELD QUALITY CONTROL

A. Installation Inspection: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections, and to prepare a written report of inspection.

B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 COMMISSIONING

A. Engage a factory-authorized service representative to perform at a minimum supervised startup service to include:
   1. Reviewing contractor start-up logs by system including line lengths, elbows, refrigerant charge, subcooling and superheat with respective outdoor ambient and visible inspection of unit and line routing. If the contractor does not have proper documentation, then the manufacturer will be hired to provide. This information should be included with the close out documentation including manufacturers work ticket to confirm this scope of work is complete.

B. Verify that units are installed and connected according to the Contract Documents.

C. Contractor shall lubricate bearings, adjust belt tension, and change filters.

D. Perform startup checks according to manufacturer's written instructions and do the following:
   1. Fill out manufacturer's checklists.
   2. Check for unobstructed airflow over coils.
   3. Check operation of condenser capacity-control device.
   4. Verify that vibration isolation devices and flexible connectors dampen vibration transmission to structure.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining units.
2. Review data in maintenance manuals. Refer to Division 1 Section "Contract Closeout."
3. Review data in maintenance manuals.
4. Schedule training with Owner, through Architect/Engineer, with at least seven days' advance notice.

END OF SECTION 238126

DIVISION 24-25

NOT USE

DIVISION 26

ELECTRICAL

SECTION 260100 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 DRAWINGS

A. Do not scale from the Drawings. Contract drawings are partially diagrammatic, and do not depict accurate locations of all elements. Contractor shall determine exact locations from field measurements. The lack of specific detail of all offsets, transitions, etc., shall not relieve the Contractor of responsibility to provide such necessary elements to coordinate his work with building construction and with other trades.

1.2 BIDDING

A. Refer to Division 0 and Division 1 for additional bidding requirements.

B. All bids must be based only on the equipment and materials as scheduled on the drawings and as specified or on equivalent equipment and materials from a pre-approved alternative manufacturer. No bids may be based on a substitute or other alternative without specific written prior approval from the Engineer. Any Contractor who assumes equivalence of products and who bases his bid on that assumption, does so at his own risk.

C. A listing of approved alternative manufacturers does not mean that all products of a particular alternative manufacturer are acceptable alternatives to the scheduled items. It merely means that prior approval is not required for bidding. All fixtures and devices must still be submitted according to the prescribed procedures. In addition, some items that significantly affect building appearance may require Engineer's or Owner's approval.

1.3 INTENT

A. All equipment, materials and labor that may be necessary to complete work in accordance with the intent of these plans and specifications shall be furnished by the Contractor without additional cost.

B. All systems represented in the documents shall, unless specifically noted to the contrary, be provided and installed complete with all necessary components to form a complete and functioning system. Submission of bids will be considered confirmation that complete and functional systems have been included in the bids.

C. If any discrepancies or confusion is perceived in the documents, the Contractor shall call such to the attention of the Engineer for clarification of the documents prior to bidding or construction. If any inconsistencies or contradictions within the construction documents are discovered after the construction contracts are awarded, Engineer shall determine the intent and correct interpretation of the construction documents.

D. Contractor shall supervise and direct the work competently and efficiently and in accordance with the drawings and specifications. Contractor shall be responsible for using construction means, methods, techniques, sequences, and procedures that are compatible with the project's

requirements and will result in a project completed in accordance with the requirements of the drawings and specifications.

1.4 CODES, PERMITS AND FEES

A. Contractor shall comply with all local, state and national codes and shall pay for all applicable costs, fees and permits.

1.5 EXAMINATION OF SITE

A. Each contractor submitting proposal(s) for this work shall examine the site and shall take into consideration conditions that may affect the work. No information given on the plans shall relieve the Contractor of this responsibility. Submission of a bid shall be considered as compliance with the site examination requirements.

B. Contractor shall verify location, size, and any other pertinent data of existing utilities. Additional costs incurred due to a failure to verify such data and to coordinate associated work with respective utility providers shall not be the Owner's responsibility but shall be borne by Contractor.

C. All costs associated with providing utilities including, but not limited to, connection fees, boring under roads, etc., shall be included in the Contractor's bid price whether such costs are incurred by Contractor or charged by a utility company.

D. Excavate by hand and with caution to locate all utilities prior to machine excavation. Should any service be interrupted, Contractor shall repair it immediately and at no cost to the Owner.

E. Submission of a bid by a Contractor shall be considered an acknowledgment by the Contractor of his compliance with this section.

1.6 VIBRATION AND NOISE

A. Each of the various pieces of equipment shall operate without objectionable vibration or noise. All rotating equipment shall be statically and dynamically balanced and shall be mounted, supported, and fastened so that vibration shall not exceed levels specified for the equipment item. The specific type of vibration isolation to be installed shall be submitted to the Engineer for his approval.

B. If, in the opinion of the Engineer, or Owner, objectionable vibration or noise or transmission thereof to the building occurs, the Contractor shall execute remedial measures as may be necessary to eliminate such unsatisfactory operating conditions, and the work and material thereby required shall be furnished and performed at the Contractor's expense.

1.7 GUARANTEE

A. Each Contractor shall guarantee all labor and materials furnished by him for a period of one year unless otherwise noted. Guarantee period shall extend from the time of final written acceptance of the installation or upon usage by a written directive from the Owner, whichever occurs first.

The guarantee shall cover the repair or replacement, without additional cost to the Owner, of any defective material or faulty workmanship.

1.8 SERVICE

A. All necessary service of each system, such as adjustment of controls, mechanical repair of equipment, and other work requiring specialized training, shall be furnished by the Contractor, at no cost to the Owner, for a period of one year, concurrent with the warranty period specified above.

1.9 SUBMITTALS

A. Before orders are placed, Contractor shall submit specific information on list of equipment and principal materials specified. Contractor shall indicate and/or provide names of manufacturers, catalog and model numbers, cut sheets, and such other supplementary information as necessary for evaluation. Related section include Division 1, Section “Submittals.” Each submittal shall include all items mentioned by model number and/or manufacturer's name in the specifications or on the drawings, including but not limited to the following:

1. Electrical - Fixtures, panels, protective devices, wiring devices, switches, motor starters, transformers, conduit, and any other equipment or principal materials.

B. Requirements - Each submittal shall comply with each of the following requirements:

1. Bear a stamp or specific written indication that Contractor has reviewed and approved all submittals prior to submission to Engineer.
2. Have all information deleted by Contractor that pertains to the means and methods of construction or to the fabrication, assembly, installation, or erection process. (Approval by Engineer shall not extend to these areas unless specifically noted by Engineer).
3. Be clearly marked as to which specific piece of equipment is being submitted, by use of a permanent marker, stamp, etc., so as to distinguish it from other pieces of equipment that may occur on the same page,
4. Be clearly marked as to which available options are being submitted that are associated with a piece of equipment, and
5. Be complete with respect to quantities, dimensions, specific performance, materials, and similar data to enable Engineer to review the proposed equipment.
6. Omission by Contractor of any of the above requirements for submittals will subject submittal to automatic rejection without review.
7. Any submittals received by Engineer that were not requested shall be returned without review of any kind.

C. Substitutions

1. No substitution is allowable without Engineer's written approval ten days prior to bid due date unless the manufacturer is listed on the Drawings or in the specifications as being a preapproved alternative manufacturer. Any submittal received without such written approval or prior approval is subject to unqualified rejection.
2. The Contractor is responsible to verify that submitted substitute equipment will fit in the space available. The Contractor's submittal for acceptance of the substitute shall include a written statement of whether or not such acceptance would require any subsequent or associated changes to the drawings or specifications. Any such changes shall be described in writing, briefly but completely.

3. The Contractor shall be responsible for the cost of any such modifications due to substitution of materials or equipment for that which was specified or scheduled. The cost shall be complete, that is, it shall include the cost effect on any and all other trades.
4. The Engineer may request shop drawings of mechanical rooms or systems of the substituted equipment.

1.10 SAFETY

A. Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work, and Contractor shall comply with all laws governing safety, specifically the "Occupational Safety and Health Standards" and the "Safety and Health Regulations for Construction", state and federal.

1.11 COORDINATION

A. Each Contractor's bid shall include the necessary detail and interconnection work to coordinate his work with the work of other trades. Failure on the part of the Contractor to coordinate with all other trades resulting in interferences shall be sufficient reason to require the Contractor to replace or rebuild the work involved at no extra charge.

1.12 STORAGE OF MATERIALS

A. Each Contractor shall provide temporary storage facilities suitable for equipment stored at the job site. Storage facilities shall be rain-proof and lockable as required. Materials or equipment stored on site but not in a lockable, rain-proof storage facility shall be stored above ground or above slab. Contractor shall take necessary precautions to prevent entry of and/or damage from dirt, trash, water, or vermin. Equipment not properly stored and protected shall be, at the discretion of the Engineer, replaced at no cost to Owner. Roofs are not acceptable storage areas unless specifically allowed in writing by the Engineer.

1.13 CERTIFICATION LABELING

A. Each device for which an independent testing authority has established a standard shall have affixed a label indicating its compliance and listing. Such independent testing authorities shall include, but not be limited to, the following:

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
FM	Factory Mutual
IAPMO	International Association of Plumbing and Mechanical Officials
ICC	International Code Council
NBS	National Bureau of Standards
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
UL	Underwriters Laboratory

1.14 SITE VISIT REPORTS

A. During the course of the job, the Engineer will make site visits to observe work in progress and will subsequently prepare a written site visit report which will be distributed to the General Contractor and to whomever else the Engineer desires.

1.15 CUTTING, PATCHING, AND PENETRATIONS

A. No joists, beams, girders, columns, slabs, or other structural elements shall be cut, drilled, or altered in any way by the Contractor without first obtaining written permission and instructions from the Engineer.

B. Where cutting any non-structural element(s) of walls, floors or ceilings is necessary to permit the installation of any work under this contract, or to repair any defects that may appear up to the expiration of the guarantee, such cutting shall be done by Contractor with as little damage as reasonably possible to the element being cut, to adjacent elements, or to the work of other trades.

C. After the necessary work has been completed, the damage shall be repaired by the Contractor, who shall pay all costs of such cutting and patching. All patching or sealing of cuts, penetrations, etc., including final appearance of same, shall be done to the approval of the Engineer.

D. Where a penetration or cutting of a ceiling, wall, or other building membrane is required or made, each such penetration or cut shall be made neatly with a cutting tool such as a saw, sharp knife, etc., and not with an impact tool such as a hammer, screwdriver, wrench, crowbar, etc. Each such penetration or cut shall be no larger than reasonably necessary, and penetrations in occupied or publicly accessible spaces shall have a chrome-plated escutcheon installed large enough to cover the entire opening.

1.16 FIRESTOPPING

A. Where a penetration is made in a fire-rated building assembly (wall, floor, ceiling, floor-ceiling, roof-ceiling, etc.) or in a membrane of a fire-rated assembly, install an appropriate firestopping assembly.

B. Select and apply firestop materials according to a design certified by a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

C. Submit firestopping design for each type of construction and penetrant before applying it.

1.17 HOUSEKEEPING PADS

A. Contractor shall construct housekeeping pads for floor-mounted electrical equipment

B. Pads shall be made of concrete with reinforcing such as welded wire screen, and with beveled edges. Indoor pads shall be 3 1/2-inches thick above floor level (6" if on a floor below grade), and outdoor pads shall be at least 6" above surrounding grade on all sides. Contractor shall paint each pad with a masonry conditioner such as Sherwin-Williams A5V2 and then with a gray (or other color at Owner's request) industrial enamel such as Sherwin-Williams B-54 series.

1.18 OPERATING TESTS

A. General

1. After all electrical systems have been completed and put into operation, Contractor shall subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation. All associated costs of such tests shall be borne by the Contractor.
2. Contractor shall make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. The Contractor shall return to the project during the first year and in the opposite season from which the system was initially operated and shall check the proper operation of the electrical systems. Contractor shall perform any adjustments or corrective procedures required for the proper operation of all systems.

B. Notice: Contractor shall give the Engineer seven days prior notification of any test so that the Engineer will have time to be present if he so desires.

C. Reports: After each test is performed, the Contractor who performed the test shall prepare and issue a report to include the following information:

1. Project name and location, the date (or range of dates) of the test, and date of the report.
2. Contractor's name, address, and telephone number; if the Contractor performing the test is a Subcontractor, indicate also for whom the test is being performed, their name, address, telephone number, and a contact person's name.
3. The name of the Contractor's employee who was responsible for performing or for overseeing the performing of the test.
4. A brief description of the system being tested,
5. A brief description of the testing procedure,
6. A summary of the test result(s),
7. A brief assertion that the system was tested as stated and that the system complied with the requirements of the contract documents or those of the Authority Having Jurisdiction, whichever is the most stringent; or a summary of the deficiencies discovered.
8. A hand-written date and signature of someone who has authority or responsibility from the company that performed test(s), and a hand-written brief note stating that the above information is true and accurate.
9. If the tested system is tested in parts, then one report may be made after the last part is tested.
10. The report shall be issued to the Engineer within five working days after the test is completed.
11. Such reports shall be required of all mechanical or electrical systems which require tests for pressure, water tightness, flow, resistance, or conductivity.

D. Services of a Manufacturer's Representative: For all major systems or equipment required by subsequent specifications sections to have tests or inspections by a manufacturer's representative, the manufacturer's representative shall prepare a written report to be sent to the Engineer for subsequent distribution to the Owner, General Contractor, and to whomever else the Engineer deems necessary.

1. The report shall include at least the following:

a. Date of the visit, name and title of the representative, name and location of the project.

b. Name and title of any observers.
c. A brief description of the equipment being inspected and/or tested,
d. A brief discussion of the quality of the installation including any important items (in the manufacturer's experience) that were done correctly, as well as any items that were done incorrectly or not to recommendations.
e. A list of tests and/or inspections performed and the results of same.
f. A brief statement of whether the installation conforms to manufacturer's recommendations and/or requirements, and if not what is required to bring the installation into conformance.

2. Deficiencies and Defects

a. Contractor shall be responsible for providing all labor and materials, at no cost to anyone except Contractor, to correct any deficiencies or defects reported by manufacturer's representative.
b. If, in the opinion of the manufacturer's representative, the deficiencies and defects are sufficiently serious, then Contractor shall arrange for, and bear all costs of, another inspection by manufacturer's representative after corrective measures have been taken.
c. The above process shall continue until the manufacturer's representative approves the installation.

1.19 TEMPORARY FACILITIES

A. Jobsite office facilities: Refer to Division 0 and Division 1.

B. Temporary storage facilities: Refer to Division 0 and Division 1.

C. Sanitary facilities for workmen: Refer to Division 0 and Division 1.

D. Temporary utilities: Refer to Division 0 and Division 1.

1. The Owner will provide water, gas and electricity for use during construction. The contractor shall provide code-compliant taps and extensions as needed for his use.

PART 2 - PRODUCTS AND WORKMANSHIP

2.1 MATERIALS

A. All materials shall be new and of the quality specified. Materials shall be free from defects. Where manufacturers' names are mentioned in these specifications or on the plans, it has been done in order to establish a standard of quality and construction.

B. Contractor will be responsible for transportation of his materials to and on the job, and will be responsible for the storage and protection of his materials and work until the final acceptance of the job. At the end of each work day, each Contractor is responsible for covering or protecting his work or materials that may be susceptible to damage even if such damage is the result of unforeseen causes, e.g. an overnight thunderstorm. Failure to do so will be sufficient cause for rejection of any item in question, and any such item shall be replaced at Contractor's expense.

C. Contractor shall verify that all pieces of equipment will fit through available openings in building and that all equipment can be installed without modification of building structure.

2.2 WORKMANSHIP

A. The workmanship shall, in all respects, be of the highest grade, and all construction shall be done according to the best practices of the trade. Piping, ducting and conduit shall be concealed unless otherwise noted, and installed square to the building lines. Any work not meeting this requirement shall be replaced or rebuilt without extra expense to the Owner.

2.3 ROOF PENETRATIONS, EQUIPMENT AND RACEWAY SUPPORTS, WALK PATHS

A. Supports for equipment, conduits, ductwork, etc. shall be provided and installed under this Contract. The Mechanical, Electrical, and Plumbing Contractor shall coordinate as to locations of supports, sizes and weights of devices or equipment being supported, etc.

B. Coordinate with roofing specialist to support items bearing on the roof. Examples are:

1. Conduit supports.
2. Panel and disconnect switch supports.
3. Elevated walking surfaces over ducts, conduit and piping.

2.4 ACCESSIBILITY

A. Access Panels: Access panels shall be provided wherever necessary for possible future replacement, adjustment, or maintenance of operating devices such as machinery, valves, dampers, switches, relays, etc., or to other critical non-operating devices such as pull boxes, inspection parts, gauges, etc. Such access panels shall be provided and installed by Contractor, whether or not shown on drawings, and shall be brought to the attention of Engineer for his approval of type, color, etc. Where access is provided in rated members, the access panels shall be of a type that maintains the integrity of the member penetrated.

B. Access to Equipment

1. All pipes, tubing, conduit, etc., including, but not limited to, electrical conduit, and wiring not in conduit shall be installed in such a way so as not to prevent and/or not to make unreasonably difficult the removal, operation, use, or maintenance of equipment, access panels or doors, pathways (especially in attics or crawl spaces), observation ports, measurement or balancing devices, junction boxes, etc..
2. If access for these purposes is prevented or made unreasonably difficult in the opinion of the Engineer or Engineer, then the Contractor shall make modifications or repairs at no cost to anyone except the Contractor. Such modifications or repairs shall be considered neither complete nor adequate until the Engineer is satisfied that access for the above purposes is achieved.
3. Provide elevated walking surfaces over floor- or roof-mounted ducts, conduit or piping that interfere with normal access and maintenance. At the least, any single run or band of conduit and/or piping over 18” wide or high shall be considered a walking obstacle.

PART 3 - RECORDS AND SERVICES FOR THE OWNER

3.1 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Contractor shall prepare and provide four copies of operating and maintenance manuals. Contractor shall deliver these four bound sets to the Engineer for approval. Each manual shall be in a ring binder and shall be indexed with dividers for each section. Delivery of required documents is a condition of final acceptance.

B. Each manual shall contain at least the following:

1. Certificates of acceptance from inspecting authorities,
2. Waiver of all liens,
3. For each piece of equipment, include the following:
    a. Operating and safety instructions, service manuals, and parts lists applicable to each item of equipment furnished (Contractor shall clearly distinguish in the manual between information that pertains to the particular equipment and information which does not.),
    b. Nameplate data and design parameters for equipment,
    c. Name, phone number, and address of vendor, manufacturer's representative, and warrantee provider,
4. Copies of all shop drawings and as-built drawings (as-built drawings shall be on a reproducible vellum as produced by a Xerox or photographic process),
5. Copies of all approved submittals,
6. Warranties with start dates and end dates for each piece of equipment and/or for each system. (Warranties shall begin on date of substantial completion and acceptance by Owner.)
7. Names, phone numbers and addresses of all subcontractors, vendors, manufacturer's representatives, and warrantee providers,
8. Acceptance letter from each Contractor with blanks entries for date of acceptance and date of expiration of warranties and guarantees.

3.2 INSTRUCTIONS FOR OWNER

A. Contractor shall instruct the Owner's operating personnel in the operation and maintenance of all mechanical equipment. Contractor shall furnish any special servicing tools required for maintenance.

3.3 DEMONSTRATION

A. Contractor shall conduct a demonstration of the installation upon completion of the work. Prior to this, all work shall have been completed, tested, balanced, and placed in operation. Qualified persons must be present at demonstration to operate all systems and prove the performance of the equipment. The schedule for this demonstration shall be coordinated with the Engineer.

3.4 REQUIREMENT

A. The above data and work are required for final acceptance of and payment for the project.

END OF SECTION 260100

SECTION 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 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Sections include the following:

1. Division 26 Section – “Control-Voltage Electrical Power Cables” for wiring of control circuits.
2. Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.
3. Division 26 Section "Undercarpet Electrical Power Cables" for flat cables for undercarpet installations.
4. Division 26 Section "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

C. Copper Conductors: Comply with NEMA WC 70.

D. Conductor Insulation: Comply with NEMA WC 70 for Type(s) THHN/THWN-2 and XHHW-2.

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:

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.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Feeders and branch circuits, 50 V to 600 V: Type THHN/THWN-2 single conductors in raceway.

D. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

E. Class 1 Control Circuits: Type THHN/THWN-2 or Type XHHW-2 individual conductors in raceway.

F. Class 2 Control Circuits: Type THHN/THWN-2 or Type XHHW-2 individual conductors in raceway; or power-limited cable, suspended above ceiling or concealed in walls or chases.

3.2 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.

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."

3.3 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.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. If existing aluminum conductors are encountered and it is not specified or practical to replace them with copper conductors, utilize the appropriate materials and personnel for working with them.

1. Prepare aluminum conductors at termination and tap locations as recommended by conductor manufacturer. Use oxide inhibitor listed for the purpose and containing sharp metal particles for penetration of any remaining oxide layer.
2. Each person preparing or making aluminum connections must have documented training by a qualified instructor selected or approved by the aluminum wiring manufacturer at the start of the project.

D. Wiring at Outlets: Install conductor at each outlet with adequate slack for connection. For #10 and smaller conductors, provide at least 6 inches (150 mm) of slack.

END OF SECTION 260519

SECTION 260520 - UNDERCARPET ELECTRICAL POWER 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. Undercarpet cable and service fittings for branch circuits.
2. Undercarpet cable and service fittings for communication and data transmission.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: From manufacturer, detailing fabrication and installation of undercarpet cable including plans, elevations, sections, details of components, and attachments to other work.

1. Indicate cable types, accessories, and transition boxes.
2. Indicate proposed layering of cables, cable dimensions, and installation requirements.

C. Samples for Initial Selection: Submit one Sample for each of the following:

D. Samples for Verification: Submit one Sample for each of the following:

1. Undercarpet cable for branch circuits.
2. Undercarpet cable for communication and data transmission.
3. Service pedestal (one of each type used).
4. Power cable transition box.
5. Communication and data cable transition box.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and sections, 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. Dimensioned undercarpet cable layout.
2. Connections to raceways, transition boxes, service fittings, and other wiring.
3. Relation of components to adjacent structural elements.

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For undercarpet cable systems to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include manufacturer's written instructions for cable repairs, repositioning, and extensions.

1.6 MAINTENANCE MATERIAL SUBMITTALS

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. Service Fittings: Furnish full-size units equal to <**Insert number**> percent of amount installed, but no fewer than 3 of each type.
2. Branch-Circuit Undercarpet Cable: Furnish total length on standard rolls equal to <**Insert number**> percent of total length installed, but no less than <**Insert feet (m)**> of each type (2, 3, or 4 wire).
3. Communication and Data Undercarpet Cable: Furnish total length on standard rolls equal to <**Insert number**> percent of total length installed, but no less than <**Insert feet (m)**> of each type.

1.7 QUALITY ASSURANCE

A. 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.

B. Source Limitations: Obtain all undercarpet cable system components through one source from a single manufacturer.

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 NEMA UC 2, "Undercarpet Power Distribution Systems" and with NFPA 70.

1.8 COORDINATION

A. Coordinate layout and installation of undercarpet cables with locations of furnishings, partitions, and building finishes.

PART 2 - PRODUCTS

2.1 POWER DISTRIBUTION CABLE

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. Tyco Electronics Corp.
2. Alcan Products Corporation; Alcan Cable Division.
3. American Insulated Wire Corp.; a Leviton Company.
4. General Cable Corporation.
5. Senator Wire & Cable Company.
6. Southwire Company.

C. Cable: Factory laminated and complying with NEMA UC 2; three-piece assembly including bottom shield, conductor assembly, and top shield.

1. Bottom Shield: [**Abrasion resistant, nonmetallic**] [or **Metallic**].
2. Top Shield: Copper or copper alloy.

2.2 COMMUNICATION AND DATA CABLE

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. Optical Cable Corporation.
2. Tyco Electronics Corp.
3. Alcan Products Corporation; Alcan Cable Division.
4. American Insulated Wire Corp.; a Leviton Company.
5. General Cable Corporation.
6. Senator Wire & Cable Company.
7. Southwire Company.

C. Category 5e Communication and Data Cable: Extruded-vinyl jacket over 4 unshielded, twisted pairs, No. 24 AWG, copper; complying with TIA/EIA 568-B; and tested to 300-lb (136-kg) rollover test.

D. Fiber-Optic Cable: Undercarpet fiber-optic cable with jacketed, low-profile construction.

1. Fibers per Cable: Two.
2. Fiber Type: 62.5/125 graded index.
3. Attenuation: 6.0 dB/km.
4. Bandwidth: 100 MHz/km.
5. Wavelength: 850 nm.

6. Buffer Diameter: 500 micrometers.

2.3 PEDESTALS

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. Tyco Electronics Corp.
2. Alcan Products Corporation; Alcan Cable Division.
3. American Insulated Wire Corp.; a Leviton Company.
4. General Cable Corporation.
5. Senator Wire & Cable Company.
6. Southwire Company.

C. Description: Manufacturer's standard [**low**] [or **regular**]-profile type, [**single**] [**two**] [**and three**] gang with [**single**] [or **duplex**] receptacles[**and Category 5e modular connectors**].

1. Pedestal Colors: As selected by Architect from manufacturer's full range.

2.4 POWER CABLE TRANSITION UNIT

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. Tyco Electronics Corp.
2. Alcan Products Corporation; Alcan Cable Division.
3. American Insulated Wire Corp.; a Leviton Company.
4. General Cable Corporation.
5. Senator Wire & Cable Company.
6. Southwire Company.

C. Description: Interface transition unit, with junction box, for connecting three-, four-, or five-conductor, flat-conductor cable to building wiring system.

2.5 COMMUNICATION AND DATA CABLE TRANSITION UNIT

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. Tyco Electronics Corp.
2. Alcan Products Corporation; Alcan Cable Division.

3. American Insulated Wire Corp.; a Leviton Company.
4. General Cable Corporation.
5. Senator Wire & Cable Company.
6. Southwire Company.

C. Description: Category 5 transition termination circuit board in wall-mounted box to convert round incoming cable to outgoing flat-undercarpet cable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine floors to receive undercarpet cables for compliance with requirements for installation tolerances and other conditions affecting performance of undercarpet cables.

B. Verify that holes in concrete slabs are filled and projections are removed, that floor has been vacuumed and all debris removed, and that concrete slabs have been sealed to prevent dusting.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not begin installation until heavy construction is completed and wheeled traffic is no longer a threat.

B. Do not stack cables in circulation routes.

C. Limit total installed height to 0.09 inch (2.29 mm).

D. Install cables in proper order with power-transmission cable first, followed by telephone cable and then data cable. Cross cables at 90-degree angles.

E. Install undercarpet cables and accessories using special tools as recommended by undercarpet cable manufacturer.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect undercarpet cable and components to branch circuits and to ground as indicated and instructed by manufacturer.

3.4 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.

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.

D. Tests and Inspections:

1. Branch-Circuit Cables: After cables have been installed and energized, perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Communication and Data Cables: After cables have been installed and connected between telecommunications outlet and system cross-connect panel, test each cable according to TIA/EIA TSB67. Certify compliance with test parameters.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260520

SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER 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. Section Includes:

1. Low-voltage control cabling.
2. Control-circuit conductors.
3. Identification products.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel section.

C. EMI: Electromagnetic interference.

D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

E. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

F. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

1. Vertical and horizontal offsets and transitions.
2. Clearances for access above and to side of cable trays.
3. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
4. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

1.5 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wire and cable to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Insulation Fire and Smoke Ratings

1. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
2. Flame-Spread Index: 25 or less.
3. Smoke-Developed Index: 50 or less.

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.

- Test optical fiber cable to determine the continuity of the strand end to end. Use [optical fiber flashlight or optical loss test set]
- Test optical fiber cable on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; include the loss value of each. Retain test data and include the record in maintenance data.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. Support of Open Cabling: NRTL labeled for support of each type of cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

B. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Cable Management Solutions, Inc.
b. Cablofil Inc.
c. Cooper B-Line, Inc.
d. Cope - Tyco/Allied Tube & Conduit.
e. GS Metals Corp.

2. Cable Tray Materials:

a. Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick.

d. Basket Cable Trays: Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).

C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Description: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry."

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Belden CDT Inc.; Electronics Division.
2. Berk-Tek; a Nexans company.
3. CommScope, Inc.
4. Draka USA.
5. Genesis Cable Products; Honeywell International, Inc.
6. KRONE Incorporated.
7. Mohawk; a division of Belden CDT.
8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Superior Essex Inc.
10. SYSTIMAX Solutions; a CommScope, Inc. brand.
11. 3M.
12. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. Description: 100-ohm, four-pair UTP.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 5e.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

a. Communications, General Purpose: Type CM or Type CMG.
b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
c. Communications, Riser Rated: Type CMR; complying with UL 1666.
d. Communications, Limited Purpose: Type CMX.
e. Multipurpose: Type MP or Type MPG.
f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Technology Systems Industries, Inc.
2. Dynacom Corporation.
3. Hubbell Premise Wiring.
4. KRONE Incorporated.
5. Leviton Voice & Data Division.
6. Molex Premise Networks; a division of Molex, Inc.
7. Nordex/CDT; a subsidiary of Cable Design Technologies.
8. Panduit Corp.
9. Siemon Co. (The).
10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. UTP Cable Connecting Hardware: IDC type, using modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of the same category or higher.

C. Connecting Blocks: Provide blocks for the number of cables terminated on the block, plus 25 percent spare; integral with connector bodies, including plugs and jacks where indicated.

2.5 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

C. Paired Cable: NFPA 70, Type CMG.

1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

D. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.

4. Plastic jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.6 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper in thermoplastic insulation complying with UL 83.

1. Type THHN-THWN or Type THHN-THWN-2, in raceway

B. Class 2 Control Circuits: Stranded copper in thermoplastic insulation complying with UL 83.

1. Type THHN-THWN or Type THHN-THWN-2, in raceway
2. Power-limited cable, concealed in building finishes
3. Power-limited tray cable, in cable tray

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

2.7 IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Brady Corporation.
2. HellermannTyton.
3. Kroy LLC.
4. Panduit Corp.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.8 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

C. Factory test UTP cables according to TIA/EIA-568-B.2.

E. Cable will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

C. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

D. Install manufactured conduit sweeps and long-radius elbows if possible.

E. Pathway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed or in the corner of room if multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard if entering room from overhead.
4. Extend conduits 3 inches (75 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

F. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.2 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
6. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Install 110-style IDC termination hardware unless otherwise indicated.
3. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

- Comply with TIA/EIA-568-B.3.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
2. Cable shall be terminated on connecting hardware that is rack or cabinet mounted.
3. Open-Cable Installation:
4. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
5. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1525 mm) apart.
6. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

- Install plenum-rated cable only.
- Install cabling after the flooring system has been installed in raised floor areas.
- Coil cable 72 inches (1830 mm) long shall be neatly coiled not less than 12 inches (305 mm) in diameter below each feed point.

E. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (305 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (600 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (305 mm).
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (75 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).

5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.3 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables.

3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. See plan.

3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping" and Division 26 Section “260100 – General Requirements for Electrical Work.”

B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. For data communication wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling according to TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Test cabling for end-to-end continuity and short circuits.

C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 260523

SECTION 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. Section Includes:

1. Grounding systems.
2. Grounding equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

- Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
  - Test wells.
  - Ground rods.
  - Ground rings.
  - Grounding arrangements and connections for separately derived systems.
  - Grounding for sensitive electronic equipment.
  - <Insert items>.
  - Qualification Data: For qualified testing agency and testing agency's field supervisor.
  - Retain first paragraph below if Contractor is responsible for field quality-control testing and inspecting.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Instructions for periodic testing and inspection of grounding features .
   a. Include recommended testing intervals.
2. Plans showing (by dimensions or scale) as-built locations of grounding features, including the following:

a. Grounding Electrode System Components
    1) Service ground-neutral bond (typically in service entrance equipment)
    2) Ground rods.
    3) Metal water piping
    4) Concrete-encased electrodes
    5) Structural steel.

b. Test wells.

3. Grounding Electrode System Diagram, showing connections between features named above and the main electrical service grounding point. Note at least the following:

    a. Connection types (bolted, welded, compression, etc.)
    b. Types and sizes of conductors

1.6 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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable as indicated, or if not indicated, insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, mounting, dimensions and hole arrangements as indicated, or if not indicated, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

A. Listed and labeled by an NRTL 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, 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.

D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m) in length.

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.

1. Bury at least 24 inches (600 mm) below grade.

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 2 inches (50 mm) minimum from wall, 6 inches (150 mm) 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, and down to specified height above floor; connect to horizontal bus.

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: Listed bolted connectors or preferably (with structural engineer's approval) welded connectors.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

1. 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.

B. Water Heater, Heat-Tracing, and Antifrost 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.

C. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
2. 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.

D. Metal and Wood 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. Interface with Existing Systems: Incorporate and interconnect existing grounding electrode elements with new grounding electrode system elements. The interconnecting elements shall not be smaller than prescribed in the National Electrical Code.

B. 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.

C. Ground Bonding Common 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.

D. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

2. If a new ground rod is specified or required, achieve 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.

E. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section " Raceways and Boxes for Electrical Systems," and shall be at least 12 inches (300 mm) 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.

F. 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 bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

G. Grounding Transformer Neutral and Case”

1. Provide grounding conductor sized as indicated on drawings, and not smaller than required by NEC.
2. Connect to at least one of the following using a suitable, listed connector consistent with this specification:

a. A building service grounding electrode, such as the metal building frame, concrete-encased electrode, or ground loop that is connected to the building grounding network with a conductor at least as large as the transformer grounding conductor.
b. A building service grounding electrode conductor not smaller than the required building service main grounding conductor, or that is at least equivalent to 3/0 AWG copper.

H. Bonding for Piping:

1. Connect grounding conductors to metal pipes using bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Use grounding conductors or braided-type bonding jumpers to electrically bypass meters, softeners, water heaters, pumps, storage tanks, regulators, valves and such equipment if electrical continuity cannot be verified to exist otherwise (such as by visible metal bodies or casings bolted to pipes).
2. Bond metal pipe connected to electrically powered equipment with a conductor sized not smaller than the electrical circuit’s equipment grounding conductor.

I. Grounding and Bonding for Piping:

1. Connect grounding conductors to metal pipes using bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Use grounding conductors or braided-type bonding jumpers to electrically bypass meters, softeners, water heaters, pumps, storage tanks, regulators, valves and such equipment if electrical

continuity cannot be verified to exist otherwise (such as by visible metal bodies or casings bolted to pipes).

2. Bond metal pipe connected to electrically powered equipment with a conductor sized not smaller than the electrical circuit's equipment grounding conductor.
3. 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. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting.
4. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
5. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

J. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

K. Ufer Ground (Concrete-Encased Grounding Electrode): Where new or extended foundations are constructed, fabricate according to NFPA 70 and to any instructions on the drawings. In the absence of more explicit instructions on the drawings, provide a 20' long #5 rebar welded to a 5/8" galvanized steel rod at least 24" long, and extending 6" above or outside the concrete footing, at least 6" above grade. Coordinate with concrete reinforcement steel work to have the rebar tied to the reinforcement steel in the usual manner. Connect to the protruding galvanized steel bar with exothermic weld to a full-sized (typically #3/0 AWG) grounding electrode conductor connected to the building's grounding electrode network.

3.5 LABELING

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance no fewer 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.

4. 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.

5. Grounding system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect, Engineer or Construction Manager promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 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. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. 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 3 times the applied force.

1.5 ACTION 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:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.

4. Equipment supports.

C. Engineered Design Documents: Where engineering design responsibilities are assigned to the Contractor, submit design documents signed and sealed by a qualified professional engineer.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates, if applicable.

1.7 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.8 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. 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. GS Metals Corp.
    e. Thomas & Betts Corporation.
    f. Unistrut; Tyco International, Ltd.
    g. Wesanco, Inc.
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-4.
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- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) 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:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. Fabco Plastics Wholesale Limited.
d. Seasafe, Inc.

2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
4. 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. **Submittal shall include a list of applications, and sufficient documentation to demonstrate suitability of the fasteners for those applications.** Each application requires approval of Design Team

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, stainless or zinc-coated 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:

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.

C. Carbon steel components such as channels, angles and rods that are exposed to weather or installed in damp locations such as crawl spaces shall be hot dip galvanized.

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 (6 mm) 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 or single-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

E. Select support materials and finishes suitable for the environments in which they will be installed. Conform to at least the following:

1. Identified high-corrosion areas: Material and finish specifically approved for the environment. If not otherwise stated, stainless steel of grade not less than Type 304
2. High chlorine environment, such as swimming pool areas: Aluminum or aluminum-plated steel.
3. Moist areas such as crawl spaces, unconditioned mechanical rooms and areas around cooling towers: Hot-dipped galvanized steel, with any cuts or fabrication damage covered with zinc-rich paint demonstrated to be equivalent to hot dip galvanizing.
4. Conditioned indoor space: Electro-galvanized, cadmium plated, passivated spring steel or phosphatized steel.
5. Other materials and finishes specifically approved for the application by the design team.

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. Large paddle fans, heaters and other suspended equipment weighing over 70 lb (32 kg) require engineered supports. If the structural design does not include provisions for such support, submit engineered shop drawings sealed by an engineer registered in Texas.

D. 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 (90 kg).

E. 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, with approval of Design Team, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick. Owner may restrict times of powder discharges.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
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.

F. 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 (100 mm) 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 (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 and/or Section 260100.

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 (0.05 mm).

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS 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.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

B. Related Requirements:

1. Refer to Section 260100 - General Requirements for Electrical Work for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items. **Any requirements for or features of conductors, raceways, sleeves or seals needed for proper penetration of fire rated construction override any conflicting requirements in this Section.**
2. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.
3. Division 27 Section "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.
4. Division 28 Section "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

1.3 DEFINITIONS

- ARC: Aluminum Rigid Conduit.

A. RMC: Rigid metal conduit

B. RGSC: Rigid Galvanized Steel Conduit.

C. GRC: Galvanized Rigid Steel Conduit.

D. IMC: Intermediate Metal Conduit.

E. EMT: Electrical Metallic Tubing

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

~~B. LEED Submittals:~~

~~1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.~~

~~2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."~~

C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Source quality-control reports.

PART 2 - PRODUCTS

#.2o SPECIAL ENVIRONMENTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. O-Z/Gedney; a brand of EGS Electrical Group.
6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
7. Republic Conduit.
8. Robroy Industries.
9. Southwire Company.
10. Thomas & Betts Corporation.
11. Western Tube and Conduit Corporation.
12. Wheatland Tube Company; a division of John Maneely Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

1. Provide threaded fittings for RGSC except where explicit, written permission is obtained to use threadless fittings due to space constraints.

D. ARC: Comply with ANSI C80.5 and UL 6A.

E. IMC: Comply with ANSI C80.6 and UL 1242.

F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Comply with ETL Verified PVC-001.
3. Coating Thickness: 0.040 inch (1 mm), minimum.

G. EMT: Comply with ANSI C80.3 and UL 797.

H. FMC: Comply with UL 1; zinc-coated steel.

I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

J. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT:

a. Material: Steel or die cast.
b. Type: Compression.

2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions in which installed, and including flexible external bonding jumper.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

K. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.
6. Condux International, Inc.
7. Electri-Flex Company.

8. Kraloy.
9. Lamson & Sessions; Carlon Electrical Products.
10. Niedax-Kleinhuis USA, Inc.
11. RACO; a Hubbell company.
12. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Materials and Types:

1. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

a. Fittings for RNC: Comply with NEMA TC 3; match to conduit type and material.

2. RTRC (Fiberglass): Comply with UL 1684A and NEMA TC 14.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. Hoffman; a Pentair company.
3. Mono-Systems, Inc.
4. Square D; a brand of Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type as required for environment unless greater protection is otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, 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.

D. Wireway Covers: Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Moulded Products, Inc.
2. Hoffman; a Pentair company.
3. Lamson & Sessions; Carlon Electrical Products.
4. Niedax-Kleinhuis USA, Inc.

B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

D. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

E. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

2.5 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect. Product usage requires special permission of the Owner’s representative.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Mono-Systems, Inc.
b. Panduit Corp.
c. Wiremold / Legrand.

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics. Product use is only by special permission of Owner’s representative, and for Class 2, Low Voltage, Limited Energy wiring.

D. Tele-Power Poles:

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Mono-Systems, Inc.
b. Panduit Corp.
c. Wiremold / Legrand.

2. Material: Galvanized steel with ivory baked-enamel finish [or Aluminum with clear anodized finish].

3. Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. EGS/Appleton Electric.
2. FSR Inc.
3. Hoffman; a Pentair company.
4. Hubbell Incorporated; Killark Division.
5. Milbank Manufacturing Co.
6. O-Z/Gedney; a brand of EGS Electrical Group.
7. RACO; a Hubbell Company.
8. Thomas & Betts Corporation.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

E. Metal Floor Boxes:

1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

D. Paddle fans, heaters and other suspended equipment weighing over 70 lb (32 kg) require engineered supports. If the structural design does not include provisions for such support, submit engineered shop drawings sealed by an engineer registered in Texas.

H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb (32 kg).

1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

L. Device Box Dimensions: Adequate for the device and wiring, and not less than4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep) unless space is too restricted.

M. Gangable boxes are allowed.

N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type as required for environment unless greater protection is otherwise indicated; with continuous-hinge cover and flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

O. Cabinets:

1. NEMA 250, Type as required for environment unless greater protection is otherwise indicated, 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.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] available 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; Hubbell Power Systems.
d. NewBasis.
e. Oldcastle Precast, Inc.; Christy Concrete Products.
f. Synertech Moulded Products; a division of Oldcastle Precast, Inc.

2. Standard: Comply with SCTE 77.

3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC.".
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.8 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. 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.
2. 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. Special Environments:

1. Use aluminum, non-metalic or non-metalic-coated boxes, enclosures and raceways where likely to be exposed to bleach or chlorinated swimming pool water.
2. Use non-metalic or non-metalic-coated boxes, enclosures and raceways where likely to be exposed to acids such as pool pH control products.

B. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRCRNC, Type EPC-40-PVC.
2. Exposed on Roof: GRC, any size, and 1” and smaller EMT with raintight steel compression fittings.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, as required for environment unless greater protection is otherwise indicated.

C. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Physical Damage: GRC. Such locations include the following and similar:

a. Loading dock.
b. Less than 8 feet above floor in corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
c. Mechanical rooms, less than 12" above floor.
d. Gymnasiums, less than 20 feet above floor.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: GRC or PVC-Coated GRC
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

D. Minimum Raceway Size: 1/2-inch (16-mm) trade size.

E. 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. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression fittings, steel (indoors or out) or cast-metal (indoors only). Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

F. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

G. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

H. Install surface raceways only where indicated on Drawings.

I. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

E. Avoid routing conduit or wiring through hazardous locations. Where this is unavoidable, provide raceway types and seals are required by the National Electrical Code.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Division 26 Section "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. A. Support conduit within 12 inches (300 mm) of enclosures to which attached.

I. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum10-foot (3-m) intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Engineer for each specific location.

J. Stub-ups to Above Suspended Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. 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.

L. Installation of the PVC-coated Conduit System shall be performed in accordance with the Manufacturer's Installation Manual. Installer certification, before installation, is required.

M. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

N. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

P. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

Q. 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.

R. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

S. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

T. For data and communications raceways, provide two (2) pull strings in each conduit 2" trade size and larger.

U. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

V. Install raceway sealing fittings at accessible locations according to NFPA 70 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 according to NFPA 70.

W. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

X. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

Y. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m).
2. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
3. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

   a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
   b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.

c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
d. Unconditioned Attics: 135 deg F (75 deg C) temperature change.

4. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
5. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
6. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

Z. Flexible Conduit Connections: Comply with NEMA RV 3.

1. Use LFMC in damp or wet locations.
2. Use 60 to 72 inches (1525 to 1830 mm) of flexible conduit for recessed and semirecessed luminaires.
3. Use between 12 and 36 inches (305 and 815 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

AA. 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.

BB. 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 surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

CC. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel. Separate by at least 24” in fire rated walls.

DD. Locate boxes so that cover or plate will not span different building finishes.

EE. 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.

FF. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

GG. Set metal floor boxes level and flush with finished floor surface.

HH. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

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 indicated on drawings, or if not indicated, with sand or other approved smoothly flowing soil at least one conduit diameter deep.
2. Install backfill as indicated on drawings, or if not indicated, using sand or other approved smoothly flowing soil to at least 6" above top of conduit.
3. After installing conduit, backfill and compact. 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 (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.
4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
5. Underground Warning Tape: Comply with requirements in Division 2616 Section "Identification for Electrical Systems."

B. Concrete-Encased Ductbanks:

1. Install premanufactured duct separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6” between tiers. Tie entire assembly together using non-metallic straps.
2. Place concrete in any run of ductbank in one continuous operation.
3. Spade concrete carefully during placement 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 side 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.
4. Reinforce concrete-encased duxt 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. Use wall of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be placed without soil inclusions; otherwise, use forms.
6. Maintain 2” between ducts for like services, 3” between ducts and exterior envelope wall, and 4 inches between power and signal ducts.
7. Install top of duct bank at depth indicated on drawings, and at least 24” below finished grade in areas not subject to deliberate traffic, and at least 30” below finished grade in deliberate traffic paths for vehicles.

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 (12.5-mm) sieve to No. 4 (4.75-mm) 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 (25 mm) above finished grade.

D. Install handholes with bottom no less than 30 inches (750 mm) below grade, except that handholes for ground rod test wells shall be mo more than 8" deep.

E. 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 enclosure.

F. 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 AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Division 26 Section "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping," and with Div. 26

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

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. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:

C. Refer to 260100 - General Requirements for Electrical Work for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items. **Any requirements for or features of sleeves or seals needed for proper penetration of fire rated construction override any conflicting requirements in this Section.**

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. CALPICO, Inc.
c. Metraflex Company (The).
d. Pipeline Seal and Insulator, Inc.
e. Proco Products, Inc.

2. Sealing Elements: EPDM or Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

C. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 FIRESTOPPING

A. Refer to 260100 - General Requirements for Electrical Work for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items. **Any requirements for or features of sleeves or seals needed for proper penetration of fire rated construction override any conflicting requirements in this Section.**

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. 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."

b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.

4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using galvanized steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install 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.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 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.

1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

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 Existing styles

A. Where suitable existing labeling and marking systems are already established, provide new labels and marking consistent with the existing systems. Conform to existing color, pattern, material, attachment, text size and other features except as necessary to conform to any code requirement or request from the Owner to use the new features specified below instead of existing features.

B. Equipment and piping system labeling patterns, numbering, and other serial labeling shall be rational extensions of the Owner's established patterns, and be approved by Owner prior to creation.

2.2 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. 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.

C. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, 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.

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.

1. Snap-Around Labels: Slit, pretensioned, 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.

C. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) 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 (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) 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, pretensioned, 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, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.5 FLOOR MARKING TAPE

A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) 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 communication 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.
4. Utilize tape with metal tracer wire or install separate tracer wire for non-metallic buried services.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE, etc.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE, etc.
4. Thickness: 12 mils (0.3 mm).
5. Weight: 36.1 lb/1000 sq. ft. (17.6 kg/100 sq. m).

2.7 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Comply with NFPA 70E, including “ARC-FLASH” warning signs on enclosures.

C. 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.

1. Warning label and sign shall include, but are not limited to, the following legends:
2. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2.8 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.9 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 (10 mm).

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 (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

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 (10 mm).

E. Stenciled Legend: In non-fading, waterproof, ink or paint. Minimum letter height shall be **1 inch (25 mm)**.

2.10 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 (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
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 (5 mm).

2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

PART 3 - EXECUTION

3.1 CONDUCTOR COLOR CODING

A. Comply with the conductor color coding requirements in the National Electrical Code.

B. Comply with any conductor color coding standards of the Facility.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, 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. Verify color coding requirements with each local Authority Having Jurisdiction.

   a. Color shall be factory applied (or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.)

2. Most jurisdictions other than the City of Austin, TX:.

   a. Colors for 208/120-V Circuits:

      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.
      4) Neutral: White
      5) Ground: Green

   b. Colors for 480/277-V Circuits:

      1) Phase A: Brown.
      2) Phase B: Orange.
      3) Phase C: Yellow.
      4) Neutral: Grey
      5) Ground: Green

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

4. For higher-voltage systems, conform to NEC, facility and/or utility color coding conventions. Clearly differentiate between different voltage classes, using supplementary color and/or text bands as necessary.

D. Comply with additional conductor color coding requirements of the local jurisdiction(s).

E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

3.2 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 (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. 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.

H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.

I. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

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. 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. Equipment to Be Labeled:

a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
b. Switchboards: Both assembly and individual circuit identification shall be engraved laminated acrylic or melamine label.
c. Enclosures and electrical cabinets.
d. Access doors and panels for concealed electrical items.
e. Enclosed switches.
f. Enclosed circuit breakers.
g. Enclosed controllers.
h. Variable-speed controllers.
i. Engine-Generator Sets
j. Transfer Switches
k. Push-button stations.
l. Remote-controlled switches, dimmer modules, and control devices.

END OF SECTION 260553

SECTION 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. Section Includes:

1. Time switches.
2. Photoelectric switches.
3. Indoor occupancy sensors.
4. Emergency shunt relays.
5. Outdoor motion sensors.
6. ~~Standalone daylight-harvesting switching controls.~~
7. Lighting contactors.

B. Related Requirements:

1. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 SYSTEM ARCHITECTURE

1. Utilize 24 VAC Class 2 control power transformers and/or 24 VDC Class 2 power supplies for all circuits switched directly by a timeclock, photocell, motion sensor or remote low-voltage switch.
2. Utilize power relays with contact configurations and voltage, ampere and load type ratings appropriate for each load.
3. Exceptions:
   - Wallbox motion sensing switches, pole-mounted photocells, and switching devices integral to lighting fixtures rated for the application may switch the power circuit directly.
   - Timeclocks with up to four (4) poles rated for the voltage, amperage and load type may switch power circuits directly.

2.2 CONTROL EQUIPMENT SCHEDULE

B. Basis of Design Products: Provide sensors, relays and accessory components of the type and quality scheduled below, or that are approved as equal for purposes of this project. Additional compatible accessories and related products may be required for specific spaces and explicit requirements of the project.

DEVICE	TYPE	MFGR	PIR	ULT-SONIC	MULTI
OCCUPANCY SENSOR	AREA	LEVITON	OSC20-I0W	OSC20-U0W	OSC20-MOW
OCCUPANCY SENSOR	HALL	LEVITON	OSC20-I0W	OSC20-U0W	OSC20-MOW
~~OCCUPANCY SENSOR~~	~~GYM~~	~~nLIGHT~~	~~nCM-6~~		
OCCUPANCY SENSOR	WALL	LEVITON			OSW12-MOW
OCCUPANCY SENSOR	WALL SW	LEVITON			OSSMT-GDW
OCCUPANCY SENSOR	FIXTURE	LEVITON	OSF10-IoW		
OCCUPANCY SENSOR	EXTERIOR	LEVITON	PS200-10W		
POWER PAK		LEVITON	OSP20-NDO		

C. Full Year Timeclock: Intermatic ET90215CR with the following features:

1. 365day astronomic timing
2. Automatic input voltage selection from 120 to 277 VAC,
3. 4,000 events plus holiday schedules
4. 30 Amp rated contacts
5. 100+ hour supercapacitor maintains date and time in case of power outage
6. USB connection for uploading, downloading and transferring of programs
7. Ethernet capable for networking of controls to other controls and PC tools
8. Easy to follow onscreen menus for programming to-the-minute accuracy
9. Nonvolatile memory protects programming indefinitely
10. Firmware upgradable infield via USB or Ethernet
11. CAN connection supports up to 32 additional circuits or inputs externally
12. Available in 1, 2, 4, 8, 12, and 16 circuits
13. Internally expandable in 4circuit increments up to 16 circuits

2.3 DIGITAL TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. See plan

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Provide with contact configurations, volt, ampere and load type ratings required for the application.
3. Programming shall be sufficient to fulfill the stated project objectives, and not less than required to comply with IECC.

- Programs: Eight on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
- Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.

4. Astronomic Time: Selected channels.
5. Automatic daylight savings time changeover.
6. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.4 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. NSi Industries LLC; TORK Products.
4. Tyco Electronics; ALR Brand.

B. General Use Photocell: Solid state, with contact configuration and voltage, amperage and load type rating required for connected relay or contactor coils, or microprocessor input; complying with UL 773A.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range.
3. Time Delay: Fifteen second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

C. Single-Load Photocell: Solid state, with contact configuration and voltage, amperage and load type rating required to operate connected load, complying with UL 773.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range.
3. Time Delay: Thirty-second minimum, to prevent false operation.
4. Lightning Arrester: Air-gap type.
5. Mounting: Twist lock complying with NEMA C136.10, with base.

2.5 DAYLIGHT-HARVESTING SWITCHING CONTROLS

A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

1. Cooper Industries, Inc.
2. Eaton Corporation.
3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lithonia Lighting; Acuity Lighting Group, Inc.
6. NSi Industries LLC; TORK Products.
7. Sensor Switch, Inc.
8. Tyco Electronics; ALR Brand.
9. Watt Stopper.
10. <**Insert manufacturer's name**>.

C. Ceiling-Mounted Switching Controls: Solid-state, light-level sensor unit, with separate power pack[**mounted on luminaire**], to detect changes in indoor lighting levels that are perceived by the eye.

D. Electrical Components, Devices, and Accessories:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
3. Sensor Output: Contacts rated to operate the associated power pack, complying with UL 773A. Sensor is powered by the power pack.
4. Power Pack: Dry contacts rated for [**20**] <**Insert value**>-A ballast load at 120- and 277-V ac, for [**13**] <**Insert value**>-A tungsten at 120-V ac, and for [**1**] <**Insert value**> hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. General Space Sensors Light-Level Monitoring Range: 10 to 200 fc (108 to 2152 lux), with an adjustment for turn-on and turn-off levels within that range.
6. Atrium Space Sensors Light-Level Monitoring Range: 100 to 1000 fc (1080 to 10 800 lux), with an adjustment for turn-on and turn-off levels within that range.
7. Skylight Sensors Light-Level Monitoring Range: 1000 to 10,000 fc (10 800 to 108 000 lux), with an adjustment for turn-on and turn-off levels within that range.
8. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling.

9. Set-Point Adjustment: Equip with deadband adjustment of 25, 50, and 75 percent above the "on" set point, or provide with separate adjustable "on" and "off" set points.
10. Test Mode: User selectable, overriding programmed time delay to allow settings check.
11. Control Load Status: User selectable to confirm that load wiring is correct.
12. Indicator: Two digital displays to indicate the beginning of on-off cycles.

2.6 DAYLIGHT-HARVESTING DIMMING CONTROLS

A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:

1. Cooper Industries, Inc.
2. Hubbell Building Automation, Inc.
3. Leviton Mfg. Company Inc.
4. Lithonia Lighting; Acuity Lighting Group, Inc.
5. Watt Stopper.
6. <**Insert manufacturer's name**>.

C. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.

1. Lighting control set point is based on two lighting conditions:

   a. When no daylight is present (target level).
   b. When significant daylight is present.

2. System programming is done with two hand-held, remote-control tools.

   a. Initial setup tool.
   b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.

D. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Sensor Output: 0- to 10-V dc to operate electronic dimming ballasts. Sensor is powered by controller unit.
3. Power Pack: Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70.
4. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc (120 to 640 lux).

2.7 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lightolier Controls.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Lutron Electronics Co., Inc.
8. NSi Industries LLC; TORK Products.
9. RAB Lighting.
10. Sensor Switch, Inc.
11. Square D; a brand of Schneider Electric.
12. Watt Stopper.

B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
4. Power Pack: 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. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. Mounting:

    - Sensor: Suitable for mounting in any position on a standard outlet box.
    - Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
    - Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
7. Bypass Switch: Override the "on" function in case of sensor failure.
8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.

C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.

1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.

D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy .

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).

E. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is 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- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.8 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lightolier Controls.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Lutron Electronics Co., Inc.
8. NSi Industries LLC; TORK Products.
9. RAB Lighting.
10. Sensor Switch, Inc.
11. Square D; a brand of Schneider Electric.
12. Watt Stopper.

B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application, and shall comply with California Title 24.
2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F (0 to 49 deg C).
3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

- Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.

4. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
5. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
6. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

2.9 HIGH-BAY OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lightolier Controls.
6. Lithonia Lighting; Acuity Lighting Group, Inc.
7. Lutron Electronics Co., Inc.
8. NSi Industries LLC; TORK Products.
9. RAB Lighting.
10. Sensor Switch, Inc.
11. Square D; a brand of Schneider Electric.
12. Watt Stopper.

B. General Description: Solid-state unit. The unit is designed to operate with the lamp and ballasts indicated.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Turn lights on when coverage area is occupied, and to half-power when unoccupied; with a time delay for turning lights to half-power that is adjustable over a minimum range of 1 to 16 minutes.
3. Continuous Lamp Monitoring: When lamps are dimmed continuously for 24 hours, automatically turn lamps on to full power for 15 minutes for every 24 hours of continuous dimming.
4. Operating Ambient Conditions: 32 to 149 deg F (0 to 65 deg C).
5. Mounting: Threaded pipe.
6. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
7. Detector Technology: PIR.

8. Power and dimming control from the lighting fixture ballast that has been modified to include the dimming capacitor and MyzerPORT option.

C. Detector Coverage: User selectable by interchangeable PIR lenses, suitable for mounting heights from 12 to 50 feet (3.7 to 15.2 m).

D. Accessories: Obtain manufacturer's installation and maintenance kit with laser alignment tool for sensor positioning and power port connectors.

~~2.10 EXTREME-TEMPERATURE OCCUPANCY SENSORS~~

~~A. Manufacturers: Subject to compliance with requirements, [**provide products by the following**] [**provide products by one of the following**] [**available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following**]:~~

~~B. Basis-of-Design Product: Subject to compliance with requirements, provide [**product indicated on Drawings**] <**Insert manufacturer's name; product name or designation**> or comparable product by one of the following:~~

~~1. Cooper Industries, Inc.~~
~~2. Sensor Switch, Inc.~~
~~3. <**Insert manufacturer's name**>.~~

~~C. Description: Ceiling-mounted, solid-state, extreme-temperature occupancy sensors with a separate power pack.~~

~~1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended application in damp locations.~~

~~2. Operation: Turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.~~
~~3. Operating Ambient Conditions: From minus 40 to plus 125 deg F (minus 40 to plus 52 deg C).~~
~~4. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.~~
~~5. Power Pack: 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. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.~~
~~6. Mounting:~~

~~a. Sensor: Suitable for mounting in any position on a standard outlet box.~~
~~b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.~~
~~c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind cover.~~

~~7. Bypass Switch: Override the "on" function in case of sensor failure.~~
~~8. Automatic Light-Level Sensor: Adjustable from 2 to 10 fc (21.5 to 108 lux); keep lighting off when selected lighting level is present.~~

~~D. Detector Technology: PIR. Ceiling mounted; detect occupants in coverage area by their heat and movement.~~

~~1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).~~
~~2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1500 sq. ft. (139 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.~~
~~3. Detection Coverage (High Bay): Detect occupancy within 25 feet (7.6 m) when mounted on a 25-foot- (7.6-m-) high ceiling.~~

2.11 OUTDOOR MOTION SENSORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Bryant Electric; a Hubbell company.
2. Cooper Industries, Inc.
3. Hubbell Building Automation, Inc.
4. Leviton Mfg. Company Inc.
5. Lithonia Lighting; Acuity Lighting Group, Inc.
6. NSi Industries LLC; TORK Products.
7. RAB Lighting.
8. Sensor Switch, Inc.
9. Watt Stopper.

B. General Requirements for Sensors: Solid-state outdoor motion sensors.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application, and shall comply with California Title 24.
2. PIR type, weatherproof. Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm). Comply with UL 773A.
3. Powered from the circuit switched or from a separate 24 VAC or 24 VDC Class 2 power supply.
4. Switch Rating:

    - Single-Load Sensor: Rated for load.
    - Low Voltage Sensor: Rated for voltage and load requirements of low voltage control system.

5. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
6. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F (minus 40 to plus 54 deg C), rated as "raintight" according to UL 773A.

2.12 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Corporation.
4. General Electric Company; GE Consumer & Industrial - Electrical Distribution; Total Lighting Control.
5. Square D; a brand of Schneider Electric.

B. Description: Electrically operated, combination-type lighting contactors with **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 as **indicated on Drawings**, matching the NEMA type specified for the enclosure.

2.13 EMERGENCY SHUNT RELAY

A. Manufacturers: Subject to compliance with requirements, **provide products by the following**:

1. Lighting Control and Design; Acuity Lighting Group, Inc.
2. Watt Stopper.

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual **or automatic** switching contacts; complying with UL 924.

2.14 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: Multiconductor cable with stranded-copper conductors not smaller than No. 22 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

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 systems, and partition assemblies.

B. 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 is 1/2 inch (13 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-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.

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 luminaires 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 tests and inspections:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 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. Distribution transformers.

1.3 ACTION 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. 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. Wiring Diagrams: Power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Source quality-control test reports.

B. Field quality-control test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 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. Comply with NFPA 70E, including “ARC-FLASH” warning signs on enclosures.

1.7 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.

1.8 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.

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, but are not limited to, the following:

1. ACME Electric Corporation; Power Distribution Products Division.
2. Challenger Electrical Equipment Corp.; a division of Eaton Corp.
3. Controlled Power Company.
4. Eaton Electrical Inc.; Cutler-Hammer Products.
5. Federal Pacific Transformer Company; Division of Electro-Mechanical Corp.
6. General Electric Company.
7. Hammond Co.; Matra Electric, Inc.
8. Magnetek Power Electronics Group.
9. Micron Industries Corp.
10. Myers Power Products, Inc.
11. Siemens Energy & Automation, Inc.
12. Sola/Hevi-Duty.
13. Square D; Schneider Electric.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Refer to “Transformer Schedule” on the drawings. Requirements on the schedule are more specific, and override any lesser requirements herein.

B. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

C. Cores: Grain-oriented, non-aging silicon steel.

D. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Indoor Location Enclosures: Ventilated , NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

D. Outdoor Location Enclosures: Totally enclosed, nonventilated, NEMA 250, Type 3R .

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

E. Taps for Transformers Smaller Than 3 kVA: None..

F. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below rated voltage.

G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below rated voltage.

H. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

I. 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.

J. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal 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.

K. Electrostatic Shielding: Apply to all transformers scheduled with K-Factor Rating 4 or higher, or serving primarily computer or communications circuits. Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.

1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
2. Include special terminal for grounding the shield.
3. Shield Effectiveness:

a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
b. Common-Mode Noise Attenuation: Minimum of minus 120 dBA at 0.5 to 1.5 kHz; minimum of minus 65 dBA at 1.5 to 100 kHz.
c. Normal-Mode Noise Attenuation: Minimum of minus 52 dBA at 1.5 to 10 kHz.

- Wall Brackets: Manufacturer's standard brackets.

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.

2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

B. Include information on transformer labels to indicate the minimum acceptable impedance in the Transformer Schedule so that any future replacements will not increase available fault beyond expectations.

2.5 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.

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.

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.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions and requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

▪ 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.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.5 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262200

SECTION 262413 - SWITCHBOARDS

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 and distribution switchboards rated 600 V and less.
2. Disconnecting and overcurrent protective devices.
3. Identification.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include schematic and wiring diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. 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.

1.5 CLOSEOUT SUBMITTALS

A. Switchboard Schedules: For record, after any construction-phase changes.

B. Operation and Maintenance Data: For switchboards 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. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions or submit shop drawing at suitable scale to propose alternate arrangements.

D. 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.

E. Comply with NEMA PB 2.

F. Comply with NFPA 70.

G. Comply with UL 891.

H. Comply with NFPA 70E, including “ARC-FLASH” warning signs on enclosures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Handle and prepare switchboards for installation according to NECA 407 .

1.8 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards 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.

2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

   a. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
   b. Altitude: Not exceeding 6600 feet (2000 m).

C. Service Conditions: NEMA PB 2, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions:

1. Notify Owner no fewer than seven (7) days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

1.9 COORDINATION

A. Coordinate layout and installation of switchboards 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.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

1. Refer to Division 260529 “Hangers and Supports” for equipment bases.

1.10 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warranty nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

B. 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 (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers Subject to compliance with requirements, provide products by one of the following available manufacturers listed below:

1. Eaton Electrical Inc.; Cutler-Hammer Products.
2. Square D; Schneider Electric.

2.2 MANUFACTURED UNITS

A. Front-Connected, Front-Accessible Switchboards:

1. Sections front and rear aligned.

B. Indoor Enclosures: Steel, NEMA 250, Type 1.

C. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

D. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

E. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.3 TRANSIENT VOLTAGE SUPPRESSION DEVICES

~~A. Provide Surge Protection Device per Section 254313 and schedule on drawing.~~

B. Provide manufacturer’s surge protective device meeting the performance characteristic scheduled on the drawings, and otherwise installed in the manufacturer’s standard manner.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489.

1. 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.
2. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

a. Instantaneous trip.
b. Long- and short-time pickup levels.
c. Ground-fault pickup level, time delay, and I^2t response.

3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.

b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Spare-Fuse Cabinet: Suitably identified, wall-mounted, lockable, compartmented steel box or cabinet. Arrange for wall mounting.

2.6 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NECA 400.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards 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 switchboards and accessories according to NECA 400.

B. Equipment Mounting: Install switchboards on concrete base or wall as recommended by manufacturer. Comply with requirements for concrete base specified in Division 03.

1. Interior switchboards: 3-1/2-inch (90-mm) nominal thickness
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to switchboards.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

E. Install filler plates in unused spaces of panel-mounted sections.

F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

G. Install spare-fuse cabinet.

H. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors 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. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard bus, 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 for Switchboards 1200 amps and larger.:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 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.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Switchboard will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies switchboards 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 components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

END OF SECTION 262413

SECTION 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.

B. For purposes of this article and the Panelboard Schedules on the drawings, the following distinctions will be drawn between Lighting and Appliance Panels, Distribution Panels and Switchboards.

1. Any panel designated as a Switchboard on the drawings or in the Panelboard Schedules, or that is rated more than 1200A shall be provided under Division-26 Section "Switchboards."
2. The specification herein for Lighting and Appliance Branch-Circuit Panelboards shall apply to either of the following:
    a. Any panel so designated on the Panel Schedule on the drawings.
    b. Any panel designated either as a Lighting and Appliance Panel or as a Distribution Panel on the drawings that has a main buss rating not above 600 A and no branch rated in excess of 225 A.
3. The specification for herein for Distribution Panelboards shall apply to either of the following:
    a. Any panel so designated on the Panel Schedule on the drawings unless it has a main buss rating not above 600 A and no branch rated in excess of 225 A.
    b. Any panel designated as a Lighting and Appliance Panel on Panel Schedules on the drawings that has a main buss rating above 600 A or any branch rated in excess of 225 A.
4. **The specification herein for Electronic Grade Panelboards shall apply to any panelboard serving primarily computers or data-com equipment. Included in this group are all panelboards with Marks that end in the letter "C."**

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

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 overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices, where applicable.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. 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.

B. Panelboard Schedules: For installation in panelboards, after any construction-phase changes.

1.6 CLOSEOUT SUBMITTALS

A. Panelboard Schedules: For record, after any construction-phase changes.

B. 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 overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MATERIALS MAINTENANCE 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. Keys: Two spares for each type of panelboard cabinet lock.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. 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.

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 NEMA PB 1.

E. Comply with NFPA 70.

F. Comply with NFPA 70E, including “ARC-FLASH” warning signs on panels.

1.9 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.

B. Handle and prepare panelboards for installation according to NECA 407 .

1.10 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.
2. Rate equipment for continuous operation under at least the following range of conditions unless otherwise indicated:
    a. Ambient Temperature: From minus 22 deg F (minus 30 deg C) to 104 deg F (40 deg C) indoors or 113 deg F (45 deg C) outdoors.
    b. Altitude: Sea level to 6600 feet (2010 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions:

1. Notify Owner no fewer than seven (7) BUSINESS days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.

3. Comply with NFPA 70E.

1.11 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.

1.12 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warranty nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

B. 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.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Refer to “Panelboard Schedules” and related notes on the drawings. Requirements on the drawings are more specific, and override any lesser requirements herein.

1. Where indicated to be Electronic Grade or Double-Neutral or High Harmonic type, panelboards shall include a 200% rated neutral bar.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

C. Enclosures:

1. Rated for environmental conditions at installed location.

2. Finishes:

a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Galvanized steel.

3. Directory Card: Inside panelboard door, mounted in transparent card holder .

4. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.

D. Panelboard Short-Circuit Current Rating shall be achieved by one of the following:

1. Fully rated to interrupt symmetrical short-circuit current available at terminals.
2. Rated for series-connected system with integral (in same enclosure) overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.
3. **Only where explicitly permitted on the drawings:** Rated for series-connected system with **remote** upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed on the drawings or one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

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 (914 mm) high, provide two latches, keyed alike.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.

1. Exception: I-line type panelboards with bus attachment features that have been tested and demonstrated to remain fastened during faults may plug on to bus and be screw-secured to the panelboard frame.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Special Enclosure Features

1. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

1. Exception: I-line type panelboards with bus attachment features that have been tested and demonstrated to remain fastened during faults may plug on to bus and be screw-secured to the panelboard frame.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Source Limitation: Provide disconnecting and overcurrent devices recommended by the panelboard manufacturer for the application.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity (series or stand-alone as indicated in each case) to meet available fault currents.

1. 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.

2. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

3. Adjustable-trip Circuit Breakers: Adjustable-trip breakers shall be factory set and marked to emulate thermal-magnetic breakers of the specified rating unless otherwise directed.

4. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Standard frame sizes, trip ratings, and number of poles.

b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

d. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407 .

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 NECA 407 .

B. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated. Limit highest switch handle in closed position to no higher than 79” above floor.

C. 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.

D. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

G. 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."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. 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. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, 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 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.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, 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.

o *16*PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 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. Wall-box motion sensors.
5. Isolated-ground receptacles.
6. Hospital-grade receptacles.
7. Snap switches and wall-box dimmers.
8. Solid-state fan speed controls.
9. Wall-switch and exterior occupancy sensors.

B. Related Sections include the following:

1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

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. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.6 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.

1.7 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

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. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; 5351 (single), 5352 (duplex).
b. Hubbell; HBL5351 (single), CR5352 (duplex).
c. Leviton; 5891 (single), 5352 (duplex).
d. Pass & Seymour; 5381 (single), 5352 (duplex).

B. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

    a. Cooper; 8300 (duplex).
    b. Hubbell; HBL8310 (single), HBL8300H (duplex).
    c. Leviton; 8310 (single), 8300 (duplex).
    d. Pass & Seymour; 9301-HG (single), 9300-HG (duplex).

3. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

    a. Cooper; TR8300.
    b. Hubbell; HBL8300SG.
    c. Leviton; 8300-SGG.
    d. Pass & Seymour; 63H.

4. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, [**feed**] [or **non-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. Cooper; GF20.
    b. Pass & Seymour; 2084.

C. Hospital-Grade, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with UL 498 Supplement SD.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper; HGF20.
    b. Hubbell; HGF8300.
    c. Leviton; 6898-HG.
    d. Pass & Seymour; 2091-SHG.

2.4 TVSS RECEPTACLES

A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.

1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 volts and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."

B. Duplex TVSS Convenience Receptacles:

1. Products: Subject to compliance with requirements, provide one of the following:
    a. Cooper; 5362BLS.
    b. Hubbell; HBL5362SA.
    c. Leviton; 5380.
2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.

C. Isolated-Ground, Duplex Convenience Receptacles:
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Cooper; IG5362BLS.
    b. Hubbell; IG5362SA.
    c. Leviton; 5380-IG.
2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

D. Hospital-Grade, Duplex Convenience Receptacles: Comply with UL 498 Supplement SD.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Cooper; 8300BLS.
    b. Hubbell; HBL8362SA.
    c. Leviton; 8380.
2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.

E. Isolated-Ground, Hospital-Grade, Duplex Convenience Receptacles:
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Cooper; IG8300HGBLS.
    b. Hubbell; IG8362SA.
    c. Leviton; 8380-IG.
2. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Comply with UL 498 Supplement SD. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.5 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

A. [**Available**]Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Cooper Crouse-Hinds.
    b. EGS/Appleton Electric.
    c. Killark; a division of Hubbell Inc.

2.6 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; L520R.
b. Hubbell; HBL2310.
c. Leviton; 2310.
d. Pass & Seymour; L520-R.

B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; IG2310.
b. Leviton; 2310-IG.

2. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.7 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.8 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.9 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. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (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).
d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Pilot Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221PL for 120 V and 277 V.
b. Hubbell; HPL1221PL for 120 V and 277 V.
c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
d. Pass & Seymour; PS20AC1-PLR for 120 V.

2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221L.
b. Hubbell; HBL1221L.
c. Leviton; 1221-2L.
d. Pass & Seymour; PS20AC1-L.

2. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995.
b. Hubbell; HBL1557.
c. Leviton; 1257.
d. Pass & Seymour; 1251.

F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995L.
b. Hubbell; HBL1557L.
c. Leviton; 1257L.
d. Pass & Seymour; 1251L.

2.10 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable [**slider**] [or **toggle switch**] [or **rotary knob**]; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.

1. 600 W; dimmers shall require no derating when ganged with other devices. [**Illuminated when "OFF."**]

2. <**Insert other wattage ratings and descriptions.**>

D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.11 FAN SPEED CONTROLS

A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.

1. Continuously adjustable [**slider**] [or **toggle switch**] [or **rotary knob**], [**5 A**] [or **1.5 A**].
2. Three-speed adjustable [**slider**] [or **rotary knob**], 1.5 A.

2.12 OCCUPANCY SENSORS

A. Wall-Switch Sensors:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 6111 for 120 V, 6117 for 277 V.
b. Hubbell; WS1277.
c. Leviton; ODS 10-ID.
d. Pass & Seymour; WS3000.
e. Watt Stopper (The); WS-200.

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

B. Wall-Switch Sensors:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; AT120 for 120 V, AT277 for 277 V.
b. Leviton; ODS 15-ID.

2. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

C. Long-Range Wall-Switch Sensors:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; ATP1600WRP.
b. Leviton; ODWWV-IRW.
c. Pass & Seymour; WA1001.

d. Watt Stopper (The); CX-100.

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

D. 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.

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. (111 sq. m).

E. 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. (111 sq. m).

F. Exterior Occupancy Sensors:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Leviton; PS200-10.
b. Watt Stopper (The); EW-100-120.

2. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot (34-m) detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

2.13 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: If not otherwise directed, assume Type 304 stainless steel with brushed finish. Submit material (stainless steel or high-impact thermoplastic), color and finish options to architect for approval.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Smooth, high-impact thermoplastic .
5. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant , die-cast aluminum or thermoplastic with lockable cover. Must be UL listed as “Raintight While in Use.”

2.14 FLOOR SERVICE FITTINGS

A. Type: Modular, [**flush-type**] [or **flap-type**] [or **above-floor**], dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: [**Rectangular**] [or **Round**], [**die-cast aluminum**] [or **solid brass**] with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: [**Blank cover with bushed cable opening**] [or **Two modular, keyed, color-coded, RJ-45 Category 5e jacks for UTP cable**].

2.15 POKE-THROUGH ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.
2. Pass & Seymour/Legrand; Wiring Devices & Accessories.
3. Square D/ Schneider Electric.
4. Thomas & Betts Corporation.
5. Wiremold Company (The).

B. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.

1. Service Outlet Assembly: [Pedestal type with services indicated] [or Flush type with two simplex receptacles and space for two RJ-45 jacks] [or Flush type with four simplex receptacles and space for four RJ-45 jacks].
2. Size: Selected to fit nominal [**3-inch (75-mm)**] [or **4-inch (100-mm)**] cored holes in floor and matched to floor thickness.
3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
4. Closure Plug: Arranged to close unused [**3-inch (75-mm)**] [or **4-inch (100-mm)**] cored openings and reestablish fire rating of floor.
5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of [**two**] [or **four**], 4-pair, Category 5e voice and data communication cables.

2.16 MULTIOUTLET ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.
2. Wiremold Company (The).

B. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. Raceway Material: [**Metal, with manufacturer's standard finish**] [or **PVC**].

D. Wire: No. 12 AWG.

2.17 SERVICE POLES

A. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.

1. Poles: Nominal 2.5-inch- (65-mm-) square cross section, with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling, and with separate channels for power wiring and voice and data communication cabling.
2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
3. Finishes: [**Manufacturer's standard painted finish and trim combination**] [or **Satin-anodized aluminum**].
4. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, 4-pair, Category 3 or 5 voice and data communication cables.
5. Power Receptacles: Two duplex, 20-A, heavy-duty, NEMA WD 6 configuration 5-20R units.
6. Voice and Data Communication Outlets: [**Blank insert with bushed cable opening**] [or **Two RJ-45 Category 5e jacks**] [or **Four RJ-45 Category 5e jacks**].

2.18 FINISHES

A. Color: Wiring device catalog numbers in the text of this Section do not designate device color.

1. Wiring Devices Connected to Normal Power System: As selected by Architect Match colors of existing similar devices in the area, 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**] [or **As specified above, with orange triangle on face**].

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 ensure 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.
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. Install wiring devices after all wall preparation, including painting, is complete.

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, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. 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 (152 mm) in length.
5. When there is a choice, 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 15- or 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. 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.

F. 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.

G. 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, multigang wall plates.

H. 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.

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.

C. Tests for Special Power Outlets:

1. Applies to all receptacles rated above 120V or above 20A.
2. Ground Impedance (neutral to ground): Values of up to 2 ohms are acceptable.
3. Verify secure mounting.
4. Verify voltage to ground at each pole.
5. Verify circuit number.
6. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 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 and enclosed switches.
2. Spare-fuse cabinets.

1.3 ACTION 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. . (May be supplied in the form of an internet link.)
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. 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. (May be supplied in the form of an internet link.)
4. Coordination charts and tables and related data.

1.5 MATERIALS MAINTENANCE 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. Do not duplicate spare fuses or spare fuse cabinets specified in other Division-26 Sections such as "Enclosed Switches and Circuit Breakers" or "Switchboards."
2. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.6 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.

1.7 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.8 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Bussmann, Inc.

2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

B. Class R and J fuses shall have indicating feature which clearly indicates when the fuse has opened (blown). Indicating feature shall be completely integral with the main fuse body and shall be clearly visible from front of the fuse when installed in equipment. The indicating feature shall be fully compatible with the fuse holder geometry.

C. Class L Fuses

1. Interrupting rating of 200,000 amperes.
2. Ten seconds time delay at 500% rated current

D. Class R or J time-delay fuses

1. Interrupting rating of 200,000 amperes.
2. Overload element of dual element fuses shall open at a temperature less than 300 degrees F., and shall be thermally-reversible to withstand repeated cycling.

E. Class R fuses

1. True dual-element, time delay
2. The means of indication shall completely isolate voltage after operation and be visible when the circuit has been de-energized.

F. 600 volt Class J fuses shall be time delay fuses.

G. 250 volt UL Listed Class R fuses shall be true dual-element, time delay fuses.

2.3 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

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. Schedules on Drawings:

1. Where panelboard, disconnect switch, motor controller or similar schedules on drawings indicate fuse type or class, comply with the schedules. Where not scheduled, select fuses appropriate for the duty as guided by this article.

B. Cartridge Fuses:

1. Service Entrance: Time delay fuses, Class L, Class RK1, or Class J.
2. Feeders: Time delay fuses, Class L, Class RK1, Class RK5, or Class J.
3. Motor Branch Circuits: Time delay fuses, Class RK1, Class RK5, or Class J.
4. Other Branch Circuits: Time delay fuses, Class RK1, Class RK5, or Class J.
5. Control Circuits: Class CC, time delay, unless fast acting fuse is recommended by control system manufacturer.

C. Motor Circuit fuses.

1. General. It is the intent of these specifications that each individual motor branch circuit be protected by the minimum fuse ratings which will permit satisfactory operation of the motor without nuisance openings. Maintaining minimum fuse ratings provides maximum protection to the circuit components and reduces damage during fault conditions. Whenever possible, fuses shall be rated as indicated on drawings. If motor characteristics are such that these ratings are not adequate, fuse ratings shall be increased the minimum necessary to permit satisfactory operation of the motor, but in no case shall the maximum fuse ratings exceed those permitted by the National Electrical Code.
2. Individual motor branch short-circuit and ground fault protection when NEMA motor controllers are used in the circuit:
    a. Motors 440 to 600 volts: Fuses for individual motor branch-circuit protection shall be 600 volt, Class RK1 dual-element indicating fuses.
    b. Motors 240 volts and below: Fuses for individual motor branch-circuit protection shall be 250 volt, Class RK5 dual-element fuses.

3. Individual motor branch short-circuit and ground fault protection when IEC motor controllers are used in the circuit and IEC Type 2 coordination, "no damage protection" is required. IEC controllers require maximum current limitation. Most manufacturers of IEC controllers have published tables specifying the fuse classes and maximum fuse ratings which will offer Type 2 protection for their controllers. These ratings shall not be exceeded. Fuses shall be Class J.

   a. Class J fuses for Type 2 coordination shall be time-delay indicating fuses.

4. Fuses in motor control centers (MCC) containing NEMA motor controllers. Provide time-delay Class RK1 or RK5 fuses in those MCC which will accept Class R fuses. Where MCC manufacturers have standardized on Class J fuses, provide time-delay Class J fuses.

D. Fuses Protecting Molded Case Circuit Breaker Panelboards

1. Fully-rated panelboards: Molded case circuit breaker panelboards having a short-circuit rating equal to or exceeding the available short-circuit current at the point where the panelboard is applied shall be protected with indicating Class RK1 or Class RK5 fuses.
2. Series-rated panelboards: Molded case circuit breaker panelboards having short-circuit ratings less than the available short-circuit current at the point where the panelboard is applied, shall be protected by Class and maximum fuse ratings listed by the panelboard manufacturer for UL series ratings. Whenever possible they shall be time-delay Class RK1 indicating fuses or Class J indicating fuses. Where manufacturers indicate only Class "T" fuses, the fuses shall be as specified by the panelboard manufacturer.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. 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

SECTION 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. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION 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. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. . (May be supplied in the form of an internet link.)

1.5 CLOSEOUT SUBMITTALS

A. 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 overcurrent protective device; include selectable ranges for each type of overcurrent protective device. . (May be supplied in the form of an internet link.)

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent 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, or submit shop drawing for approval of any deviation or re-arrangement.

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.

E. Comply with NFPA 70E, including “ARC-FLASH” warning signs on enclosures.

1.7 PROJECT CONDITIONS

A. Rate equipment for continuous operation under at least the following range of conditions unless otherwise indicated:

1. Ambient Temperature: From minus 22 deg F (minus 30 deg C) to 104 deg F (40 deg C) indoors or 113 deg F (45 deg C) outdoors.
2. Altitude: Sea level to 6600 feet (2010 m).

B. 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 Architect, Construction Manager and/or Owner no fewer than two (2) <Insert number> days in advance of proposed interruption of electric service.

2. Do not proceed with interruption of electric service without written permission from Architect, Construction Manager and/or Owner.
3. Comply with NFPA 70E.

1.8 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.

PART 2 - PRODUCTS

2.1 SAFETY SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. For fusible switches, provide clips or bolt pads to accommodate specified or indicated fuses.

C. Provide switches with features, properties and ratings indicated on the drawings. If not explicitly noted or scheduled, match voltage, amperes, poles, wires to properties of the circuit and load served, and provide enclosure suitable for the environment.

D. Fusible switches are required except where non-fusible switches are explicitly permitted. (Even if the upstream breaker trip rating is equal to or smaller than the switch rating, and even if the breaker fault rating is adequate for the fault at its location, it does not necessarily protect a non-fusible switch in a high-fault event. Further, changing the fuse size at a disconnect switch is typically easier than changing out a circuit breaker if a circuit's overcurrent rating exceeds the maximum overcurrent protection rating of the original or future replacement equipment.)

E. Type HD, Heavy Duty, Single Throw, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

F. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
1. Neutral Kit: Provide if indicated or if circuit served requires a neutral conductor. Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
2. Class R Fuse Kit: Provide for rejection of other fuse types when Class R fuses are specified.
3. Auxiliary Contact Kit: NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Provide quantity required for application.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.

2.2 MOLDED-CASE CIRCUIT BREAKERS

A. Provide breakers with features, properties and ratings indicated on the drawings. If not explicitly noted or scheduled, match voltage, amperes, poles, and wires to properties of the circuit and load served, and provide enclosure suitable for the environment.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

C. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

D. 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.

E. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

F. 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.

G. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

H. 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.

I. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

J. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

K. 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.

2.3 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. Provide enclosure type indicated on the drawing, or if not indicated, provide suitable enclosure under guidance of the following:

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen & Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Cooling Tower Areas: NEMA 250, Type 4X, stainless steel.
5. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
6. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

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 APPLICATIONS

A. Provide enclosed switches and circuit breakers with features and ratings indicated on the drawings and as required to perform the indicated functions. Where features and ratings are not enumerated, provide devices with electrical ratings, poles and wires to match indicated circuit ratings and features. Provide equipment enclosures rated for the environment.

B. Any switching device applied downstream of a variable frequency drive shall be equipped with an auxiliary contact wired to shut down the VFD just before the switch contacts are opened.

C. Any switching or protective device applied downstream of a variable frequency drive shall be suitable for operation at any frequency, voltage and current at which the drive may operate.

3.3 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

- Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.4 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.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

END OF SECTION 262816

SECTION 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 600 V and less:

1. Full-voltage magnetic.

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 200 hp.

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: Overcurrent protective device.

1.4 ACTION 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.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. 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 setting field-adjustable overload relays.

1.7 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.

B. Comply with NFPA 70.

1.8 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.

1.9 PROJECT CONDITIONS

A. Rate equipment for continuous operation under at least the following range of conditions unless otherwise indicated:

1. Ambient Temperature: From minus 22 deg F (minus 30 deg C) to 104 deg F (40 deg C) indoors or 113 deg F (45 deg C) outdoors.
2. Altitude: Sea level to 6600 feet (2010 m).

1.10 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.

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. Magnetic Controllers: Full voltage, across the line, electrically held.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
    c. Rockwell Automation, Inc.; Allen-Bradley brand.
    d. Siemens Energy & Automation, Inc.
    e. Square D; a brand of Schneider Electric.

2. Configuration: Non-reversing.
3. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.

    a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
6. Bimetallic Overload Relays:

    a. Inverse-time-current characteristic.
    b. Tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
    c. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.

7. Solid-State Overload Relay:

    a. Switch or dial selectable for motor running overload protection.
    b. Sensors in each phase.
    c. Tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

8. External overload reset push button.

C. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
    c. Rockwell Automation, Inc.; Allen-Bradley brand.
    d. Siemens Energy & Automation, Inc.
    e. Square D; a brand of Schneider Electric.

2. Fusible Disconnecting Means:

a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class J fuses.
b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

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

2.3 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 type.

a. Pilot Lights: LED types; verify colors with Owner.
b. Selector Switches: Rotary type.

B. Auxiliary contacts: 2 NO, 2 NC or more if specified on drawings.

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. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in each fusible-switch enclosed controller.

D. Install fuses in control circuits if not factory installed. Comply with requirements in Division 26 Section "Fuses."

E. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

F. 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.

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.

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.
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 Engineer and 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. 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.

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.

3.7 PROTECTION

A. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 262913

SECTION 264313 - SURGE PROTECTIVE 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. Section includes field-mounted SPD for low-voltage (120 to 600 V) power distribution and control equipment.

B. Related Sections:

1. Division 26 Section "Switchboards" for factory-installed SPD.
2. Division 26 Section "Panelboards" for factory-installed SPD.
3. Division 26 Section "Wiring Devices" for devices with integral SPD.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. SPD: Surge Protective Device(s), both singular and plural.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For SPD to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.

B. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.

C. Comply with NEMA LS 1.

D. Comply with UL 1449.

E. Comply with NFPA 70.

1.8 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:

B. Notify Owner no fewer than two days in advance of proposed electrical service interruptions.

1. Do not proceed with interruption of electrical service without Owner's written permission.

C. Service Conditions: Rate SPD for continuous operation under the following conditions unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
3. Humidity: 0 to 85 percent, noncondensing.
4. Altitude: Less than 20,000 feet (6090 m) above sea level.

1.9 COORDINATION

A. Coordinate location of field-mounted SPD to allow adequate clearances for maintenance.

1.10 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warranty nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge protective devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SURGE PROTECTIVE DEVICE SCHEDULE

A. Comply with all ratings and requirements in the Surge Protective Device (SPD) Schedule on the drawings.

B. Any deviation from the scheduled requirements must be noted clearly on the submittal and be approved by the Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install SPD at service entrance on load side, with ground lead bonded to service entrance ground.

B. Install SPD 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.

1. Provide multi-pole circuit breaker as a dedicated disconnecting means for SPD unless otherwise indicated.

3.2 DEMONSTRATION

A. Train Owner's maintenance personnel to maintain SPD.

END OF SECTION 264313

SECTION 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. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Building-mounted exterior fixtures, lamps and ballasts
3. Emergency lighting units.
4. Exit signs.
5. Lighting fixture supports.

B. Related Sections:

1. Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION 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, including BF.

4. Energy-efficiency data.

1.5 INFORMATIONAL SUBMITTALS

1. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 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.

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.

1.8 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.

1.9 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warranty nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

B. 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: 10 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 and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURE SCHEDULE

A. Refer to Lighting Fixture Schedule and related notes on the Drawings.

B. Features explicitly specified in the Lighting Fixture Schedule shall be considered more specific and thus override the more general requirements in this Specification Section.

2.2 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.3 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

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 relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. In wet locations, provide aluminum frames with neoprene gasketing between the lens, doorframe, housing and mounting surface.

G. In food preparation areas and where regular wipe-down is required for sanitation, install lenses with the smooth side down and install neoprene gasketing between the lens, doorframe, housing and mounting surface.

H. Diffusers 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. Pattern #12 unless otherwise indicated.

a. Lens Thickness: At least 0.125 inch (3.175 mm) averaged between the thickest and thinnest parts of the lens pattern unless otherwise indicated.

2.4 UV stabilized.

1. Glass: Annealed crystal glass unless otherwise indicated.

B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
f. CCT and CRI for all luminaires.

2.5 LED LIGHT FIXTURE

A. Power supplies must use Constant Current Reduction (CCR) for dimming.

B. See schedule page as indicated on plan.

C. Lamp life of minimum of 60,000 hours or as specified.

D. Fixtures must be supplied with multiple power supplies for multi-level switching when specified.

2.6 EXIT SIGNS

A. General Requirements for Exit Signs: 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, two for each fixture, 20,000 hours of rated lamp life.
2. Lamps for AC Operation: LEDs, 50,000 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 a flashing red LED.

4. Master/Remote Sign Configurations:

2.7 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: 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 15 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 a flashing red LED.

2.8 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.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, gage no less than recommended by fixture manufacturer, and compliant with local code.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, gage no less than recommended by fixture manufacturer, and compliant with local code.

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.9 RETROFIT KITS FOR FLUORESCENT LIGHTING FIXTURES

A. Reflector Kit: UL 1598, Type I. Suitable for two- to four-lamp, surface-mounted or recessed lighting fixtures by improving reflectivity of fixture surfaces.

B. Ballast and Lamp Change Kit: UL 1598, Type II. Suitable for changing existing ballast, lamps, and sockets.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) 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 (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least two (2) independent support rods or wires from structure to a tab on lighting fixture. Wires or rods shall have breaking strength of the weight of fixture at a safety factor of 3.

E. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), 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.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.
5. For heavy or multi-part pendant fixtures such as high-bay HID luminaires, provide a chain, cable or manufactured accessory to provide supplemental safety support for every separable component of the fixture.

F. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

G. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 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.

B. 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.

3.4 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting luminaires and control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.

1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 265100

SECTION 265600 - EXTERIOR 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. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.

B. Related Sections:

1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. HID: High-intensity discharge.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

F. Pole: Luminaire support structure, including tower used for large area illumination.

G. Standard: Same definition as "Pole" above.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.

C. Ice Load: Applied as stated in AASHTO LTS-4-M Ice Load Map.

D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M. Use windspeed data for the project site and inportance criteria obtained from the Architect, Owner and/or local code authorities.

1.5 ACTION SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
6. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by one of the following:
    a. Manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
    b. 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. Photoelectric relays.
8. Ballasts, including energy-efficiency data.
9. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
10. Materials, dimensions, and finishes of poles.
11. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
12. Anchor bolts for poles.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.6 INFORMATIONAL SUBMITTALS

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.

B. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

1.8 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.

B. 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.

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 IEEE C2, "National Electrical Safety Code."

E. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch (6 mm) deep. Do not apply tools to section of pole to be installed below ground line.

D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.

E. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.10 WARRANTY

A. General Warranty: The contractor shall warrant all materials and workmanship for one year following the date of substantial completion. Neither this warranty nor any special warranty specified in this Article shall deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents or local laws, and shall be in addition to, and run concurrently with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain,

perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURE SCHEDULE

A. Refer to Lighting Fixture Schedule and related notes on the Drawings.

B. Features explicitly specified in the Lighting Fixture Schedule shall be considered more specific and thus override the more general requirements in this Specification Seciton.

2.2 MANUFACTURERS

A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.3 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

1. LER Tests Fluorescent Fixtures: Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
2. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during

relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. 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.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

    a. Color: As selected by Architect from manufacturer's standard catalog of colors.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

    a. "USES ONLY" and include specific lamp type.

b. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
d. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.
e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
f. CCT and CRI for all luminaires.

2.4 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens or aperature in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with ANSI C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.5 FLUORESCENT BALLASTS AND LAMPS

A. Ballasts for Low-Temperature Environments:

1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.

B. Ballast Characteristics:

1. Power Factor: 90 percent, minimum.
2. Sound Rating: Class A.
3. Total Harmonic Distortion Rating: Less than 10 percent.
4. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.
5. Transient-Voltage Protection: Comply with IEEE C62.41.1 and IEEE C62.41.2, Category A or better.

C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures 0 deg F (minus 18 deg C) and higher.

2.6 BALLASTS FOR HID LAMPS

A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. 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 (Minus 30 deg C).
3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).

B. Auxiliary, Instant-On, Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent of light output.

C. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. 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-Restrike 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. Restrike 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 (Minus 40 deg C).

2.7 HID LAMPS

B. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 65, and CCT color temperature 4000 K.

C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and CCT color temperature 4000 K.

D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and CCT color temperature 4000 K.

2.8 LED LAMPS

A. See plan.

2.9 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Each pole for lighting fixture support shall be selected for the Effective Projected Area (EPA) of the service platform, arms and fixtures to be supported, and of the pole itself. Weight, center of gravity and any stresses from lowering of the fixtures or hinging of the pole shall be accommodated.

B. Pole manufacturer shall supply complete loading information and pole base information for design of the structural support base, footing, piling or such. Poles shall be equipped with hand holes, grounding lugs, bases, bolt covers, anchor bolts, setting templates and such accessories as are required for complete readiness of the pole for use.

C. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.

D. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

E. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

F. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

G. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws. Provide on all, except wood poles.

H. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

2.10 LIGHT POLE AND ACCESSORY FEATURES

A. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

B. Intermediate Handhole and Cable Support: Weathertight, 3-by-5-inch (76-by-127-mm) handhole located at midpoint of pole with cover for access to internal welded attachment lug for electric cable support grip.

C. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

D. Platform for Lamp and Ballast Servicing: Factory fabricated of steel with finish matching that of pole.

E. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

F. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.

G. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

H. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind

welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."

2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

2.11 DECORATIVE POLES

A. Pole Material:

1. Cast ductile iron.
2. Cast gray iron, according to ASTM A 48/A 48M, Class 30.
3. Cast aluminum.
4. Cast concrete.
5. Spun concrete.
6. Steel tube, covered with closed-cell polyurethane foam, with a polyethylene exterior.

B. Mounting Provisions:

1. Bolted to concrete foundation.
2. Embedded.

C. Fixture Brackets:

1. Cast ductile iron.
2. Cast gray iron.
3. Cast aluminum.

D. Pole Finish.

2.12 PRESTRESSED CONCRETE POLES

A. Poles: Manufactured

1. Shape: [Round, tapered] [or Round, straight] [or Square, tapered] [or Square, straight].
2. Mounting Provisions: [Steel butt flange for bolted mounting to foundation or breakaway support] [or Embedded].
3. Finishing: Capped at top and plugged at bottom. Seat each steel reinforcing strand with epoxy adhesive.
4. Grounding: Continuous copper ground wire cast into pole. Terminate at top of pole[and attach to 24-inch (610-mm) lightning rod].

B. Cure with wet steam and age for a minimum of 15 days before installation.

C. Fabricate poles with a hard, nonporous surface that is resistant to water, frost, and road and soil chemicals and that has a maximum water-absorption rate of 3 percent.

D. Cast aluminum nameplate into pole wall at approximately 5 feet (1.5 m) above ground line, listing name of manufacturer, Project identifier, overall height, and approximate weight.

E. Pole Brackets: Comply with ANSI C136.13.

F. Finish Color: Provided by color material complying with ASTM C 979, uniformly impregnated throughout the pole concrete. Color material shall provide a uniform, stable, permanent <**Insert adjectives**> color and be as follows:

1. Inert, and carbon free.
2. Unaffected by environmental conditions and contaminants including, but not limited to, UV solar radiation, salts, and alkalis.

G. Finish Texture: [Standard form] [or Polished exposed aggregate] [or Etched exposed aggregate].

1. Exposed aggregate shall be of <Insert aggregate type selected from manufacturers' lists> type.

2.13 POLE ACCESSORIES

A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Division 26 Section "Wiring Devices" for ground-fault circuit-interrupter type.

1. [Surface mounted] [or Recessed], [**12 inches (300 mm)**] above finished grade.
2. Nonmetallic polycarbonate plastic or reinforced fiberglass, weatherproof in use, cover, that when mounted results in NEMA 250, [Type 3R] [or Type 4X] enclosure.
3. With cord opening.
4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.

B. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings and/or approved by Architect:

1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).

3. Trees: 15 feet (5 m) from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
2. Install base covers unless otherwise indicated.
3. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Make holes 6 inches (150 mm) in diameter larger than pole diameter.
2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.
3. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
4. Cure concrete a minimum of 72 hours before performing work on pole.

F. Raise and set poles using web fabric slings (not chain or cable).

3.3 BOLLARD LUMINAIRE INSTALLATION

A. Align units for optimum directional alignment of light distribution.

B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

3.4 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

A. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

3.5 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.6 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Install grounding conductor and conductor protector.
3. Ground metallic components of pole accessories and foundations.

3.7 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):

a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting Installations."
b. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
c. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
d. IESNA LM-64, "Photometric Measurements of Parking Areas."
e. IESNA LM-72, "Directional Positioning of Photometric Data."

D. 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.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices.

END OF SECTION 265600

SECTION 267100 - ROOF-RELATED ELECTRICAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. These specifications include all labor, materials, equipment and related items required to disconnect and re-connect all equipment, electrical relocations as required to accommodate proper roof flashings, and to complete the Work within the intent of the Drawings and Specifications, whether or not specifically mentioned or shown therein. For this reason, the Contractor shall visit the site and familiarize himself with the areas in which Work is to be done before submitting his bid.

B. Electrical Work necessary for this project includes but is not limited to the resetting of conduit for building and HVAC units, removal of unused conduits, the disconnecting and reconnecting of electrical supply to HVAC and other mechanical units scheduled to receive new or modified curbs, etc., all in accordance with one another and necessary to achieve proper flashing heights and details. Where required for compliance with applicable codes and local amendments, Contractor shall provide disconnect switches and weatherproof, GFCI protected maintenance receptacles per NEC on separately mounted galvanized steel support racks for roof mounted HVAC equipment. Where required for compliance with applicable codes and local amendments, provide disconnect switches and weatherproof, GFCI-protected racks for roof-mounted HVAC equipment.

C. Modifications to existing communications cables (fiber optic and copper) will be accomplished by the Owner. No disruption may occur in these lines without minimum 72-hour written notice to the Architect and Owner and granting of approval.

D. Set all sleeves and cut and patch all miscellaneous holes necessary for the convenient and proper installation of the Work as applicable. Required holes through existing masonry construction with an area of less than 35 square inches shall be considered miscellaneous holes.

E. Any Work installed without regard to the Work of other crafts which must, in the opinion of the Architect, be moved to permit the installation of other Work, shall be moved and replaced as part of this Work without extra charge.

F. Removed conduits shall have all associated wire and cables taken back to associated circuit breaker, fuse box or other such junction so as to allow for complete removal with no exceptions taken with regards to safety or code requirements.

G. All Work shall be accomplished within the scheduled times indicated in Section 237100, Article 1.08.

H. Contractor shall follow and be responsible for all necessary contract closeouts, hoisting, caulking and sealants, hangers and related items pertaining to this contract.

1.2 RELATED REQUIREMENTS

General Conditions, Supplementary General Conditions, Forms, Specification Sections found in Division 01 through Division 16, and all Drawings apply to Work specified in this Section.

1.3 RELATED SECTIONS

A. Section 077200 - Roof Accessories

PART 2 - PRODUCTS

2.1 MATERIALS

A. Where mechanical items must be disconnected and re-connected as necessary by the re-roofing of the specified areas at these facilities, all wires, conduits, panels, motor starters, raceways, switches, stations, etc., shall be replaced or renewed to match existing if damaged, cut or needing extension, etc. All materials shall meet the minimum standards of the National Electrical Code; latest edition adopted by the Bastrop county.

B. Prior to installation, coordinate all necessary Work with associated trades and Owner.

PART 3 - EXECUTION

3.1 PERFORMANCE

Work shall be performed by a qualified electrical contractor, licensed to do Work in the city or county. All workmanship shall be in compliance with all code requirements and shall be inspected as required by all governing authorities. All Work shall meet the minimum standards of the latest edition of the National Electrical Code and locally adopted amendments.

3.2 SCHEDULING

A. All Work necessary shall be in compliance with Owner's requests for proper scheduling so that the least amount of interference with daily production and school duties is required.

B. Work requiring the disconnection or re-connection of any electrical or communication line(s) must be coordinated through the Architect with a minimum of 72-hours written notice.

C. All electrical disconnects shall be accomplished during periods when the building will not be disrupted by power outages.

END OF SECTION 267100