



JEFFERSON COUNTY PURCHASING DEPARTMENT
Deborah L. Clark, Purchasing Agent

1149 Pearl Street, 1st Floor, Beaumont, TX 77701 409-835-8593 Fax 409-835-8456

LEGAL NOTICE

Advertisement for Invitation for Bids

May 23, 2023

Notice is hereby given that sealed bids will be accepted by the Jefferson County Purchasing Department for Invitation for Bid (IFB 23-035/JW) Crane Bayou Pump Station Generators and Building – Community Development Block Grant-Disaster Recovery (CDBG-DR) Program Project for Jefferson County (GLO Contract No. 20-065-121-C408). Specifications for this project may be obtained from the Jefferson County website, <https://www.co.jefferson.tx.us/Purchasing/> or by calling 409-835-8593.

Bids are to be sealed and addressed to the Purchasing Agent with the bid number and name marked on the outside of the envelope or box. Bidders shall forward an original and two (2) copies of their bid to the address shown below. Jefferson County does not accept bids submitted electronically. Late bids will be rejected as non-responsive. Bids will be publicly opened and read aloud in the Jefferson County Engineering Department Conference Room (5th Floor, Historic Courthouse) 1149 Pearl Street, Beaumont, Texas 77701, at the time and date below. Bidders are invited to attend the sealed bid opening.

BID NAME: Crane Bayou Pump Station Generators and Building -
 Community Development Block Grant-Disaster Recovery (CDBG-DR) Program Project
 for Jefferson County

BID NUMBER: IFB 23-035/JW

DUE BY TIME/DATE: 11:00 AM CT, Wednesday, June 21, 2023

MAIL OR DELIVER TO: Jefferson County Purchasing Department
 1149 Pearl Street, 1st Floor
 Beaumont, Texas 77701

There will be a **Pre-Bid Conference** at **2:00 PM CT on Tuesday, June 6, 2023**, at the Jefferson County Engineer Department Conference Room (5th Floor, Historic Courthouse) 1149 Pearl Street, Beaumont, Texas 77701.

The County shall require the bidder to furnish a bid security in the amount of five percent (5%) of the total contract cost. The bid bond must be executed with a surety company authorized to do business in the State of Texas. Within ten (10) days after the date of the signing of a contract, the bidder shall furnish a performance bond to the County for the full amount of the contract, if the contract exceeds one hundred thousand dollars (\$100,000). If the contract is for one hundred thousand dollars (\$100,000) or less, the County may provide that no money be paid to the contractor until completion and acceptance of the work or the fulfillment of the purchase obligation to the County.

Any questions relating to these bid requirements should be directed to Jamey West, Contract Specialist at 409-835-8593 or via email at: Jamey.West@jeffcotx.us

Jefferson County encourages Disadvantaged Business Enterprises (DBEs), Minority/Women Business Enterprises (M/WBEs), and Historically Underutilized Businesses (HUBs) to participate in the bidding process. Jefferson County does not discriminate on the basis of race, color, national origin, sex, religion, age or disability in employment, or the provisions of services. Individuals requiring special accommodations are requested to contact our office at least seven (7) days prior to the bid due date at 409-835-8593.

All interested firms are invited to submit a bid in accordance with the terms and conditions stated in this bid.

Bidders are strongly encouraged to carefully read the entire invitation, as failure to return and/or complete all required documentation will result in a response being declared as non-responsive.

Deborah L. Clark, Purchasing Agent
 Jefferson County, Texas

PUBLISH:
Beaumont Enterprise & Port Arthur News:
 MAY 24, 2023 AND MAY 31, 2023
The Examiner:
 MAY 25, 2023

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BID SUBMISSIONS:

One (1) Original and Two (2) Bid Copies; with all copies to include a Completed Copy of this specifications packet (including technical specifications), in its entirety.

Each Bidder shall ensure that required parts of their bid submission are completed with accuracy and submitted as per the requirements within this specifications packet, including any addenda.

Additionally, Bidder shall monitor the Jefferson County Purchasing Department Website for any addenda, additional instructions, or bid updates. <https://www.co.jefferson.tx.us/Purchasing/>

Failure to return and/or complete all required documentation will result in a response being declared as non-responsive.

SECTION 1: GENERAL CONDITIONS OF BIDDING AND TERMS OF CONTRACT

By execution of this document, the Vendor accepts all general and special conditions of the contract as outlined below and, in the specifications, and plans.

1. BIDDING.

1.1 BIDS.

All bids must be submitted on the bid form furnished in this package.

1.2 AUTHORIZED SIGNATURES.

The bid must be executed personally by the Vendor, duly authorized partner of the partnership, or duly authorized officer of the corporation. If executed by an agent, a power of attorney or other evidence of authority to act on behalf of the Vendor shall accompany the bid to become a valid bid.

1.3 LATE BIDS.

Bids must be in the office of the Jefferson County Purchasing Agent before or at the specified time and date bids are due. Bids received after the submission deadline shall be rejected as non-responsive and returned unopened.

1.4 WITHDRAWAL OF BID PRIOR TO OPENING.

A bid may be withdrawn before the opening date by submitting a written request to the Purchasing Agent. If time allows, the Bidder may submit a new bid. Bidder assumes full responsibility for submitting a new bid before or at the specified time and date bids are due. Jefferson County reserves the right to withdraw a request for bids before the opening date.

1.5 WITHDRAWAL OF BID AFTER OPENING.

Bidder agrees that its offer may not be withdrawn or cancelled by the Vendor for a period of ninety (90) days following the date and time designated for the receipt of bids unless otherwise stated in the bid and/or specifications.

1.6 BID AMOUNTS.

Bids shall show net prices, extensions where applicable and net total. In case of conflict between unit price and extension, the unit price will govern. Any ambiguity in the bid as a result of omission, error, unintelligible or illegible wording shall be interpreted in the favor of Jefferson County.

1.7 EXCEPTIONS AND/OR SUBSTITUTIONS.

All bids meeting the intent of the specifications and plans will be considered for award. Vendors taking exception to the specifications and plans, or offering substitutions, shall state these exceptions in the section provided. If bid is made on an article other than the one specified, which a Bidder considers comparable, the name and grade of said article must be specified in the bid and sufficient specifications and descriptive data must accompany same to permit thorough evaluation. The absence of stated exceptions and/or substitutions shall indicate that the Vendor has not taken any exceptions to the specifications and shall be responsible to perform in strict accordance with the specifications. As a matter of practice, Jefferson County rejects exception(s) and /or substitutions as non-responsive but reserves the right to accept any and/or all of the exception(s) and/or substitution(s) deemed to be in the best interest of Jefferson County.

1.8 ALTERNATES.

The Invitation for Bid and/or specifications may expressly allow Bidder to submit an alternate bid. Presence of such an offer shall not be considered an indication of non-responsiveness.

1.9 DESCRIPTIONS.

Unless otherwise specified, any reference to make, manufacturer and/or model used in the bid specifications is merely descriptive and not restrictive, and is used only to indicate type, style, or quality of material desired.

1.10 BID ALTERATIONS.

Bids cannot be altered or amended after submission deadline. Any interlineations, alterations, or erasures made before opening time must be initialed by the signer of the bid, guaranteeing authenticity.

1.11 TAX EXEMPT STATUS.

Jefferson County is exempt from federal excise tax and state sales tax. Unless the bid form or specifications specifically indicate otherwise, the bid price must be net, exclusive of above-mentioned taxes and will be so construed. Therefore, the bid price shall not include taxes.

1.12 QUANTITIES.

Quantities indicated are estimated quantities only and are not a commitment to buy. Approximate usage does not constitute an order, but only implies the probable quantity that will be used. Commodities will be ordered on an as-needed basis. Bidder is responsible for accurate final counts.

1.13 BID AWARD.

Award of contract shall be made to the most responsible, responsive Bidder, whose offer is determined to be the best value, taking into consideration the relative importance of price. Jefferson County reserves the right to be the sole judge as to whether items bid will serve the purpose intended.

Jefferson County reserves the right to award based upon individual line items, sections or total bid.

1.14 SILENCE OF SPECIFICATIONS FOR COMPLETE UNITS.

All materials, equipment and/or parts that will become a portion of the completed work, including items not specifically stated herein but, necessary to render the service(s) complete and operational per the specifications, are to be included in the bid price. Vendor may be required to furnish evidence that the service, as bid, will meet or exceed these requirements.

1.15 ADDENDA.

Any interpretations, corrections or changes to the specifications and plans will be made by addenda no later than forty-eight (48) hours prior to the bid opening. Addenda will be posted on the Purchasing web site. Vendors are responsible for monitoring the web site in order to remain informed on addenda. Vendors shall acknowledge receipt of all addenda with submission of bid.

1.16 GENERAL BID BOND/SURETY REQUIREMENTS.

Failure to furnish bid bond/surety, if requested, will result in bid being declared non-responsive. Non-responsive bids will not be considered for award.

1.17 GENERAL INSURANCE REQUIREMENTS.

Failure to furnish Affidavit of Insurance, if required in these specifications, will result in bid being declared non-responsive. Non-responsive bids will not be considered for award.

1.18 RESPONSIVENESS.

A responsive bid shall substantially conform to the requirements of this Invitation to Bid and/or specifications contained herein. Bidders who substitute any other terms, conditions, specifications and/or requirements or who qualify their bids in such a manner as to nullify or limit their liability to the contracting entity shall have their bids deemed non-responsive. Also, bids containing any clause that would limit contracting authority shall be considered non-responsive. Examples of non-responsive bids include but shall not be limited to: a) bids that fail to conform to required delivery schedules as set forth in the bid request; b) bids with prices qualified in such a manner that the bid price cannot be determined, such as with vague wording that may include "price in effect at the time of delivery," and c) bids made contingent upon award of other bids currently under consideration.

1.19 RESPONSIBLE STANDING OF BIDDER.

To be considered for award, Bidder must at least: have the ability to obtain adequate financial resources, be able to comply with required or proposed delivery/completion schedule, have a satisfactory record of performance; have a satisfactory record of integrity and ethics, and be otherwise qualified and eligible to receive award.

1.20 CONFIDENTIAL/PROPRIETARY INFORMATION.

If any material in the bid submission is considered by Bidder to be confidential or proprietary information (including manufacturing and/or design processes exclusive to the Bidder), Bidder **must** clearly mark the applicable pages of bid submission to indicate each claim of confidentiality. Additionally, Bidder must include a statement on company letterhead identifying all Bid Submission section(s) and page(s) that have been marked as confidential. Jefferson County will protect from public disclosure such portions of a bid, unless directed otherwise by legal authority, including existing open records acts. Merely making a blanket claim that the entire bid submission is protected from disclosure because it contains some proprietary information is not acceptable, and will make the entire bid submission subject to release under the Texas Public Information Act.

By submitting a bid, Bidder agrees to reproduction by Jefferson County, without cost or liability, of any copyrighted portions of Bidder's bid submission or other information submitted by Bidder.

1.21 PUBLIC BID OPENING.

Bidders are invited to be present at the opening of bids. After the official opening of bids, a period of not less than one week is necessary to evaluate bids. The amount of time necessary for bid evaluation may vary and is determined solely by the County. Following the bid evaluation, all bids submitted are available for public review.

2. PERFORMANCE.

2.1 DESIGN, STRENGTH, AND QUALITY.

Design, strength, and quality of materials and workmanship must conform to the highest standards of manufacturing and engineering practices. The apparent silence of specifications and/or plans as to any detailed description concerning any point shall be regarded as meaning that only the best commercial practices are to prevail. All interpretations of these specifications and/or plans shall be made on the basis of this statement.

2.2 AGE AND MANUFACTURE.

All tangible goods being bid must be new and unused, unless otherwise specified, in first-class condition, of current manufacture, and furnished ready to use. All items not specifically mentioned that are required for a complete unit shall be furnished.

2.3 DELIVERY LOCATION.

All deliveries will be made to the address(es) specified on the purchase order during normal office working hours of 8:00 am CT to 4:00 pm CT, Monday through Friday, unless otherwise authorized by the Purchasing Agent or designee.

2.4 DELIVERY SCHEDULE.

Delivery time may be an important consideration in the evaluation of best value. The maximum number of days necessary for delivery ARO shall be stated in the space, if provided, on the bid form.

2.5 DELIVERY CHARGES.

All delivery and freight charges, F.O.B. destination shown on Jefferson County purchase order, as necessary to perform contract are to be included in the bid price.

2.6 INSTALLATION CHARGES.

All charges for assembly, installation and set-up shall be included in the bid price. Unless otherwise stated, assembly,

installation and set-up will be required.

2.7 OPERATING INSTRUCTIONS AND TRAINING.

Clear and concise operating instructions and descriptive literature will be provided in English, if requested. On-site detailed training in the safe and efficient use and general maintenance of item(s) purchased shall be provided as needed at the request of Jefferson County. Instructions and training shall be at no additional cost to the County.

2.8 STORAGE.

Bidder agrees to provide storage of custom ordered materials, if requested, for up to thirty (30) calendar days.

2.9 COMPLIANCE WITH FEDERAL, STATE, COUNTY, AND LOCAL LAWS.

Bids must comply with all federal, state, county and local laws, including, but not limited to, all applicable standard safety, emission, and noise control requirements. Any vehicles or equipment shall contain all standard safety, emission, and noise control requirements required for the types and sizes of equipment at the time of their manufacture. The contractor agrees, during the performance of work or service, to comply with all applicable codes and ordinances of Jefferson County or the State of Texas as they may apply, as these laws may now read, or as they may hereafter be changed or amended.

2.10 OSHA.

The Bidder will certify all equipment complies with all regulations and conditions stipulated under the Williams-Steiger Occupational Safety and Health Act of 1971, as amended. The successful Bidder will further certify that all items furnished under this project will conform and comply with federal and State of Texas OSHA standards. The successful Bidder will agree to indemnify and hold harmless Jefferson County for any and all damages that may be assessed against the County.

2.11 PATENTS AND COPYRIGHTS.

The successful Vendor agrees to protect the County from claims involving infringements of patents and/or copyrights.

2.12 SAMPLES, DEMONSTRATIONS, AND TESTING.

At Jefferson County's request and direction, Bidder shall provide product samples and/or testing of items bid to ensure compliance with specifications. Samples, demonstrations and/or testing may be requested at any point prior to or following bid award. Samples, demonstrations and/or testing may be requested upon delivery and/or any point during the term of resulting contract. All samples (including return thereof), demonstrations, and/or testing shall be at the expense of the Bidder/Vendor.

2.13 ACCEPTABILITY.

All articles enumerated in the bid shall be subject to inspection by an officer designated for that purpose by Jefferson County. If found inferior to the quality called for, or not equal in value to the specifications, deficient in workmanship or otherwise, this fact shall be certified to the Purchasing Agent, who shall have the right to reject the whole or any part of the same. Items and/or work determined to be contrary to specifications must be replaced at the vendor's expense. Inferior items not retrieved by the vendor within thirty (30) calendar days, or an otherwise agreed upon time, shall become the property of the County. If disposal of such items warrants an expense, an amount equal to the disposal expense will be deducted from amounts payable to the vendor.

2.14 MAINTENANCE.

Maintenance required for equipment bid should be available in Jefferson County by a manufacturer authorized maintenance facility. Cost for this service shall be shown on the bid sheet as requested or on a separate sheet, as required. If Jefferson County opts to include maintenance, it shall be so stated in the purchase order and said cost will be included. Service will commence only upon expiration of applicable warranties and should be priced accordingly.

2.15 MATERIAL SAFETY DATA SHEETS.

Under the "Hazardous Communications Act," common known as the "Texas Right to Know Act," a Bidder must provide the user department, with each delivery, material safety data sheets which are applicable to hazardous substances defined in the Act. Failure of the Bidder to furnish this documentation, will be cause to reject any bid applying thereto.

2.16 EVALUATION.

Evaluation shall be used as a determinant as to which services are the most efficient and/or most economical for the County. It shall be based on all factors having a bearing on price and performance of the items in the user environment. All bids are subject to tabulation by the Jefferson County Purchasing Department and recommendation to Jefferson County Commissioners' Court. Compliance with all bid requirements and needs of the using department are considered in evaluating bids. Pricing is not the only criteria for making a recommendation. The Jefferson County Purchasing Department reserves the right to contact any Bidder, at any time, to clarify, verify or requirement information with regard to this bid.

3. PURCHASE ORDERS AND PAYMENT.

3.1 PURCHASE ORDERS.

A purchase order(s) shall be generated by the Jefferson County Purchasing Agent to the successful vendor. The purchase order number must appear on all itemized invoices and packing slips. The County will not be held responsible for any work orders placed and/or performed without a valid current purchase order number. Payment will be made for all services rendered and accepted by the contract administrator for which a valid invoice has been received.

3.2 INVOICES.

All invoices shall reference the Purchase Order number. Invoices shall reference the bid item number or a detailed description for each item invoiced. If an item purchased and itemized on the invoice does not correspond to an item in any of the categories awarded to the vendor, invoice shall reference the item as "N/C" to indicate that it is a non-contract item. This requirement is to assist the County in verifying contract pricing on all invoices. Payment will be made under terms of net thirty (30) days unless otherwise agreed upon by seller and the purchasing department.

3.3 PROMPT PAYMENT.

In accordance with the State of Texas Prompt Payment Act, Article 601f V.T.C.S., payment will be made after receive and acceptance by the County of the merchandise ordered and of a valid invoice. Successful Bidder(s) is required to pay subcontractors within ten (10) days after the successful Bidder receives payment from the County.

3.4 FUNDING.

Jefferson County is operated and funded on an October 1 to September 30 basis; accordingly, the County reserves the right to terminate, without liability to the County, any contract for which funding is not available.

4. CONTRACT.

4.1 CONTRACT DEFINITION.

The General Conditions of Bidding and Terms of Contract, Specifications, Plans, Bidding Forms, Addenda, and any other documents made a part of this bid shall constitute the complete bid. This bid, when duly accepted by Jefferson County, shall constitute a contract equally binding between the successful Bidder and Jefferson County.

4.2 CHANGE ORDER.

No different or additional terms will become part of this contract with the exception of a change order. No oral statement of any person shall modify or otherwise change, or affect the terms, conditions or specifications stated in the resulting contract. All change orders to the contract will be made in writing and at the discretion and approval of Jefferson County. No change order will be binding unless signed by an authorized representative of the County and the vendor.

4.3 PRICE RE-DETERMINATION.

A price re-determination may be requested at the time of annual renewal. All requests for price re-determination shall be in written form. Cause for such request, i.e., manufacturer's direct cost, postage rates, Railroad Commission rates, Federal/State minimum wage law, Federal/State unemployment taxes, F.I.C.A, Insurance Coverage Rates, etc., shall be substantiated in writing by the source of the cost increase. The Bidder's past experience of honoring contracts at the bid price will be an important consideration in the evaluation of the lowest and best bid. Jefferson County reserves the right to accept or reject any/all requests for price re-determination as it deems to be in the best interest of the County.

4.4 TERMINATION.

Jefferson County reserves the right to terminate the contract for default if the Bidder breached any of the terms therein, including warranties of Bidder or if the Bidder becomes insolvent or commits acts of bankruptcy. Such right of termination is in addition to and not in lieu of any other remedies which Jefferson County may have in law or equity. Default may be construed as, but not limited to, failure to deliver the proper goods and/or service within the proper amount of time, and/or to properly perform any and all services required to Jefferson County's satisfaction and/or to meet all other obligations and requirements. Contracts may be terminated without cause upon thirty (30) days' written notice to either party unless otherwise specified. Jefferson County reserves the right to award canceled contract to the next lowest Bidder. Bidder, in submitting this bid, agrees that Jefferson County shall not be liable to prosecution for damages in the event that the County declares the Bidder in default.

4.5 CONFLICT OF INTEREST.

Employees of the County are not permitted to maintain financial interest in, or receive payment, directly or indirectly, borrow from, lend to, invest in, or engage in any substantial financial transaction with any individual, organization, supplier, or subcontractor who does business with the County without disclosure. When conflict of interest is discovered, it shall be grounds for termination of contract.

4.6 INTEREST BY PUBLIC OFFICIALS.

No public official shall have interest in this contract, in accordance with Texas Local Government Code.

4.7 PRE-AWARD/CONTRACT CONTACT BETWEEN COUNTY AND VENDORS.

The Jefferson County Purchasing Department may initiate discussions with selected vendors; however, discussions may not be initiated by vendors.

The Jefferson County Purchasing Department expects to conduct discussions with vendor's representatives authorized to contractually obligate the vendor with an offer. **Vendors shall not contact any Jefferson County personnel during the IFB process without the express permission from the Jefferson County Purchasing Agent. The Purchasing Agent will disqualify any vendor who has made site visits, contacted Jefferson County personnel, or distributed any literature without authorization from the Jefferson County Purchasing Department.**

All correspondence relating to this IFB, from advertisement to award shall be sent to the Jefferson County Purchasing Department. All presentations and/or meetings between Jefferson County and the vendor relating to this IFB shall be coordinated by the Jefferson County Purchasing Department.

Selected vendors may be expected to make a presentation/product demonstration to an Evaluation Committee. Proposals, vendor presentations, and product/service evaluations may develop into negotiating sessions with the vendor(s) as selected by the Evaluation Committee. Jefferson County expects to conduct negotiations with vendor representatives authorized to contractually obligate the vendor with an offer. If vendor is unable to agree to contract terms and conditions, Jefferson County reserves the right to terminate contract negotiations with that vendor and initiate negotiations with another vendor. In addition to a presentation, visits by the Evaluation Committee to representative vendor client sites may be conducted where the proposed solution can be demonstrated in a production environment.

4.8 INJURIES OR DAMAGES RESULTING FROM NEGLIGENCE.

Successful vendor shall defend, indemnify and save harmless Jefferson County and all its officers, agents and employees from all suits, actions, or other claims of any character, name and description brought for or on account of any injuries or damages received or sustained by any person, persons, or property on account of any negligent act or fault of the successful vendor, or of any agent, employee, subcontractor or supplier in the execution of, or performance under, any contract which may result from bid award. Successful vendor shall pay any judgment with cost which may be obtained against Jefferson County growing out of such injury or damages.

4.9 WARRANTY.

The successful vendor shall warrant that all materials utilized in the performance of this contract shall conform to the proposed specifications and/or all warranties as stated in the Uniform Commercial Code and be free from all defects in material, workmanship and title.

4.10 UNIFORM COMMERCIAL CODE.

The successful vendor and Jefferson County agree that both parties have all rights, duties, and remedies available as stated in the Uniform Commercial Code.

4.11 VENUE.

This agreement will be governed and construed according to the laws of the State of Texas. This agreement is performable in the County of Jefferson, Texas.

4.12 SALE, ASSIGNMENT, OR TRANSFER OF CONTRACT.

The successful vendor shall not sell, assign, transfer or convey this contract, in whole or in part, without the prior written consent of Jefferson County.

4.13 SILENCE OF SPECIFICATIONS.

The apparent silence of these specifications as to any detailed description concerning any point, shall be regarded as meaning that only the best commercial practices are to prevail. All interpretations of these specifications shall be made on the basis of this statement.

5. REJECTION OR WITHDRAWAL.

Submission of additional terms, conditions or agreements with the bid document are grounds for deeming a bid non-responsive and may result in bid rejection. Jefferson County reserves the right to reject any and all bids and to waive any informalities and minor irregularities or defects in bids. Bids may be withdrawn in person by a bidder or authorized representative, provided their identity is made known and a receipt is signed for the bid, but only if the withdrawal is made prior to the time set for receipt of bids. Bids are an irrevocable offer and may not be withdrawn within 90 days after opening date.

6. EMERGENCY/DECLARED DISASTER REQUIREMENTS.

In the event of an emergency or if Jefferson County is declared a disaster area, by the County, State, or Federal Government, this Acceptance of Offer may be subjected to unusual usage. Contractor shall service the county during such an emergency or declared disaster under the same terms and conditions that apply during non-emergency/disaster conditions. The pricing as specified in this Acceptance of Offer shall apply to serving the County's needs regardless of the circumstances. If Contractor is unable to supply the services under the terms of the Acceptance of Offer, then Contractor shall provide proof of such disruption and a copy of the invoice from Contractor's supplier(s).

Additional profit margin as a result of supplying services during an emergency or declared disaster shall not be permitted. In the event that additional equipment, supplies, and materials are required during the declared disaster, additional shipping, handling and drayage fees may apply.

7. AWARD.

The bid will be awarded to the responsible, responsive bidder(s) whose bid, conforming to the solicitation, will be

most advantageous to Jefferson County – price and other factors considered. Unless otherwise specified in this IFB, Jefferson County reserves the right to accept a bid in whole or in part, and to award by item or by group, whichever is deemed to be in the best interest of Jefferson County. Any bidder who is in default to Jefferson County at the time of submittal of the bid shall have that bid rejected.

Jefferson County reserves the right to clarify any contractual terms with the concurrence of the Contractor; however, any substantial non-conformity in the offer, as determined by Jefferson County, shall be deemed non-responsive and the offer rejected.

In evaluating bids, Jefferson County shall consider the qualifications of the bidders, and, where applicable, operating costs, delivery time, maintenance requirements, performance data, and guarantees of materials and equipment.

In addition, Jefferson County may conduct such investigation as it deems necessary to assist in the evaluation of a bid and to establish the responsibility, qualifications, and financial ability of the bidders to fulfill the contract.

Jefferson County reserves the right to award this contract on the basis of **lowest and best bid** in accordance with the laws of the State of Texas, to waive any formality or irregularity, to make awards to more than one offeror, and/or to reject any or all bids. In the event the lowest dollar offeror meeting specifications is not awarded a contract, Offeror may appear before the Commissioners' Court and present evidence concerning Offeror responsibility after officially notifying the Office of the Purchasing Agent of Offeror's intent to appear.

8. CONTRACT.

A response to an IFB is an offer to contract with Jefferson County based upon the terms, conditions, and specifications contained in the IFB. Bids do not become contracts unless and until they are executed by Jefferson County, eliminating a formal signing of a separate contract. For that reason, all of the terms and conditions of the contract are contained in the IFB, unless any of the terms and conditions is modified by an IFB Amendment, a Contract Amendment, or by mutually agreed terms and conditions in the contract documents.

9. WAIVER OF SUBROGATION.

Bidder and bidder's insurance carrier waive any and all rights whatsoever with regard to subrogation against Jefferson County as an indirect party to any suit arising out of personal or property damages resulting from bidder's performance under this agreement.

10. FISCAL FUNDING.

A multi-year contract (if requested by the specifications) continuing as a result of an extension option must include fiscal funding out. If, for any reason, funds are not appropriated to continue the contract, said contract shall become null and void.

11. BID RESULTS.

Bid results are not provided in response to telephone inquiries. A preliminary tabulation of bids received will be posted on the Purchasing web page at <https://www.co.jefferson.tx.us/Purchasing/> as soon as possible following bid opening. A final tabulation will be posted following bid award, and will also be available for review in the Purchasing Department.

12. CHANGES AND ADDENDA TO BID DOCUMENTS.

Each change or addendum issued in relation to this IFB document will be on file in the Office of the Purchasing Agent, and will be posted on the Purchasing web site as soon as possible. It shall be the bidder's responsibility to make inquiry as to change or addenda issued, and to monitor the web site. All such changes or addenda shall become part of the contract and all bidders shall be bound by such addenda. Information on all changes or addenda issued will be available at the Office of the County Purchasing Agent.

13. SPECIFICATIONS.

Unless otherwise stated by the bidder, the bid will be considered as being in accordance with Jefferson County's applicable standard specifications, and any special specifications outlined in the bid document. References to a particular trade name, manufacturer's catalogue, or model number are made for descriptive purposes to guide the

bidder in interpreting the requirements of Jefferson County, and should not be construed as excluding bids on other types of materials, equipment, and supplies. However, the bidder, if awarded a contract, will be required to furnish the particular item referred to in the specifications or description unless departure or substitution is clearly noted and described in the bid.

Jefferson County reserves the right to determine if equipment/ product being bid is an acceptable alternate. All goods shall be new unless otherwise so stated in the bid. Any unsolicited alternate bid, or any changes, insertions, or omissions to the terms and conditions, specifications, or any other requirements of the bid, may be considered non-responsive.

14. DELIVERY.

Bids shall include all charges for delivery, packing, crating, containers, etc. Unless otherwise stated by the bidder (in writing on the included Bid Form), prices bid will be considered as being based on F.O.B. destination/delivered freight included.

15. INTERPRETATION OF BID AN/OR CONTRACT DOCUMENTS.

All inquiries shall be made within a reasonable time prior to the date and time fixed for the bid opening, in order that a written response in the form of an addendum, if required, can be processed before the bids are opened. Inquiries received that are not made in a timely fashion may or may not be considered.

16. CURRENCY.

Prices calculated by the bidder shall be stated in U.S. dollars.

17. PRICING.

Prices shall be stated in units of quantity specified in the bid documents. In case of discrepancy in computing the amount of the bid, the unit price shall govern.

18. NOTICE TO PROCEED/PURCHASE ORDER.

The successful bidder may not commence work under this contract until authorized to do so by the Purchasing Agent.

19. CERTIFICATION.

By signing the offer section of the Offer and Acceptance page, Bidder certifies:

- The submission of the offer did not involve collusion or other anti-competitive practices.
- The Bidder has not given, offered to give, nor intends to give at any time hereafter, any economic opportunity, future employment, gift, loan, gratuity, special discount, trip, favor, or service to any public servant in connection with the submitted offer.
- The Bidder hereby certifies that the individual signing the bid is an authorized agent for the Bidder and has the authority to bind the Bidder to the contract.

20. DEFINITIONS.

“County” – Jefferson County, Texas.

“Contractor” – The Bidder whose proposal is accepted by Jefferson County.

21. MINORITY-OWNED (MWBE), WOMEN-OWNED (WBE) AND HISTORICALLY UNDERUTILIZED (HUB) BUSINESS ENTERPRISE PARTICIPATION.

It is the desire of Jefferson County to increase the participation of Minority-Owned (MBE), Women-Owned (WBE), and Historically Underutilized (HUB) business enterprises in its contracting and procurement programs. While the County does not have any preference or set aside programs in place, it is committed to a policy of equitable participation for these firms.

**SECTION 2: FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)
MANDATED CONTRACT PROVISIONS FOR NON-FEDERAL ENTITY UNDER FEDERAL AWARDS
REQUIRED BY 2 C.F.R. §200.326 APPENDIX II TO 2 CFR §200**

2 CFR 200.327 Contract provisions. The non-Federal entity’s contracts should contain applicable provisions described in Appendix II to Part 200—Contract Provisions for non-Federal Entity Contracts Under Federal Awards. The non-Federal entity’s contracts must contain the provisions described in Appendix II to Part 200—Contract Provisions for non-Federal Entity Contracts Under Federal Awards, as applicable. ***Language as of August 31, 2022.**

THRESHOLD	PROVISION	CITATION
<p>>\$250,000 (Simplified Acquisition Threshold)</p>	<p>Contracts for more than the simplified acquisition threshold, which is the inflation adjusted amount determined by the Civilian Agency Acquisition Council and the Defense Acquisition Regulations Council (Councils) as authorized by 41 U.S.C. 1908, must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.</p>	<p>2 CFR 200 APPENDIX II (A)</p>
<p>>\$10,000</p>	<p>All contracts in excess of \$10,000 must address termination for cause and for convenience by the non-Federal entity including the manner by which it will be affected and the basis for settlement.</p>	<p>2 CFR 200 APPENDIX II (B)</p>
<p>None</p>	<p>Equal Employment Opportunity. Except as otherwise provided under 41 CFR Part 60, all contracts that meet the definition of “federally assisted construction contract” in 41 CFR Part 60-1.3 must include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, “Equal Employment Opportunity” (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, “Amending Executive Order 11246 Relating to Equal Employment Opportunity,” and implementing regulations at 41 CFR part 60, “Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor.”</p> <p>41 CFR 60-1.4 Equal opportunity clause.</p> <p>(b) Federally assisted construction contracts. (1) Except as otherwise provided, each administering agency shall require the inclusion of the following language as a condition of any grant, contract, loan, insurance, or guarantee involving federally assisted construction which is not exempt from the requirements of the equal opportunity clause:</p> <p>The [recipient] hereby agrees that it will incorporate or cause to be incorporated into any contract for construction work, or modification thereof, as defined in the regulations of the Secretary of Labor at 41 CFR Chapter 60, which is paid for in whole or in part with funds obtained from the Federal Government or borrowed on the credit of the Federal Government pursuant to a grant, contract, loan, insurance, or guarantee, or undertaken pursuant to any Federal program involving such grant, contract, loan, insurance, or guarantee, the following equal opportunity clause:</p> <p>During the performance of this contract, the contractor agrees as follows:</p> <p>(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following:</p>	<p>2 CFR 200 APPENDIX II I and 41 CFR §60-1.4(b)</p>

	<p>Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.</p> <ul style="list-style-type: none">(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.(3) The contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.(4) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.(5) The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.(6) The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.(7) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in	
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	<p>Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.</p> <p>(8) The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance:</p> <p>Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the contractor may request the United States to enter into such litigation to protect the interests of the United States.</p> <p>The [recipient] further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally assisted construction work: Provided, that if the [recipient] so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract.</p> <p>The [recipient] agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of contractors and subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance.</p> <p>The [recipient] further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a contractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and subcontractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the [recipient] agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this grant (contract, loan, insurance, guarantee); refrain from extending any further assistance to the [recipient] under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such [recipient]; and refer the case to the Department of Justice for appropriate legal proceedings.</p>	
>\$2,000	<p>Davis-Bacon Act, as amended (40 U.S.C. 3141-3148). When required by Federal program legislation, all prime construction contracts in excess of \$2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (40 U.S.C. 3141-3144, and 3146-3148) as supplemented by Department of Labor regulations (29 CFR Part 5, "Labor Standards Provisions</p>	2 CFR 200 APPENDIX II (D)

	Applicable to Contracts Covering Federally Financed and Assisted Construction”). In accordance with the statute, contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be conditioned upon the acceptance of the wage determination. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency. The contracts must also include a provision for compliance with the Copeland “Anti-Kickback” Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3 , “Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States”). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.	
>\$100,000	Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708). Where applicable, all contracts awarded by the non-Federal entity in excess of \$100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. 3702 and 3704 , as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.	2 CFR 200 APPENDIX II (E)
None	Rights to Inventions Made Under a Contract or Agreement. If the Federal award meets the definition of “funding agreement” under 37 CFR § 401.2 (a) and the recipient or subrecipient wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that “funding agreement,” the recipient or subrecipient must comply with the requirements of 37 CFR Part 401 , “Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements,” and any implementing regulations issued by the awarding agency.	2 CFR 200 APPENDIX II (F)
>\$150,000	Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended - Contracts and subgrants of amounts in excess of \$150,000 must contain a provision that requires the non-Federal award to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the Federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).	2 CFR 200 APPENDIX II (G)

>\$25,000	Debarment and Suspension (Executive Orders 12549 and 12689) - A contract award (see 2 CFR 180.220) must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.	2 CFR 200 APPENDIX II (H)
>\$100,000	Byrd Anti-Lobbying Amendment (31 U.S.C. 1352) - Contractors that apply or bid for an award exceeding \$100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352 . Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.	2 CFR 200 APPENDIX II (I) and 24 CFR §570.303
	See 2 CFR §200.323.	2 CFR 200 APPENDIX II (J)
	See 2 CFR §200.216.	2 CFR 200 APPENDIX II (K)
	See 2 CFR §200.322.	2 CFR 200 APPENDIX II (L)
>\$10,000	A non-Federal entity that is a state agency or agency of a political subdivision of a state and its contractors must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired during the preceding fiscal year exceeded \$10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.	2 CFR 200.323
>\$100,000	<p><i>§135.38 Section 3 clause</i> <i>All section 3 covered contracts shall include the following clause (referred to as the section 3 clause):</i></p> <p>A. The work to be performed under this contract is subject to the requirements of section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (Section 3). The purpose of section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by section 3, shall, to the greatest extent feasible, be directed to low- and very low-income persons, particularly persons who are recipients of HUD assistance for housing.</p> <p>B. The parties to this contract agree to comply with HUD's regulations in 24 CFR part 135, which implement section 3. As evidenced by their execution of this contract, the parties to this contract certify that they are under no contractual or other impediment that would prevent them from complying with the part 135 regulations.</p>	

	<p>C. The contractor agrees to send to each labor organization or representative of workers with which the contractor has a collective bargaining agreement or other understanding, if any, a notice advising the labor organization or workers' representative of the contractor's commitments under this section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work shall begin.</p> <p>D. The contractor agrees to include this section 3 clause in every subcontract subject to compliance with regulations in 24 CFR part 135, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR part 135. The contractor will not subcontract with any subcontractor where the contractor has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR part 135.</p> <p>E. The contractor will certify that any vacant employment positions, including training positions, that are filled (1) after the contractor is selected but before the contract is executed, and (2) with persons other than those to whom the regulations of 24 CFR part 135 require employment opportunities to be directed, were not filled to circumvent the contractor's obligations under 24 CFR part 135.</p> <p>F. Noncompliance with HUD's regulations in 24 CFR part 135 may result in sanctions, termination of this contract for default, and debarment or suspension from future HUD assisted contracts.</p> <p>G. With respect to work performed in connection with section 3 covered Indian housing assistance, section 7(b) of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450e) also applies to the work to be performed under this contract. Section 7(b) requires that to the greatest extent feasible (i) preference and opportunities for training and employment shall be given to Indians, and (ii) preference in the award of contracts and subcontracts shall be given to Indian organizations and Indian-owned Economic Enterprises. Parties to this contract that are subject to the provisions of section 3 and section 7(b) agree to comply with section 3 to the maximum extent feasible, but not in derogation of compliance with section 7(b).</p>	
None	<p>Section 889(b)(1) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (FY2019 NDAA) and 2 C.F.R. § 200.216, as implemented by FEMA Policy 405-143-1, Prohibitions on Expending FEMA Award Funds for Covered Telecommunications Equipment or Services (Interim), prohibit the obligation or expending of federal award funds on certain telecommunication products or from certain entities for national security reasons. Effective August 13, 2020, FEMA recipients and subrecipients, as well as their contractors and subcontractors, may not obligate or expend any FEMA award funds to:</p> <p>Recipients and subrecipients are prohibited from obligating or expending loan or grant funds to:</p> <ol style="list-style-type: none"> (1) Procure or obtain; (2) Extend or renew a contract to procure or obtain; or (3) Enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that uses covered 	2 CFR 200.216

	<p>telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).</p> <p>(i) For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).</p> <p>(ii) Telecommunications or video surveillance services provided by such entities or using such equipment.</p> <p>(iii) Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.</p> <p>(b) In implementing the prohibition under Public Law 115-232, section 889, subsection (f), paragraph (1), heads of executive agencies administering loan, grant, or subsidy programs shall prioritize available funding and technical support to assist affected businesses, institutions and organizations as is reasonably necessary for those affected entities to transition from covered communications equipment and services, to procure replacement equipment and services, and to ensure that communications service to users and customers is sustained.</p> <p>(c) See Public Law 115-232, section 889 for additional information.</p> <p>(d) See also § 200.471.</p>	
None	<p>As appropriate and to the extent consistent with law, the non-Federal entity should, to the greatest extent practicable under a Federal award, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). The requirements of this section must be included in all subawards including all contracts and purchase orders for work or products under this award. For purposes of this section:</p> <p>(1) "Produced in the United States" means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.</p> <p>(2) "Manufactured products" means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.</p>	2 CFR 200.322(a)(b)(1) (2)
None	<p>The Federal awarding agency must establish conflict of interest policies for Federal awards. The non-Federal entity must disclose in writing any potential conflict of interest to the Federal awarding agency or pass-through entity in accordance with applicable Federal awarding agency policy.</p>	2 CFR 200.112

None	<p>The Federal awarding agency and the non-Federal entity should, whenever practicable, collect, transmit, and store Federal award-related information in open and machine-readable formats rather than in closed formats or on paper in accordance with applicable legislative requirements. A machine-readable format is a format in a standard computer language (not English text) that can be read automatically by a web browser or computer system. The Federal awarding agency or pass-through entity must always provide or accept paper versions of Federal award-related information to and from the non-Federal entity upon request. If paper copies are submitted, the Federal awarding agency or pass-through entity must not require more than an original and two copies. When original records are electronic and cannot be altered, there is no need to create and retain paper copies. When original records are paper, electronic versions may be substituted through the use of duplication or other forms of electronic media provided that they are subject to periodic quality control reviews, provide reasonable safeguards against alteration, and remain readable.</p>	2 CFR 200.336
None	<p>Contracting with HUB, small and minority businesses, women's business enterprises, and labor surplus area firms.</p> <p>(a) The non-Federal entity must take all necessary affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible.</p> <p>(b) Affirmative steps must include:</p> <p>(1) Placing qualified small and minority businesses and women's business enterprises on solicitation lists;</p> <p>(2) Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;</p> <p>(3) Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses, and women's business enterprises;</p> <p>(4) Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises;</p> <p>(5) Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce; and</p> <p>(6) Requiring the prime contractor, if subcontracts are to be let, to take the affirmative steps listed in paragraphs (b)(1) through (5) of this section.</p>	2 CFR 200.321
None	<p>Financial records, supporting documents, statistical records, and all other non-Federal entity records pertinent to a Federal award must be retained for a period of three years from the date of submission of the final expenditure report or, for Federal awards that are renewed quarterly or annually, from the date of the submission of the quarterly or annual financial report, respectively, as reported to the Federal awarding agency or pass-through entity in the case of a subrecipient. Federal awarding agencies and pass-through entities must not impose any other record retention requirements upon non-Federal entities. The only exceptions are the following:</p> <p>(a) If any litigation, claim, or audit is started before the expiration of the 3-year period, the records must be retained until all litigation, claims, or audit findings involving the records have been resolved and final action taken.</p> <p>(b) When the non-Federal entity is notified in writing by the Federal awarding agency, cognizant agency for audit, oversight agency for audit, cognizant agency for indirect costs, or pass-through entity to extend the retention period.</p> <p>(c) Records for real property and equipment acquired with Federal funds must be retained for 3 years after final disposition.</p>	2 CFR 200.334

	<p>(d) When records are transferred to or maintained by the Federal awarding agency or pass-through entity, the 3-year retention requirement is not applicable to the non-Federal entity.</p> <p>(e) Records for program income transactions after the period of performance. In some cases, recipients must report program income after the period of performance. Where there is such a requirement, the retention period for the records pertaining to the earning of the program income starts from the end of the non-Federal entity's fiscal year in which the program income is earned.</p> <p>(f) Indirect cost rate proposals and cost allocations plans. This paragraph applies to the following types of documents and their supporting records: Indirect cost rate computations or proposals, cost allocation plans, and any similar accounting computations of the rate at which a particular group of costs is chargeable (such as computer usage chargeback rates or composite fringe benefit rates).</p> <p>(1) <i>If submitted for negotiation.</i> If the proposal, plan, or other computation is required to be submitted to the Federal Government (or to the pass-through entity) to form the basis for negotiation of the rate, then the 3-year retention period for its supporting records starts from the date of such submission.</p> <p>(2) <i>If not submitted for negotiation.</i> If the proposal, plan, or other computation is not required to be submitted to the Federal Government (or to the pass-through entity) for negotiation purposes, then the 3-year retention period for the proposal, plan, or computation and its supporting records starts from the end of the fiscal year (or other accounting period) covered by the proposal, plan, or other computation.</p>	
None	<p>CONTRACTS WITH COMPANIES ENGAGED IN BUSINESS WITH IRAN, SUDAN, OR FOREIGN TERRORIST ORGANIZATION PROHIBITED. A governmental entity may not enter into a governmental contract with a company that is identified on a list prepared and maintained under Section 2270.0052, 2270.0102, or 2270.0152. In accordance with Texas Government Code, Chapter 2252, Subchapter F, Respondent hereby represents and warrants that it is not a company identified on the lists prepared and maintained under Texas Government Code §§ 2270.0052 (companies with business operations in Sudan), 2270.0102 (companies with business operations in Iran), or 2270.0152 (companies known to have contracts with or provide supplies or services to a foreign terrorist organization). Notwithstanding the foregoing, a company that the United States government affirmatively declares to be excluded from its federal sanctions regime relating to Sudan, Iran, or to a foreign terrorist organization, is not subject to contract prohibition under this clause. A company claiming such exemption must submit the official copy of the declaration.</p>	Texas Government Code 2252.152
>\$100,000	<p>PROVISION REQUIRED IN CONTRACT. (a) This section applies only to certain solicitations and contracts. Section 2271.002 of the Texas Government Code states the following:</p> <p>(a) This section applies only to a contract that:</p> <p>(1) is between a governmental entity and a company with 10 or more full-time employees; and</p> <p>(2) has a value of \$100,000 or more that is to be paid wholly or partly from public funds of the governmental entity.</p> <p>(b) A governmental entity may not enter into a contract with a company for goods or services unless the contract contains a written verification from the company that it:</p> <p>(1) does not boycott Israel; and</p>	Texas Government Code 2271.002

	(2) will not boycott Israel during the term of the contract. Section 2271.001(2) of the Government Code defines "company" to be the meaning assigned by Section 808.001 of the Texas Government Code, except that the term does not include a sole proprietorship.	
Option Contract Language for contracts awarded prior to Grant Award	The contract award is contingent upon the receipt of federal funds. If no such funds are awarded, the contract shall terminate.	Optional
	Mandatory standards and policies relating to energy efficiency which are contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act.	42 U.S.C. 6201
	The Firm agrees that no otherwise qualified individual with disabilities shall, solely by reason of his/her disability, be denied the benefits of, or be subjected to discrimination, including discrimination in employment, under any program or activity receiving federal financial assistance.	Section 504 of the Rehabilitation Act of 1973, as amended.

BYRD ANTI-LOBBYING CERTIFICATION

Certification for Contracts, Grants, Loans, and Cooperative Agreements-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 an 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 contract, the making 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 Form to Report Lobbying," in accordance with its instructions.
- 3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients 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, U.S. 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.

The Contractor _____ certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C.Chap. 38, Administrative Remedies for False Claims and Statements, apply to this certification and disclosure, if any.

Signature of Contractor's Authorized Official

Name and Title of Contractor's Authorized Official

Date

<p>REQUIRED FORM <u>Bidder</u>: Please complete this form and include with bid submission.</p>

DEBARMENT/SUSPENSION CERTIFICATION

Non-Federal entities and contractors are subject to the debarment and suspension regulations implementing Executive Order 12549, Debarment and Suspension (1986) and Executive Order 12689, Debarment and Suspension (1989) at 2 C.F.R. Part 180 and the Department of Homeland Security's regulations at 2 C.F.R. Part 3000 (No procurement Debarment and Suspension).

This requirement applies to all FEMA grant and cooperative agreement programs.

Federal Executive Order (E .O.) 12549 "Debarment" requires that all contractors receiving individual awards, using federal funds, and all sub recipients certify that the organization and its principals are not debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency from doing business with the Federal Government. By signing this document, you certify that your organization and its principals are not debarred. Failure to comply or attempts to edit this language may disqualify your bid. Information on debarment is available at the following websites: www.sam.gov and <https://acquisition.gov/far/index.html> see section 52.209-6.

The Contractor _____ certifies or affirms by your signature that neither you nor your principal is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department or agency.

Signature of Contractor's Authorized Official

Name and Title of Contractor's Authorized Official

Date

REQUIRED FORM
Bidder: Please complete this form
and include with bid submission.

CIVIL RIGHTS COMPLIANCE PROVISIONS

1. EQUAL EMPLOYMENT OPPORTUNITY (Equal Opportunity Clause)

(For all awarded contracts that meet the definition of "federally assisted construction contract" provided in 41 CFR Part 60-1.3)

During the performance of this contract, the contractor agrees as follows:

- 1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following:
Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.
- 2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.
- 3) The contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.
- 4) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- 5) The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.
- 6) The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.
- 7) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or order this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
- 8) The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (8) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance:

CIVIL RIGHTS COMPLIANCE PROVISIONS (CONTINUED)

Provided, however, that in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

The applicant further agrees that it will be bound by the above equal opportunity clause with respect to its own employment practices when it participates in federally assisted construction work: Provided, that if the applicant so participating is a State or local government, the above equal opportunity clause is not applicable to any agency, instrumentality or subdivision of such government which does not participate in work on or under the contract.

The applicant agrees that it will assist and cooperate actively with the administering agency and the Secretary of Labor in obtaining the compliance of contractors and subcontractors with the equal opportunity clause and the rules, regulations, and relevant orders of the Secretary of Labor, that it will furnish the administering agency and the Secretary of Labor such information as they may require for the supervision of such compliance, and that it will otherwise assist the administering agency in the discharge of the agency's primary responsibility for securing compliance.

The applicant further agrees that it will refrain from entering into any contract or contract modification subject to Executive Order 11246 of September 24, 1965, with a contractor debarred from, or who has not demonstrated eligibility for, Government contracts and federally assisted construction contracts pursuant to the Executive Order and will carry out such sanctions and penalties for violation of the equal opportunity clause as may be imposed upon contractors and subcontractors by the administering agency or the Secretary of Labor pursuant to Part II, Subpart D of the Executive Order. In addition, the applicant agrees that if it fails or refuses to comply with these undertakings, the administering agency may take any or all of the following actions: Cancel, terminate, or suspend in whole or in part this grant (contract, loan, insurance, guarantee); refrain from extending any further assistance to the applicant under the program with respect to which the failure or refund occurred until satisfactory assurance of future compliance has been received from such applicant; and refer the case to the Department of Justice for appropriate legal proceedings.

Signature of Contractor's Authorized Official

Name and Title of Contractor's Authorized Official

Date

REQUIRED FORM
Bidder: Please complete this form
and include with bid submission.

SECTION 3: SPECIAL REQUIREMENTS/BID SUBMISSION INSTRUCTIONS

The following requirements and instructions supersede General Requirements where applicable.

1. SUBMISSION OF BID.

Bidder is Responsible for Submitting:

One (1) Original and Two (2) Bid Copies; with all copies to include a Completed Copy of this specifications packet (including technical specifications), in its entirety.

The County requests that bid submissions NOT be bound by staples or glued spines.

Each Bidder shall ensure that required parts of their bid submission are completed with accuracy and submitted as per the requirements within this specifications packet, including any addenda.

Additionally, Bidder shall monitor the Jefferson County Purchasing Department Website for any addenda, additional instructions, or bid updates. <https://www.co.jefferson.tx.us/Purchasing/>

Failure to return and/or complete all required documentation will result in a response being declared as non-responsive.

Bids must be submitted in complete original form by mail or messenger to the following address:

Jefferson County Purchasing Department
1149 Pearl Street, 1st Floor
Beaumont, TX 77701

BID PACKAGING: Bidder shall submit response in a tightly sealed opaque envelope or box, plainly marked "SEALED BID." The outside of the envelope or box shall also include the IFB Number, IFB Name, IFB Due Date, and the Bidder's Name and Address; and shall be addressed to the Purchasing Agent.

All submissions must be received by: 11:00 am CT, Wednesday, June 21, 2023.

Bids will be accepted at the above address until the time and date specified herein, and immediately after will be publicly opened and read aloud.

Jefferson County will not accept any responsibility for bids being delivered by third party carriers.

Late bids will not be accepted and will be returned unopened to the Bidder.

Jefferson County shall not be responsible for any effort or cost expended in the preparation of a response to this IFB.

All bid responses submitted in response to this invitation shall become the property of Jefferson County and will be a matter of public record available for review.

All protests should be coordinated through the Purchasing Office prior to award recommendation to Commissioners' Court.

COURTHOUSE SECURITY: All visitors to the Courthouse must pass through Security. Respondents planning to hand deliver proposals must allow time to get through Security, as a delay in entering the Courthouse will not be accepted as an excuse for late submittal. Mondays and Tuesdays are particularly heavy days.

In response to the Covid-19 pandemic, Jefferson County has implemented precautionary measures as currently recommended by the CDC within its facilities. Bidders are strongly urged to plan accordingly.

COUNTY HOLIDAYS (2023 REMAINING):

May 29	(Monday)	Memorial Day
July 4	(Tuesday)	Independence Day
September 4	(Monday)	Labor Day
November 10	(Friday)	Veteran's Day
November 23 & 24	(Thursday & Friday)	Thanksgiving
December 25 & 26	(Monday & Tuesday)	Christmas
January 1, 2024	(Monday)	New Year's

Submissions During Time of Inclement Weather, Disaster, or Emergency:

In case of inclement weather or any other unforeseen event causing the County to close for business on the date of a bid/proposal/statement of qualifications submission deadline, the IFB closing will automatically be postponed until the next business day that County offices are open to the public. Should inclement weather conditions or any other unforeseen event cause delays in courier service operations, the County may issue an addendum to all known vendors interested in the project to extend the deadline. It will be the responsibility of the vendor to notify the county of their interest in the project should these conditions impact their ability to submit a bid/proposal/statement of qualifications submission before the stated deadline. The County reserves the right to make the final judgement call to extend any deadline.

Should an emergency or unanticipated event interrupt normal County processes, and bid/proposal/statement of qualifications submissions cannot be received by the Jefferson County Purchasing Department's office by the exact time specified in the IFB and urgent County requirements preclude amendment to the IFB, the time specified for receipt of Statements of Qualifications will be deemed to be extended to the same time of day specified in the solicitation on the first business day on which normal County processes resume.

2. PRE-BID MEETING

There will be a Non Mandatory **Pre-Bid Meeting on Tuesday, June 6, 2023, at 2:00 PM CT**, at the Jefferson County Engineering Department Conference Room (5th floor, Historic Courthouse) 1149 Pearl, Beaumont, Texas 77701. A site visit will follow the pre-bid meeting.

3. QUESTIONS/DEADLINE FOR QUESTIONS.

Questions may be emailed to **Jamey West, Contract Specialist** with the Jefferson County Purchasing Department at: Jamey.West@jeffcotx.us

The Deadline for asking questions or requesting additional information (in writing) is: **5:00 pm CT, MONDAY, JUNE 12, 2023.**

4. VENDOR REGISTRATION (System for Award Management).

Vendors doing business with Jefferson County are **required** to be registered with The System for Award Management (SAM), with an "active" status. The System for Award Management (SAM) is the Official U.S. Government system that consolidated the capabilities of CCR/FedReg, ORCA, and EPLS. There is NO fee to register for this site. Entities may register at no cost directly from the SAM website at: <https://www.sam.gov>

In instances where a vendor has either an "Inactive" SAM Registration or is not currently registered with the System for Award Management, the Purchasing Department may *initially* accept proof (printout from the SAM website) that the vendor has begun the registration process in order for the IFB/RFQ/RFP submission to be considered as "responsive" to the specifications for the project.

However, the SAM Registration must be completed (showing "active" status, with no exclusions) prior to the award and/or execution of an agreement or contract for the project.

BIDDER: INSERT PROOF OF SYSTEM FOR AWARD MANAGEMENT (SAM) BEHIND THIS PAGE.

5. FORM 1295 (Texas Ethics Commission) SUBMISSION REQUIREMENT/INSTRUCTIONS FOR BIDDERS.

All Non-Exempt Bidders are required to submit a completed FORM 1295 with bid submission.

1. Submit a FORM 1295 online via the Texas Ethics Commission website link below.

Vendors must enter the required information on Form 1295, and print a copy of the completed form. The form will include a certification of filing that will contain a unique certification number.

2. Submit a FORM 1295 hard copy (completed & signed by an Authorized Agent of the Awarded Vendor), to the Jefferson County Purchasing Department with bid submission.

FORM 1295, Completion Instructions, and Login Instructions are available via the Texas Ethics Commission Website at: https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm

A sample of a completed FORM 1295 is included on **PAGE 29**.

FORM 1295 Implementation Background:

In accordance with House Bill 1295 (passed January 1, 2016), Vendors entering into contracts and professional agreements with Jefferson County will be required to complete a Certificate of Interested Parties (FORM 1295), **unless contract is considered exempt as described below.**

In 2017, the Texas 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 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. 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.

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.”

Question: Will the date of birth and address provided appear on the TEC’s website when the form is filed?

Answer: 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)

FORM 1295 EXEMPTIONS:

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: the value of the contract cannot be determined at the time the contract is executed; and 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
- a contract with a gas utility, as that term is defined by Section 121.001, Utilities Code

SAMPLE COMPLETED FORM 1295

VENDOR: FORM 1295 MUST BE COMPLETED/SUBMITTED ON TEXAS ETHICS COMMISSION WEBSITE. HARD COPY OF FORM 1295 IS TO BE PRINTED, COMPLETED, SIGNED, AND SUBMITTED WITH BID/PROPOSAL/AGREEMENT/CONTRACT. JEFFERSON COUNTY WILL CONFIRM RECEIPT OF COMPLETED HARD COPY WITH THE TEXAS ETHICS COMMISSION.

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. VENDOR: ENTER YOUR BUSINESS NAME, CITY, STATE, AND COUNTRY HERE		Must file online at www.ethics.state.tx.us/File							
2 Name of governmental entity or state agency that is a party to the contract for which the form is being filed. JEFFERSON COUNTY, TEXAS									
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. VENDOR: ENTER BID/PROPOSAL/CONTRACT/AGREEMENT REF# AND TITLE HERE									
4	Name of Interested Party	City, State, Country (place of business)	Nature of Interest (check applicable)						
			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Controlling</th> <th style="width: 50%;">Intermediary</th> </tr> <tr> <td style="text-align: center;">X</td> <td></td> </tr> <tr> <td></td> <td style="text-align: center;">X</td> </tr> </table>	Controlling	Intermediary	X			X
Controlling	Intermediary								
X									
	X								
VENDOR: ENTER EACH PERSON HAVING INTEREST, OWNERS ARE THE CONTROLLING PARTIES.									
VENDOR: WORKERS (OR NON-OWNERS) IN YOUR COMPANY ARE INTERMEDIARY PARTIES.									
5		CHECK BELOW IF APPLICABLE							
Check only if there is no Interested Party.		<input type="checkbox"/>							
6 UNSWORN DECLARATION VENDOR: COMPLETE, DATE, AND SIGN THIS DECLARATION SECTION.									
My name is _____, and my date of birth is _____. My address: _____ (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									

Form provided by Texas Ethics Commission www.ethics.state.tx.us Revised 12/22/2017
NOTE: JEFFERSON COUNTY WILL KEEP A COPY OF THIS FORM ON FILE FOR EACH BID/PROPOSAL/CONTRACT/AGREEMENT AND EACH VENDOR RESPONDING TO BIDS/PROPOSALS.

BIDDER: INSERT COMPLETED FORM 1295 BEHIND THIS PAGE.

SECTION 3: SPECIAL REQUIREMENTS/BID SUBMISSION INSTRUCTIONS (CONTINUED)

6. MULTIPLE VENDOR AWARD.

Jefferson County reserves the right to award this contract to more than one vendor at the County's discretion.

7. DELIVERY.

If delivery is required, all items must be packaged so as to be protected from damage during shipping and handling. Any item(s) damaged in shipping must be replaced in kind, or repaired, by the contractor, at the discretion of, and at no additional charge to, Jefferson County.

8. PAYMENT.

Jefferson County will pay original invoices that clearly itemize the goods and/or services provided as to quantity, part number, description, price, applicable discount (if any), labor charges showing time differential, if applicable and if previously agreed to, and delivery, installation, and set-up costs, if applicable and if previously agreed to. Only charges as stated on the Bid Form(s) submitted as a part of the bid will be considered.

Invoices must indicate Jefferson County as applicable, the address to which the product(s) and/or service(s) were delivered, and the applicable purchase order number. Invoices will be matched to delivery tickets prior to payment; therefore, all delivery tickets should have an accurate description of the product(s) and/or service(s).

Invoices shall be submitted to:

Jefferson County Auditing Department
Attention: Accounts Payable
1149 Pearl Street, 7th floor
Beaumont, TX 77701.

9. USAGE REPORTS.

Jefferson County reserves the right to request, and receive at no additional cost, up to two (2) times during the contract period, a usage report detailing the products and/or services furnished to date under a contract resulting from this IFB. The reports must be furnished no later than five (5) working days after written request and itemize all purchases to date by Jefferson County department, description of each item purchased, including manufacturer, quantity of each item purchased, per unit and extended price of each item purchased, and total amount and price of all items purchased.

10. INSURANCE.

The contractor (including any and all subcontractors as defined in Section 11.1.3 below) shall, at all times during the term of this contract, maintain insurance coverages with not less than the type and requirements shown below. Such insurance is to be provided at the sole cost of the contractor. These requirements do not establish limits of the contractor's liability.

All policies of insurance shall waive all rights of subrogation against the County, its officers, employees and agents; a copy of the policy wording or endorsement is required.

Contractor shall furnish Jefferson County with Certificate of Insurance naming Jefferson County as additional insured and will provide the actual policy wording or endorsement showing as such.

All insurance must be written by an insurer licensed to conduct business in the State of Texas.

Minimum Insurance Requirements:

Public Liability, including Products & Completed Operations \$1,000,000

Excess Liability \$1,000,000

Property Insurance (policy below that is applicable to this project):

Improvements & Betterments Policy: Improvements/Remodeling (for Lease Tenants)

Builder's Risk Policy: Structural Coverage for Construction Projects

Installation Floater Policy: Improvements/Alterations to Existing Structure

11. WORKERS' COMPENSATION INSURANCE

11.1 Definitions:

- 11.1.1 **Certificate of coverage ("Certificate")** – A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement, DWC-81, DWC-82, DWC-83, or DWC-84 showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on a project, for the duration of the project.
 - 11.1.2 **Duration of the project** – Includes the time from the beginning of the work on the project until the contractor's/person's work on the project has been completed and accepted by the governmental entity.
 - 11.1.3 **Persons providing services on the project ("subcontractor") in article 406.096** – Includes all persons or entities performing all or part of the services under the contractor has undertaken to perform on the project, regardless of whether that person contracted directly with the contractor and regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractor, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity which furnishes persons to provide services on the project. "Services" includes, without limitation, providing, hauling or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.
- 11.2 The Contractor shall provide coverage, based on proper reporting of classification code and payroll amounts and filing any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the contractor providing services on the project, for the duration of the project.
- 11.3 The Contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract – refer to Section 10 above.
- 11.4 If the coverage period shown on the Contractor's current certificate of coverage ends during the duration of the project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with the governmental entity showing that coverage has been extended.
- 11.5 The Contractor shall obtain from each person providing services on a project, and provide to the governmental entity:
- 11.5.1 A certificate of coverage, prior to that person beginning work on the project, so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on the project; and
 - 11.5.2 No later than seven (7) days after receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate ends during the duration of the project.
- 11.6 The Contractor shall retain all required certificates of coverage for the duration of the project and for one (1) year thereafter.
- 11.7 The Contractor shall notify the governmental entity in writing by certified mail or personal delivery, within ten (10) days after the contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.
- 11.8 The Contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Department of Workers' Compensation, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.
- 11.9 The Contractor shall contractually require each person with whom it contracts to provide services on a project to:
- 11.9.1 Provide coverage, based on reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section

- 401.011(44) for all its employees providing services on the project, for the duration of the project.
- 11.9.2 Provide to the Contractor, prior to that person beginning work on the project a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project.
 - 11.9.3 Provide the Contractor, prior to the end of coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.
 - 11.9.4 Obtain from each person with whom it contracts, and provide to the Contractor:
 - 11.9.4.1 A certificate of coverage, prior to the other person beginning work on the project; and
 - 11.9.4.2 the coverage period, if the coverage period shown on the current certificate of a new certificate of coverage showing extension of coverage, prior to the end of coverage ends during the duration of the project.
 - 11.9.5 Retain all required certificates of coverage on file for the duration of the project and for one (1) year thereafter.
 - 11.9.6 Notify the governmental entity in writing by certified mail or personal delivery, within ten (10) days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and
 - 11.9.7 Contractually require each person with whom it contracts to perform as required by paragraphs 11.1. – 11.7., with the certificates of coverage to be provided to the person for whom they are providing services.
- 11.10 By signing this contract or providing or causing to be provided a certificate of coverage, the Contractor is representing to the governmental entity that all employees of the contractor who will provide services of the project will be covered by workers' compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.
- 11.11 The Contractor's failure to comply with any of these provisions is a breach of contract by the Contractor which entitles the governmental entity to declare the contract void if the Contractor does not remedy the breach within ten (10) days after receipt of notice of breach from the governmental entity.

BIDDER: INSERT COPY OF CERTIFICATE OF INSURANCE (COI) BEHIND THIS PAGE.

Note: For bid purposes, a general COI will suffice. However, a COI that includes the notation that “Jefferson County as an additional insured” will be required from Awarded Bidder(s) prior to the issuance of a Purchase Order.

BIDDER INFORMATION FORM

Instructions: Complete the form below. Please provide legible, accurate, and complete contact information.
PLEASE PRINT.

Bid Number & Name: INVITATION FOR BID (IFB 23-035/JW)
CRANE BAYOU PUMP STATION GENERATORS AND BUILDING –
COMMUNITY DEVELOPMENT BLOCK GRANT-DISASTER RECOVERY (CDBG-DR)
PROGRAM PROJECT FOR JEFFERSON COUNTY

Bidder's Company/Business Name: _____

Bidder's TAX ID Number: _____

If Applicable: HUB Vendor No. _____ DBE Vendor No. _____

Contact Person: _____ **Title:** _____

Phone Number (with area code): _____

Alternate Phone Number if available (with area code): _____

Fax Number (with area code): _____

Email Address: _____

Mailing Address (Please provide a physical address for bid bond return, if applicable):

Address

City, State, Zip Code

REQUIRED FORM
**Bidder: Please complete this form
and include with bid submission.**

SECTION 4: MINIMUM SPECIFICATIONS

The following requirements and specifications supersede General Bid Requirements where applicable. Any questions relating to bid submission or bid item specifications requirements should be directed to Jamey West, Contract Specialist with the Jefferson County Purchasing Department at 409-835-8593 or via email at: Jamey.West@jeffcotx.us Please reference Bid Number: IFB 23-035/JW.

SCOPE OF PROJECT:

Jefferson County is soliciting bids for:

1. Construction of a new concrete building to house two generators complete with louvers, doors, lighting and electrical improvements.
2. Installation of two (2) 200kW Generators with sub base fuel tanks, automatic transfer switch and associated wiring and controls.
3. Electrical wiring, conduit, lighting, grounding and controls to support the new building and equipment.
4. Replacement of the existing station motor control center.

**BIDDER: INSERT ALL ADDENDA BEHIND THIS PAGE.
PLEASE BE SURE TO COMPLETE, SIGN, ATTEST, AND DATE EACH ADDENDUM.**

BIDDER: INSERT BID SURETY BEHIND THIS PAGE.

VENDOR REFERENCES FORM

Bidder: Please list at least three (3) companies or governmental agencies (preferably a municipality) where the same or similar products and/or services as contained in this specification package were recently provided.

REQUIRED FORM
Bidder: Please complete this form and include with bid submission.

REFERENCE ONE

Government/Company Name: _____

Address: _____

Contact Person and Title: _____

Phone: _____ Fax: _____

Email Address: _____ Contract Period: _____

Scope of Work:

REFERENCE TWO

Government/Company Name: _____

Address: _____

Contact Person and Title: _____

Phone: _____ Fax: _____

Email Address: _____ Contract Period: _____

Scope of Work:

REFERENCE THREE

Government/Company Name: _____

Address: _____

Contact Person and Title: _____

Phone: _____ Fax: _____

Email Address: _____ Contract Period: _____

Scope of Work: _____

SIGNATURE PAGE

As permitted under Article 4413 (32c) V.A.C.S., other governmental entities may wish to participate under the same terms and conditions contained in this contract (i.e., piggyback). In the event any other entity participates, all purchase orders will be issued directly from and shipped directly to the entity requiring supplies/services. Jefferson County shall not be held responsible for any orders placed, deliveries made or payment for supplies/services ordered by another entity. Each entity reserves the right to determine their participation in this contract.

Would Bidder be willing to allow other governmental entities to piggyback off this contract, if awarded, under the same terms and conditions? **Yes** **No**

This bid shall remain in effect for ninety (90) days from bid opening and shall be exclusive of federal excise and state and local sales tax (exempt).

The undersigned agrees, if this bid is accepted, to furnish any and all items upon which prices are offered, at the price and upon the terms and conditions contained in the Invitation for Bid, Conditions of Bidding, Terms of Contract, and Specifications and all other items made a part of the accepted contract.

The undersigned affirms that they are duly authorized to execute the contract, that this company, corporation, firm, partnership or individual has not prepared this bid in collusion with any other Bidder, and that the contents of this bid as to prices, terms or conditions of said bid have not been communicated by the undersigned nor by any employee or agent to any other Bidder or to any other person(s) engaged in this type of business prior to the official opening of this bid. And further, that neither the Bidder nor their employees nor agents have been for the past six (6) months directly nor indirectly concerned in any pool or agreement or combination to control the price of goods or services on, nor to influence any person to bid or not to bid thereon.

Bidder (Entity Name)

Signature

Street & Mailing Address

Print Name

City, State & Zip

Date Signed

Telephone Number

Fax Number

E-mail Address

<p>REQUIRED FORM Bidder: Please complete this form and include with bid submission.</p>

CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

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 an 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 contract, the making 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 Form to Report Lobbying," in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients 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, U.S. 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.

The Contractor, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. Chap. 38, Administrative Remedies for False Claims and Statements, apply to this certification and disclosure, if any.

<hr style="border: 0; border-top: 1px solid black; margin-bottom: 5px;"/> <p>Signature of Contractor's Authorized Official</p> <hr style="border: 0; border-top: 1px solid black; margin-bottom: 5px;"/> <p>Name and Title of Contractor's Authorized Official <i>(Please Print)</i></p> <hr style="border: 0; border-top: 1px solid black; margin-bottom: 5px;"/> <p>Date</p>

REQUIRED FORM
Bidder: Please complete this form and include with bid submission.

CONFLICT OF INTEREST QUESTIONNAIRE

CONFLICT OF INTEREST QUESTIONNAIRE		FORM CIQ
For vendor doing business with local governmental entity		OFFICE USE ONLY
<p>This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.</p> <p>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).</p> <p>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.</p> <p>A vendor commits an offense if the vendor knowingly violates Section 176.006, Local Government Code. An offense under this section is a misdemeanor.</p>	<p>Date Received</p>	
<p>1 Name of vendor who has a business relationship with local governmental entity.</p>		
<p>2 <input type="checkbox"/> Check this box if you are filing an update to a previously filed questionnaire.</p> <p>(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.)</p>		
<p>3 Name of local government officer about whom the information in this section is being disclosed.</p> <p style="text-align: center;">_____</p> <p style="text-align: center;">Name of Officer</p> <p>This section (item 3 including subparts A, B, C, & D) must be completed for each officer with whom the vendor has an employment or other business relationship as defined by Section 176.001(1-a), Local Government Code. Attach additional pages to this Form CIQ as necessary.</p> <p>A. Is the local government officer named in this section receiving or likely to receive taxable income, other than investment income, from the vendor?</p> <p style="text-align: center;"><input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>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 named in this section AND the taxable income is not received from the local governmental entity?</p> <p style="text-align: center;"><input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>C. Is the filer of this questionnaire employed by 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?</p> <p style="text-align: center;"><input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>D. Describe each employment or business and family relationship with the local government officer named in this section.</p>		
<p>4</p> <p style="text-align: center;">_____</p> <p style="text-align: center;">Signature of vendor doing business with the governmental entity</p> <p style="text-align: center;">_____</p> <p style="text-align: center;">Date</p>		

Adopted 8/7/2015

REQUIRED FORM
Bidder: Please complete this form and include with bid submission.

**LOCAL GOVERNMENT OFFICER
CONFLICTS DISCLOSURE STATEMENT – OFFICE USE ONLY**

LOCAL GOVERNMENT OFFICER CONFLICTS DISCLOSURE STATEMENT		FORM CIS
<p>This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.</p> <p>This is the notice to the appropriate local governmental entity that the following local government officer has become aware of facts that require the officer to file this statement in accordance with Chapter 176, Local Government Code.</p>		OFFICE USE ONLY
1	Name of Local Government Officer	Date Received
2	Office Held	
3	Name of vendor described by Sections 176.001(7) and 176.003(a), Local Government Code	
4	Description of the nature and extent of employment or other business relationship with vendor named in item 3	
5	<p>List gifts accepted by the local government officer and any family member, if aggregate value of the gifts accepted from vendor named in item 3 exceeds \$100 during the 12-month period described by Section 176.003(a)(2)(B).</p> <p>Date Gift Accepted _____ Description of Gift _____</p> <p>Date Gift Accepted _____ Description of Gift _____</p> <p>Date Gift Accepted _____ Description of Gift _____</p> <p style="text-align: center;">(attach additional forms as necessary)</p>	
6	<p>AFFIDAVIT</p> <p>I swear under penalty of perjury that the above statement is true and correct. I acknowledge that the disclosure applies to each family member (as defined by Section 176.001(2), Local Government Code) of this local government officer. I also acknowledge that this statement covers the 12-month period described by Section 176.003(a)(2)(B), Local Government Code.</p> <p style="text-align: right; margin-right: 100px;">_____</p> <p style="text-align: right; margin-right: 100px;">Signature of Local Government Officer</p> <p>AFFIX NOTARY STAMP / SEAL ABOVE</p> <p>Sworn to and subscribed before me, by the said _____, this the _____ day of _____, 20____, to certify which, witness my hand and seal of office.</p> <p>_____ Signature of officer administering oath Printed name of officer administering oath Title of officer administering oath</p>	

Adopted 8/7/2015

**THIS FORM IS FOR
OFFICE USE ONLY**

GOOD FAITH EFFORT (GFE) DETERMINATION CHECKLIST

Bidder intends to utilize subcontractors/subconsultants in the fulfillment of this contract (if awarded).

Yes No

Instructions: In order to determine if a “Good Faith Effort” was made in soliciting HUBs for subcontracting opportunities, the following checklist and supporting documentation shall be completed by the Prime Contractor/Consultant, and returned with the Prime Contractor/ Consultant’s bid. This list contains the **minimum** efforts that should be put forth by the Prime Contractor/Consultant when attempting to achieve or exceed the goals of HUB Subcontractor participation. The Prime Contractor/Consultant may extend his/her efforts in soliciting HUB Subcontractor participation beyond what is listed below.

Did the Prime Contractor/Consultant . . . ?

- | | | |
|------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> Yes | <input type="checkbox"/> No | 1. To the extent practical, and consistent with standard and prudent industry standards, divide the contract work into the smallest feasible portions, to allow for maximum HUB Subcontractor participation? |
| <input type="checkbox"/> Yes | <input type="checkbox"/> No | 2. Notify in writing a reasonable number of HUBs, allowing sufficient time for effective participation of the planned work to be subcontracted? |
| <input type="checkbox"/> Yes | <input type="checkbox"/> No | 3. Provide HUBs that were genuinely interested in bidding on a subcontractor, adequate information regarding the project (i.e., plans, specifications, scope of work, bonding and insurance requirements, and a point of contact within the Prime Contractor/Consultant’s organization)? |
| <input type="checkbox"/> Yes | <input type="checkbox"/> No | 4. Negotiate in good faith with interested HUBs, and not reject bids from HUBs that qualify as lowest and responsive Bidders? |
| <input type="checkbox"/> Yes | <input type="checkbox"/> No | 5. Document reasons HUBs were rejected? Was a written rejection notice, including the reason for rejection, provided to the rejected HUBs? |
| <input type="checkbox"/> Yes | <input type="checkbox"/> No | 6. If Prime Contractor/Consultant has zero (0) HUB participation, please explain the reasons why. |

**If “No” was selected, please explain and include any pertinent documentation with your bid.
If necessary, please use a separate sheet to answer the above questions.**

Printed Name of Authorized Representative

Signature

Title

Date

REQUIRED FORM

**Bidder: Please complete this form
and include with bid submission.**

**NOTICE OF INTENT (NOI) TO SUBCONTRACT WITH
HISTORICALLY UNDERUTILIZED BUSINESS (HUB)**

Bidder intends to utilize subcontractors/subconsultants in the fulfillment of this contract (if awarded).

Yes No

Instructions for Prime Contractor/Consultant: Bidder shall submit this form with the bid; however, the information below may be submitted after contract award, but prior to beginning performance on the contract. Please submit one form for each HUB Subcontractor/Subconsultant with proper signatures, per the terms and conditions of your contract.

Contractor Name: _____ HUB: Yes No

Address: _____
Street City State Zip

Phone (with area code): _____ Fax (with area code): _____

Project Title & No.: _____

Prime Contract Amount: \$ _____

HUB Subcontractor Name: _____

HUB Status (Gender & Ethnicity): _____

Certifying Agency: Tx. Bldg & Procurement Comm. Jefferson County Tx Unified Certification Prog.

Address: _____
Street City State Zip

Phone (with area code): _____ Fax (with area code): _____

Proposed Subcontract Amount: \$ _____ Percentage of Prime Contract: _____ %

Description of Subcontract Work to be Performed: _____

Printed Name of Contractor Representative Signature of Representative Date

Printed Name of HUB Signature of Representative Date

Note: Nothing on this Notice of Intent Form is intended to confer any rights, expressed or implied, to any third parties. Pre-Approval for Subcontractor Substitutions must be obtained from the Jefferson County Purchasing Agent's Representative. The "HUB Subcontractor/Subconsultant Change Form" must be completed and faxed to 409-835-8456.

REQUIRED FORM

Bidder: Please complete this form and include with bid submission.

**HISTORICALLY UNDERUTILIZED BUSINESS (HUB)
SUCONTRACTING PARTICIPATION DECLARATION FORM**

PAGE 1 OF 4

Bidder intends to utilize subcontractors/subconsultants in the fulfillment of this contract (if awarded).

Yes No

Prime Contractor: _____ HUB: Yes No

HUB Status (Gender & Ethnicity): _____

Address: _____
Street City State Zip

Phone (with area code): _____ Fax (with area code): _____

Project Title & No.: _____ IFB/RFP No.: _____

Total Contract: \$ _____ Total HUB Subcontract(s): \$ _____

Construction HUB Goals: 12.8% MBE: _____ % 12.6% WBE: _____ %

Sub-goals: 1.7 African-American, 9.7% Hispanic, 0.7% Native American, 0.8% Asian American.
Use these goals as a guide to diversify.

FOR HUB OFFICE USE ONLY:

Verification date HUB Program Office reviewed and verified HUB Sub information Date: _____ Initials: _____

PART I. HUB SUBCONTRACTOR DISCLOSURE

HUB Subcontractor Name: _____

HUB Status (Gender & Ethnicity): _____

Certifying Agency: Texas Bldg & Procurement Comm. Texas Unified Certification Prog.

Address: _____
Street City State Zip

Contact person: _____ Title: _____

Phone (with area code): _____ Fax (with area code): _____

Proposed Subcontract Amount: \$ _____ Percentage of Prime Contract: _____ %

Description of Subcontract Work to be Performed: _____

REQUIRED FORM
**Bidder: Please complete this form
and include with bid submission.**

**HISTORICALLY UNDERUTILIZED BUSINESS (HUB)
SUBCONTRACTING PARTICIPATION DECLARATION FORM**

PAGE 3 OF 4

PART II: STATEMENT OF NON-COMPLIANCE FOR NOT MEETING HUB SUBCONTRACTING GOALS

Please complete Good Faith Effort (GFE) Checklist and attach any supporting documentation.

Our firm was unable to meet the HUB goals for this project for the following reasons:

- All subcontractors to be utilized are "Non-HUBs." (Complete Part III)
- HUBs were solicited but did not respond.
- HUBs solicited were not competitive.
- HUBs were unavailable for the following trade(s):
- Other: _____

Was the Jefferson County HUB Office contacted for assistance in locating HUBs? Yes No

PART III: DISCLOSURE OF OTHER "NON-HUB" SUBCONTRACTS

The Bidder shall use this area to provide a listing of all "Non-HUB" Subcontractors, including suppliers, that will perform under this project. A list of those "Non-HUB" Subcontractors the Bidder selects, after bid submission, shall be provided to the Purchasing Office not later than five (5) calendar days after being notified that Bidder is the apparent low Bidder. A list of those "Non-HUB" Subcontractors that are selected after contract award must be provided **immediately** after their selection.

Subcontractor Name: _____

Address: _____
Street City State Zip

Contact person: _____ Title: _____

Phone (with area code): _____ Fax (with area code): _____

Proposed Subcontract Amount: \$ _____ Percentage of Prime Contract: _____ %

Description of Subcontract Work to be Performed: _____

Subcontractor Name: _____

Address: _____
Street City State Zip

Contact person: _____ Title: _____

Phone (with area code): _____ Fax (with area code): _____

Proposed Subcontract Amount: \$ _____ Percentage of Prime Contract: _____ %

Description of Subcontract Work to be Performed: _____

REQUIRED FORM
**Bidder: Please complete this form
and include with bid submission.**

**HISTORICALLY UNDERUTILIZED BUSINESS (HUB)
SUBCONTRACTING PARTICIPATION DECLARATION FORM**

PAGE 4 OF 4

Subcontractor Name: _____

Address: _____
 Street City State Zip

Contact person: _____ Title: _____

Phone (with area code): _____ Fax (with area code): _____

Proposed Subcontract Amount: \$ _____ Percentage of Prime Contract: _____ %

Description of Subcontract Work to be Performed: _____

Subcontractor Name: _____

Address: _____
 Street City State Zip

Contact person: _____ Title: _____

Phone (with area code): _____ Fax (with area code): _____

Proposed Subcontract Amount: \$ _____ Percentage of Prime Contract: _____ %

Description of Subcontract Work to be Performed: _____

I hereby certify that I have read the *HUB Program Instructions and Information*, truthfully completed all applicable parts of this form, and **attached any necessary support documentation as required**. I fully understand that intentionally falsifying information on this document may result in my not receiving a contract award or termination of any resulting contract.

Name (print or type): _____

Title: _____

Signature: _____

Date: _____

E-mail address: _____

Contact person that will be in charge of invoicing for this project:

Name (print or type): _____

Title: _____

Date: _____

E-mail address: _____

<p style="text-align: center;">REQUIRED FORM <u>Bidder</u>: Please complete this form and include with bid submission.</p>

RESIDENCE CERTIFICATION/TAX FORM

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

- (3) "Non-resident Bidder" refers to a person who is not a resident.
- (4) "Resident Bidder" refers to a person whose principal place of business is in this state, including a contractor whose ultimate parent company or majority owner has its principal place of business in this state.

- I certify that _____ [company name] is a Resident Bidder of Texas as defined in Government Code §2252.001.
- I certify that _____ [company name] is a Nonresident Bidder as defined in Government Code §2252.001 and our principal place of business is _____ (city and state).

Taxpayer Identification Number (T.I.N.):	
Company Name submitting bid/proposal:	
Mailing address:	
If you are an individual, list the names and addresses of any partnership of which you are a general partner:	

Property: List all taxable property owned by you or above partnerships in Jefferson County.

Jefferson County Tax Acct. No.*	Property address or location**

* This is the property amount identification number assigned by the Jefferson County Appraisal District.
 ** For real property, specify the property address or legal description. For business property, specify the address where the property is located. For example, office equipment will normally be at your office, but inventory may be stored as a warehouse or other location.

REQUIRED FORM
Bidder: Please complete this form and include with bid submission.

HOUSE BILL 89 VERIFICATION

I, _____, the undersigned representative of (company or business name) _____ (heretofore 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.

Pursuant to Section 2270.002, 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 ordinary business purposes; and

2. **“Company”** means a for-profit sole proprietorship, organization, association, corporation, partnership, joint venture, limited partnership, limited liability partnership, or an limited liability company, including a wholly owned subsidiary, majority-owned subsidiary, parent company or affiliate of those entities or business association that exist to make a profit.

Signature of Company Representative

Date

On this _____ 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

Date

<p style="text-align: center;">REQUIRED FORM Bidder: Please complete this form and include with bid submission.</p>

SENATE BILL 252 CERTIFICATION

On this day, I, Deborah L. Clark, Purchasing Agent for Jefferson County, Texas, pursuant to Texas Government Code, Chapter 2252, Section 2252.152 and Section 2252.153, certify that I did review the website of the Comptroller of the State of Texas concerning the listing of companies that is identified under Section 806.051, Section 807.051, or Section 2253.253 and I have ascertained that the below named company is not contained on said listing of companies which do business with Iran, Sudan, or any Foreign Terrorist Organization.

Company Name

IFB/RFP/RFQ number

Certification check performed by:

Purchasing Representative

Date

BID AFFIDAVIT

The undersigned certifies that the bid prices contained in this bid have been carefully reviewed and are submitted as correct and final. Bidder further certifies and agrees to furnish any and/or all commodities upon which prices are extended at the price offered, and upon the conditions contained in the specifications and the Notice to Bidders.

STATE OF _____ COUNTY OF _____

BEFORE ME, the undersigned authority, a Notary Public in and for the State of _____,

on this day personally appeared _____, who
(name)

after being by me duly sworn, did depose and say:

"I, _____ am a duly authorized officer of/agent
(name)
for _____ and have been duly authorized to execute the
(name of firm)
foregoing on behalf of the said _____.
(name of firm)

I hereby certify that the foregoing bid has not been prepared in collusion with any other Bidder or other person or persons engaged in the same line of business prior to the official opening of this bid. Further, I certify that the Bidder is not now, nor has been for the past six (6) months, directly or indirectly concerned in any pool or agreement or combination, to control the price of services/commodities bid on, or to influence any person or persons to bid or not to bid thereon."

Name and address of Bidder: _____

Fax: _____ Telephone# _____

by: _____ Title: _____
(print name)

Signature: _____

SUBSCRIBED AND SWORN to before me by the above-named
_____ on

this the _____ day of _____, 20__.

REQUIRED FORM
Bidder: Please complete this form and include with bid submission.

Notary Public in and for
the State of _____

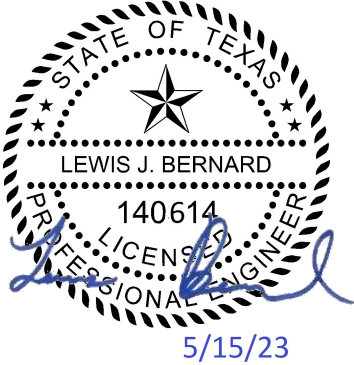
**CONTRACT DOCUMENTS
FOR CONSTRUCTION OF
CRANE BAYOU PUMP STATION
GENERATORS AND BUILDING**


Bid No. 23-035/JW

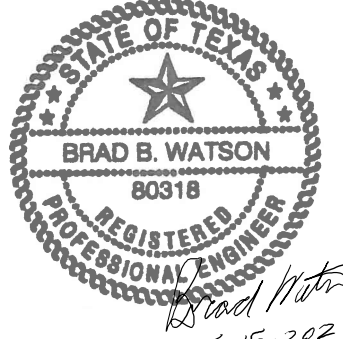



**100% Submittal
May 15th, 2023**


00 01 07 DESIGN PROFESSIONAL SEALS

	Specification Sections Sealed		
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	00 01 07	Design Professional Seals	
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	00 61 13	Performance Bond	
	00 61 16	Payment Bond	
	00 73 00	Supplementary Conditions	
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	<p>Freese and Nichols Inc. Texas Registered Engineering Firm F-2114</p>	Division 01	General Requirements
		01 11 00	Summary of Work
01 26 00		Change Management	
01 29 00		Application for Payment Procedures	
01 29 01		Measurement and Basis for Payment	
01 31 00		Project Management and Coordination	
01 31 13		Project Administration	
01 33 00		Document Management	
01 33 02		Shop Drawings	
01 33 03		Product Data	
01 33 04		Operation and Maintenance Data	
01 33 05		Construction Progress Schedule	
01 33 06		Graphic Documentation	
01 35 00		Special Procedures	
01 40 00		Quality Management	
01 40 01		IBC Special Inspections	
01 50 00		Temporary Facilities and Controls	
01 57 00		Temporary Controls	
01 57 23		Temporary Stormwater Pollution Control	
01 60 00		Product Requirements	
01 70 00		Execution and Closeout Requirements	
01 74 23		Final Cleaning	
01 75 00		Starting and Adjusting	
01 79 00	Training of Operation and Maintenance Personnel		
Division 32	Exterior Improvements		
32 12 16	Asphalt Paving		

	Specification Sections Sealed	
	Division 5 05 52 13	Metals Pipe and Tube Railings
<p style="text-align: center;">Freese and Nichols Inc. Texas Registered Engineering Firm F-2114</p>	Division 6 06 10 00	Woods, Plastics and Composites Rough Carpentry
	Division 7 07 52 16	Thermal and Moisture Protection Styrene-Butadiene-Styrene (Sbs) Modified Bituminous Membrane Roofing
	07 62 00	Sheet Metal Flashing and Trim
	07 84 13	Penetration Firestopping
	07 92 00	Joint Sealants
	Division 8 08 11 13	Openings Hollow Metal Doors and Frames
	08 33 23	Overhead Coiling Doors
	08 71 00	Door Hardware
	Division 9 09 91 00	Finishes Painting
	Division 10 10 44 01	Specialties Fire Extinguishers

	Specification Sections Sealed	
	Division 03 03 11 00	Concrete Concrete Forming
<p style="text-align: center;">Freese and Nichols Inc. Texas Registered Engineering Firm F-2114</p>	03 21 00	Reinforcing Steel
	03 30 00	Cast in Place Concrete
	03 41 00	Plant Precast Structural Concrete
	Division 31 31 23 10	Earthwork Structural Excavation and Backfill
	31 05 13	Soils for Earthwork

	Specification Sections Sealed	
	Division 8 08 90 00	Openings Louvers and Vents
Freese and Nichols Inc. Texas Registered Engineering Firm F-2114	Division 23 23 05 13	HVAC Common Motor Requirements for HVAC Equipment
	23 05 29	Hangers and Supports for HVAC Piping and Equipment
	23 05 53	Identification for HVAC Piping and Equipment
	23 05 93	Testing, Adjusting, and Balancing for HVAC
	23 31 13	Metal Ducts
	23 34 23	HVAC Power Ventilators
	23 35 16	Engine Exhaust Piping and Specialties

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	Division 26 26 05 00	Electrical Basic Electrical Methods
Freese and Nichols Inc. Texas Registered Engineering Firm F-2114	26 05 19	Equipment Wiring Systems
	26 05 26	Grounding and Bonding
	26 05 29	Supporting Devices
	26 05 33	Conduits
	26 05 33.16	Boxes
	26 05 53	Electrical Identification
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	26 24 16	Panelboards and Switchboards
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	26 27 26	Wiring Devices
	26 28 16	Low Voltage Enclosed Circuit Breakers and Switches
	26 32 13	Diesel Engine Drive Generator Sets
	26 36 00	Automatic Transfer Switches
	26 43 13	Surge Protection Device for Low-Voltage Electrical Power Circuits
	26 51 00	Interior Lighting
26 56 00	Exterior Lighting	

END OF SECTION

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01 11 00	Summary of Work
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01 29 00	Application for Payment Procedures
01 29 01	Measurement and Basis for Payment
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01 31 13	Project Administration
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01 33 04	Operation and Maintenance Data
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01 33 06	Graphic Documentation
01 35 00	Special Procedures
01 40 00	Quality Management
01 40 01	IBC Special Inspections
01 50 00	Temporary Facilities and Controls
01 57 00	Temporary Controls
01 57 23	Temporary Stormwater Pollution Control
01 60 00	Product Requirements
01 70 00	Execution and Closeout Requirements
01 74 23	Final Cleaning
01 75 00	Starting and Adjusting
01 79 00	Training of Operation and Maintenance Personnel
Division 03	Concrete
03 11 00	Concrete Forming

Section	Title
03 21 00	Reinforcing Steel
03 30 00	Cast in Place Concrete
03 41 00	Plant Precast Structural Concrete
Division 5	Metals
05 52 13	Pipe and Tube Railings
Division 6	Woods, Plastics and Composites
06 10 00	Rough Carpentry
Division 7	Thermal and Moisture Protection
07 52 16	Styrene-Butadiene-Styrene (SBS) Modified Bituminous Membrane Roofing
07 62 00	Sheet Metal Flashing and Trim
07 84 13	Penetration Firestopping
07 92 00	Joint Sealants
Division 8	Openings
08 11 13	Hollow Metal Doors and Frames
08 33 23	Overhead Coiling Doors
08 71 00	Door Hardware
08 90 00	Louvers and Vents
Division 9	Finishes
09 91 00	Painting
Division 10	Specialties
10 44 01	Fire Extinguishers
Division 23	HVAC
23 05 13	Common Motor Requirements for HVAC Equipment
23 05 29	Hangers and Supports for HVAC Piping and Equipment
23 05 53	Identification for HVAC Piping and Equipment
23 05 93	Testing, Adjusting, and Balancing for HVAC
23 31 13	Metal Ducts
23 34 23	HVAC Power Ventilators
23 35 16	Engine Exhaust Piping and Specialties
Division 26	ELECTRICAL
26 05 00	Basic Electrical Methods
26 05 19	Equipment Wiring Systems
26 05 26	Grounding and Bonding
26 05 29	Supporting Devices

Section	Title
26 05 33	Conduit
26 05 33.16	Boxes
26 05 53	Electrical Identification
26 05 73	Power System Studies
26 22 13	Low Voltage Distribution Transformers
26 24 16	Panelboards and Switchboards
26 24 19	Motor-Control Centers
26 27 26	Wiring Devices
26 28 16	Low Voltage Enclosed Circuit Breakers and Switches
26 32 13	Diesel Engine Drive Generator Sets
26 36 00	Automatic Transfer Switches
26 43 13	Surge Protection Device for Low-Voltage Electrical Power Circuits
26 51 00	Interior Lighting
26 56 00	Exterior Lighting
Division 31	Earthwork
31 05 13	Soils for Earthwork
31 23 10	Structural Excavation and Backfill
Division 32	Exterior Improvements
32 12 16	Asphalt Paving
Appendix A	Geotechnical Engineering Report – No 129545

END OF SECTION

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00 41 13 BID FORM

ARTICLE 1 – BID RECIPIENT

1.01 Offeror submits this Bid to:

**Jefferson County
Purchasing Department
1149 Pearl St. First Floor
Beaumont, TX, 77701
Attention: Jamey West
Crane Bayou Pump Station Generators and Building**

ARTICLE 2 – OFFEROR’S ACKNOWLEDGMENTS

- 2.01 Offeror proposes and agrees, if this Bid is accepted, to enter into an Agreement with the Owner on the form included in the Contract Documents and to perform all Work specified or indicated in Contract Documents for the Contract Price indicated in this Bid or as modified by Contract Amendment. Offeror agrees to complete the Work within the Contract Times established in the Agreement or as modified by Contract Amendment and comply with all terms and conditions of the Contract Documents.
- 2.02 Offeror accepts all terms and conditions of Section 00 11 16 “Invitation to Bid” and Section 00 21 13 “Instructions to Offerors.”
- 2.03 Offeror accepts the provisions of the Agreement as to liquidated damages in the event of its failure to complete Work in accordance with the schedule set forth in the Agreement.
- 2.04 Offeror acknowledges receipt of the following Addenda:

Addendum No.	Addendum Date	Signature Acknowledging Receipt

ARTICLE 3 – OFFEROR’S REPRESENTATIONS

- 3.01 Offeror has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
- 3.02 Offeror has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- 3.03 Offeror is familiar with Laws and Regulations that may affect cost, progress, and performance of the Work.
- 3.04 Offeror has carefully studied the following Site-related reports and drawings as identified in the Supplementary Conditions:
 - A. Geotechnical Data Reports regarding subsurface conditions at or adjacent to the Site;

- B. Drawings of physical conditions relating to existing surface or subsurface structures at the Site;
 - C. Underground Facilities referenced in reports and drawings;
 - D. Reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site; and
 - E. Technical Data related to each of these reports and drawings.
- 3.05 Offeror has considered the:
- A. Information known to the Offeror;
 - B. Information commonly known to contractors doing business in the locality of the Site;
 - C. Information and observations obtained from visits to the Site; and
 - D. The Contract Documents.
- 3.06 Offeror has considered the items identified in this Article with respect to the effect of such information, observations, and documents on:
- A. The cost, progress, and performance of the Work;
 - B. The means, methods, techniques, sequences, and procedures of construction to be employed by Offeror; and
 - C. Offeror's safety precautions and programs.
- 3.07 Offeror agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents based on the information and observations referred to in the preceding paragraphs.
- 3.08 Offeror is aware of the general nature of Work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
- 3.09 Offeror has correlated the information known to the Offeror, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- 3.10 Offeror has given the Construction Manager written notice of all conflicts, errors, ambiguities, or discrepancies that the Offeror has discovered in the Contract Documents, and the written resolution provided by the Construction Manager is acceptable to the Offeror.
- 3.11 The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
- 3.12 Offeror's submittal of a Bid constitutes an incontrovertible representation that, without exception, all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

ARTICLE 4 – BASIS OF OFFER

- 4.01 Offeror will complete the Work in accordance with the Contract Documents at the unit prices shown in the attached in Section 00 41 16 “Bid Form Exhibit A”:
- A. Extended amounts have been computed in accordance with the General Conditions.
 - B. Offeror acknowledges that the estimated quantities are not guaranteed, and final payment for all unit price items will be based on actual quantities provided, measured as provided in the Contract Documents.
 - C. Unit prices will be used to compute the actual Bid price.

ARTICLE 5 – TIME OF COMPLETION

- 5.01 Offeror will complete the Work required to be substantially completed within 500calendar days after the date when the Contract Times commence to run as provided in the General Conditions. Offeror will complete the Work required for final payment in accordance with the General Conditions within 530days after the date when the Contract Times commence to run.

ARTICLE 6 – ATTACHMENTS TO THIS BID

- 6.01 The following documents are attached to and made a condition of this Bid:
- A. Contract documents provided by Jefferson County, TX.
 - B. Section 00 41 16 “Bid Form Exhibit A.”

ARTICLE 7 – VENUE

- 7.01 Offeror agrees that venue will lie exclusively in Jefferson County, Texas for any legal action.

ARTICLE 8 – BID DELIVERY

8.01 This Bid is submitted by:

Offeror: _____
(typed or printed name of organization)

Signature: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Address for giving notices:

Phone: _____ Email: _____
(Attach evidence of authority to sign if Offeror is a corporation, partnership, or a joint venture.)

END OF SECTION

00 41 16 Bid Form Exhibit A

Project:	Crane Bayou Pump Station Generators and Building		Project No.:			
Owner:	Jefferson County		IFB 23-035			
Design Professional:	Freese and Nichols, Inc.		JFF22292			
Offeror:						
Base Bid						
Item No.	Item Description	Unit	Estimated Quantity	Unit Price	Extended Amount	
Items in Base Bid (excluding Allowances) per Section 01 29 01 "Measurement and Basis for Payment"						
A-01	Mobilization	LS	1			
A-02	All other Work	LS	1			
A	Total Base Bid Items Amount (Sum of Extended Amounts for each Base				\$	-

BID SUBMITTED BY:	
Offeror:	_____
Signature:	_____
Printed Name:	_____
Title:	_____
Date:	_____

BIDDER ACKNOWLEDGEMENT OF BID ADDENDA (IF APPLICABLE):	
Addendum 1	Date Received _ _
Addendum 2	Date Received _ _
Addendum 3	Date Received _ _
BIDDER: INCLUDE FULL, SIGNED, & ATTESTED COPY OF EACH ADDENDUM ISSUED WITH BID SUBMISSION.	

REQUIRED FORM
Bidder: Please complete this form and include with bid submission.

00 43 13 BID BOND

Owner will accept this form or other submission that includes the information requested herein

<p>Offeror as Principal</p> <p>Name:</p> <p>Mailing address (principal place of business):</p>	<p>Surety</p> <p>Name:</p> <p>Mailing address (principal place of business):</p>
<p>Owner</p> <p>Name:</p> <p>Mailing address (principal place of business):</p>	<p>Physical address (principal place of business):</p> <p>Telephone (Main):</p> <p>Telephone (Claims):</p>
<p>Contract</p> <p>Project name and number:</p> <p>Bid/Proposal Due Date:</p>	<p>Surety's state of incorporation:</p> <p><i>By submitting this bond, Surety affirms it is authorized to do business and licensed to execute bonds in the state where the Project is located.</i></p> <p>Local Agent for Surety</p> <p>Name:</p>
<p>Bond</p> <p>Contract Price Offered:</p> <p>Penal Sum of Bond:</p> <p>5% of Contract Price offered</p> <p>Date of Bond:</p>	<p>Company:</p> <p>Mailing address (principal place of business):</p> <p>Telephone (Main):</p>

Surety and Offeror, intending to be legally bound by this bond, do each cause this bond to be duly executed on its behalf by its authorized officer, agent, or representative. Surety and Offeror bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally to this bond. The condition of this obligation is such that if Owner accepts the Offeror's Bid or Proposal and Offeror delivers the executed Agreement and the required bonds and evidence of insurance within the time stipulated in the Bidding or Proposal Documents this obligation is null and void. Payment under this bond will be due and payable upon default by Offeror and within 30 days after receipt by Offeror and Surety of written notice of default from Owner. This Agreement shall be administered and interpreted under the laws of the state where the Project is located. Venue lies exclusively in Jefferson County, Texas for any legal action.

<p>Offeror as Principal</p> <p>Signature: _____</p> <p>Name: _____</p> <p>Title: _____</p> <p>Email: _____</p>	<p>Surety</p> <p>Signature: _____</p> <p>Name: _____</p> <p>Title: _____</p> <p>Email: _____</p> <p style="text-align: right;"><i>(Attach Power of Attorney)</i></p>
-----------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------

END OF SECTION

00 52 13 AGREEMENT

This Agreement is between **Jefferson County** (Owner) and **[name of Contractor to be inserted at time of Contract execution]** (Contractor).

Owner and Contractor agree as follows:

ARTICLE 1 – WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is designated as follows:

Crane Bayou Pump Station Generators and Building
Jefferson County Bid No. 23-035/JW

ARTICLE 2 – DESIGN PROFESSIONAL

2.01 The Design Professional for this Project is:

Freese and Nichols, Inc
10497 Town and Country Way, Suite 500
Houston, TX 77024

ARTICLE 3 – CONSTRUCTION MANAGER

3.01 The Construction Manager for this Project is:

Freese and Nichols, Inc
10497 Town and Country Way, Suite 500
Houston, TX 77024

ARTICLE 4 – CONTRACT TIMES

4.01 Contract Times

A. The Work is required to be substantially complete within **450** days after the date when the Contract Times commence to run as provided in the General Conditions and complete and ready for final payment in accordance with the General Conditions within **30** days after the date of Substantial Completion.

4.02 Liquidated Damages

A. Owner and Contractor recognize that the Contract Times specified Substantial Completion and Final Completion are of the essence in the Contract. Owner and Contractor recognize that the Owner will suffer financial loss if the Work is not completed within the Contract Times specified in this Agreement and in Section 01 35 00 "Special Procedures" as may be adjusted in accordance with the General Conditions. Owner and Contractor also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed within the Contract Times.

Accordingly, instead of requiring proof of the amount of these damages, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. Contractor agrees to pay Owner \$500 for each day that expires after the time specified in this Agreement for Substantial Completion until the Work is substantially complete.
 2. Contractor agrees to pay Owner \$500 for each day that expires after the time specified in this Agreement for Final Completion until the Work is completed and ready for final payment in accordance with the General Conditions.
- B. Liquidated damages for failing to timely attain Substantial Completion and Final Completion are not additive and will not be imposed concurrently.
- C. OPT will determine whether the Work has been completed within the Contract Times. Assessment of liquidated damages by the Owner does not waive the Owner's right to assess or collect additional damages which the Owner may sustain by the failure of the Contractor to perform in accordance with the terms of the Contract.

ARTICLE 5 – CONTRACT PRICE

5.01 Owner will pay Contractor for completion of the Work in accordance with the Contract Documents at the prices shown in this Agreement. The Contract Price has been computed in accordance with the General Conditions. Contractor acknowledges that for unit price items, estimated quantities are not guaranteed and are solely for the purpose of comparing Bids, and that final payment will be based on actual quantities determined in accordance with the Contract Documents.

ARTICLE 6 – PAYMENT PROCEDURES

- 6.01 Submit Applications for Payment in accordance with the General Conditions. Applications for Payment will be processed by the Construction Manager per Section 01 29 00 "Application for Payment Procedures."
- 6.02 Owner will make progress payments on or about the second Tuesday of each month during performance of the Work. Jefferson County pays on a "Net 30" basis, meaning it has up to pay 30 days to pay invoices from their date of issuance. Payment is based on the total earned value of Work completed in the previous month in accordance with the Schedule of Values established as provided in the General Conditions.
- 6.03 Payment will be made for the total earned value of Work completed in the previous month after deducting:
- A. Retainage calculated per this Agreement;
 - B. Set-offs determined in accordance with the General Conditions; and
 - C. The total amount of payments previously made.
- 6.04 Retainage
- A. Progress payments will be made in an amount equal to 90 percent of the total earned value to date for completed Work and properly stored materials. The remaining 10 percent of the total earned value to date will be held as retainage in accordance with Tex. Prop. Code Chapter 53.

- B. Progress payments will be made in an amount equal to 90 percent of the total earned value to date for completed Work and properly stored materials. The remaining 10 percent of the total earned value to date will be held as retainage in accordance with Tex. Gov't Code Chapter 2252.
- 6.05 Release or reduction in retainage is contingent upon the consent of surety to the reduction in retainage. Submit a Consent of Surety Company to Reduction of or Partial Release of Retainage form as provided by or approved by the Construction Manager.
- 6.06 Owner will pay the remainder of the Contract Price as recommended by Construction Manager in accordance with the General Conditions upon Final Completion and acceptance of the Work.

ARTICLE 7 – PAYMENT OF INTEREST

- 7.01 No interest payments will be paid to the Contractor for invoices not paid when due as provided in the General Conditions.

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

- 8.01 The Contractor makes the following representations:
- A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.
 - B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
 - C. Contractor is familiar with Laws and Regulations that may affect cost, progress, and performance of the Work.
 - D. Contractor has carefully studied the following Site related reports and drawings as identified in the Supplementary Conditions:
 - 1. Geotechnical Data Reports regarding subsurface conditions at or adjacent to the Site;
 - 2. Drawings of physical conditions relating to existing surface or subsurface structures at the Site;
 - 3. Underground Facilities referenced in reports and drawings;
 - 4. Reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site; and
 - 5. Technical Data related to each of these reports and drawings.
 - E. Contractor has considered the:
 - 1. Information known to Contractor;
 - 2. Information commonly known to contractors doing business in the locality of the Site;
 - 3. Information and observations obtained from visits to the Site; and
 - 4. The Contract Documents.

- F. Contractor has considered the items identified in this Article with respect to the effect of such information, observations, and documents on:
 - 1. The cost, progress, and performance of the Work;
 - 2. The means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and
 - 3. Contractor's safety precautions and programs.
- G. Based on the information and observations referred to in the preceding paragraphs, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.
- H. Contractor is aware of the general nature of Work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
- I. Contractor has correlated the information known to the Contractor, information and observations obtained from visits to the Site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- J. Contractor has given the Construction Manager written notice of all conflicts, errors, ambiguities, or discrepancies that the Contractor has discovered in the Contract Documents, and the written resolution provided by the Construction Manager is acceptable to the Contractor.
- K. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
- L. Contractor's entry into this Agreement constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

ARTICLE 9 – ACCOUNTING RECORDS

- 9.01 Accounting Record Availability: Contractor is to establish and maintain, in accordance with generally accepted accounting practices, full and detailed accounting records of materials incorporated into the Project, and labor, tools, materials, and equipment used for the Work, consistent with the requirements of the General Conditions and as necessary for proper financial management under this Agreement. Subject to prior written notice, provide Owner reasonable access during normal business hours to Contractor's records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and the Contractor's fee. Preserve all such documents for a period of 3 years after the final payment by the Owner.

ARTICLE 10 – OTHER REQUIREMENTS

- 10.01 Ineligibility to Receive State Grants or Loans or Receive Payment on State Contracts: As required by Tex. Fam. Code Section 231.006, Contractor certifies that the individual or business entity named in this contract, bid, or application is not ineligible to receive the specified grant, loan, or

payment and acknowledges that this Contract may be terminated and payment may be withheld if this certification is inaccurate.

10.02 Workers' Compensation Insurance

- A. By signing this Agreement, Contractor certifies that it provides workers' compensation insurance coverage for all employees employed on this Project pursuant to Tex. Lab. Code Section 406.096(a).
- B. As required by Section 406.096(b), Contractor must require each Subcontractor to certify in writing to the Contractor that the Subcontractor provides workers' compensation insurance coverage for all of the employees it employs on this Project. Contractor must provide these certifications to the Owner within **[10]** days of the Effective Date of the Agreement.

10.03 Contracts Prohibited by Tex. Gov't Code Chapter 2155

A. Section 2155.004:

- 1. Section 2155.004 states that "a state agency may not accept a bid or award a contract that includes proposed financial participation by a person who received compensation from the agency to participate in preparing the specifications or request for proposals on which the bid or contract is based."
- 2. Under Section 2155.004, Government Code, Contractor certifies that the individual or business entity named in this bid or contract is not ineligible to receive the specified Contract and acknowledges that this Contract may be terminated and payment withheld if this certification is inaccurate.

B. Section 2155.006:

- 1. Section 2155.006 states that "a state agency may not accept a bid or award a contract, including a contract for which purchasing authority is delegated to a state agency, that includes proposed financial participation by a person who, during the five-year period preceding the date of the bid or award, has been: (1) convicted of violating a federal law in connection with a contract awarded by the federal government for relief, recovery, or reconstruction efforts as a result of Hurricane Rita, as defined by Section 39.459, Utilities Code, Hurricane Katrina, or any other disaster occurring after September 24, 2005; or (2) assessed a penalty in a federal civil or administrative enforcement action in connection with a contract awarded by the federal government for relief, recovery, or reconstruction efforts as a result of Hurricane Rita, as defined by Section 39.459, Utilities Code, Hurricane Katrina, or any other disaster occurring after September 24, 2005.
- 2. Under Section 2155.006, Government Code, Contractor certifies that the individual or business entity named in this bid or contract is not ineligible to receive the specified Contract and acknowledges that this Contract may be terminated and payment withheld if this certification is inaccurate.

10.04 Prohibition on Contracts with Companies Engaged in Business with Iran, Sudan, or Foreign Terrorist Organizations

- A. Tex. Gov't Code Chapter 2252, Subchapter F, prohibits the award of governmental contracts to companies engaged in business with Iran, Sudan, or foreign terrorist organizations.

- B. By signing this Agreement, Contractor certifies that it is not ineligible to be awarded this Contract under Chapter 2252, Subchapter F.
- 10.05 Prohibition on Contracts with Certain Companies that Boycott Israel
- A. Tex. Gov't Code Chapter 2271 prohibits a governmental entity from entering into a contract with a company for goods or services unless the contract contains a written verification from the company that it: (1) does not boycott Israel; and (2) will not boycott Israel during the term of the contract.
 - B. By signing this Agreement, Contractor certifies that it does not boycott Israel and will not boycott Israel during the term of this Contract.
- 10.06 Prohibition on Contracts with Certain Foreign-Owned Companies in Connection with Critical Infrastructure
- A. Tex. Gov't Code Chapter 2274, as added by SB 2116 during the 87th Leg., prohibits a governmental entity from entering into certain contracts or other agreements relating to critical infrastructure if the governmental entity knows that the company has ownership interests held or controlled by citizens or the governments of China, Iran, North Korea, Russia or other countries designated by the State of Texas.
 - B. By signing this Agreement, Contractor certifies that it is not ineligible to be awarded this Contract under this Chapter 2274.
- 10.07 Prohibition on Contracts with Companies Boycotting Certain Energy Companies
- A. Tex. Gov't Code Chapter 2274, as added by SB 13 during the 87th Leg., prohibits a governmental entity from entering into a contract with a company for goods or services unless the contract contains a written verification from the company that it: (1) does not boycott energy companies; and (2) will not boycott energy companies during the term of the contract.
 - B. By signing this Agreement, Contractor certifies that it does not boycott energy companies and will not boycott energy companies during the term of this Contract.
- 10.08 Prohibition on Contracts with Companies That Discriminate Against Firearm and Ammunition Industries
- A. Tex. Gov't Code Chapter 2274, as added by SB 19 during the 87th Leg., prohibits a governmental entity from entering into a contract with a company for goods or services unless the contract contains a written verification from the company 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.
 - B. By signing this Agreement, Contractor certifies that it does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association and will not discriminate against a firearm entity or firearm trade association during the term of the contract.
- 10.09 Certificate of Interested Parties: Contractor must complete and submit a Certificate of Interested Parties (Form 1295) to the Owner with the signed Agreement as required by Tex. Gov't Code Section 2252.908.

ARTICLE 11 – VENUE

11.01 Contractor agrees that venue lies exclusively in Jefferson County, Texas for any legal action.

ARTICLE 12 – CONTRACT DOCUMENTS

12.01 Contract Documents

- A. Specifications Sections listed in Section 00 01 10 “Table of Contents”
- B. Drawings listed in the Sheet Index on the Drawings
- C. Addenda (Numbers 00 91 01 to 00 91 **[XX]**, inclusive).
- D. Appendices listed in Section 00 01 10 “Table of Contents” except as specifically excluded in Paragraph **12.02**.
- E. The following Funding Agency forms are Contract Documents:
 1. **[List Funding Agency forms which are to be included as Contract Documents by Section Number or by Title.]**
- F. The following are also Contract Documents which may be delivered or issued on or after the Effective Date of the Contract:
 1. Notice to Proceed.
 2. Contract Amendment(s).
 3. Change Order(s).
 4. Field Order(s).
 5. Work Change Directive(s).
- G. There are no Contract Documents other than those listed above in this Paragraph. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

12.02 Informational Documents

- A. The following documents are provided for information only and are not part of the Contract Documents:
 1. Geotechnical Investigation Report.

The Effective Date of the Contract is **[date to be inserted at the time of contract execution]**.

Owner: _____ Contractor: _____
(typed or printed) *(typed or printed)*

By: _____ By: _____
(individual's signature) *(individual's signature)*

Name: _____ Name: _____
(typed or printed) *(typed or printed)*

Title: _____ Title: _____
(typed or printed) *(typed or printed)*
(Attach evidence of authority to sign)

Address for giving notice: _____ Address for giving notice: _____

Designated representative: _____ Designated representative: _____
Name: _____ Name: _____
Title: _____ Title: _____
Address: _____ Address: _____

Phone: _____ Phone: _____

Email: _____ Email: _____

END OF SECTION

00 61 13 PERFORMANCE BOND

Owner will accept this form or other submission that includes the information requested herein.

<p>Contractor as Principal</p> <p>Name:</p> <p>Mailing address (principal place of business):</p>	<p>Surety</p> <p>Name:</p> <p>Mailing address (principal place of business):</p>
<p>Owner</p> <p>Name: Jefferson County, Texas</p> <p>Mailing address (principal place of business):</p> <p>Jefferson County 1149 Pearl Street 1st Floor Beaumont, TX 77701</p>	<p>Physical address (principal place of business):</p> <p>Telephone (Main):</p> <p>Telephone (Claims):</p>
<p>Contract</p> <p>Project name and number: JFF22292</p> <p>Contract Price:</p> <p>Effective Date of Contract:</p>	<p>Surety's state of incorporation:</p> <p><i>By submitting this bond, Surety affirms that it is licensed to provide and execute this bond and authorized to do business in Texas.</i></p> <p>Local Agent for Surety</p> <p>Name:</p> <p>Mailing address (principal place of business):</p>
<p>Bond</p> <p>Bond Amount: 100 percent of Contract Price</p> <p>Date of Bond:</p> <p>(Date of Bond cannot be earlier than Effective Date of Contract)</p>	<p>Telephone (Main):</p> <p><i>The address of the surety company to which any notice of claim should be sent may be obtained from the Texas Dept. of Insurance by calling the following toll-free number: 1-800-252-3439.</i></p>

Surety and Contractor, intending to be legally bound and obligated to Owner, do each cause this performance bond to be duly executed on its behalf by its authorized officer, agent, or representative. The Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally to this bond. The condition of this obligation is such that if the Contractor as Principal faithfully performs the Work required by the Contract then this obligation will be null and void; otherwise the obligation is to remain in full force and effect. Provisions of this bond shall be pursuant to the terms and provisions of Texas Government Code Chapter 2253 as amended and all liabilities on this bond shall be determined in accordance with the terms and provisions of said Chapter to the same extent as if it were copied at length herein. Venue lies exclusively in [specify name] County, Texas for any legal action.

Contractor as Principal	Surety
Signature: _____	Signature: _____
Name: _____	Name: _____
Title: _____	Title: _____
Email: _____	Email: _____
	<i>(Attach Power of Attorney and place surety seal below)</i>

END OF SECTION

00 61 16 PAYMENT BOND

Owner will accept this form or other submission that includes the information requested herein.

<p>Contractor as Principal</p> <p>Name:</p> <p>Mailing address (principal place of business):</p>	<p>Surety</p> <p>Name:</p> <p>Mailing address (principal place of business):</p>
<p>Owner</p> <p>Name: Jefferson County, Texas</p> <p>Mailing address (principal place of business):</p> <p>Jefferson County 1149 Pearl Street 1st Floor Beaumont, TX 77701</p>	<p>Physical address (principal place of business):</p> <p>Telephone (Main):</p> <p>Telephone (Claims):</p>
<p>Contract</p> <p>Project name and number: JFF22292</p> <p>Contract Price:</p> <p>Effective Date of Contract:</p>	<p>Surety's state of incorporation:</p> <p><i>By submitting this bond, Surety affirms that it is licensed to provide and execute this bond and authorized to do business in Texas.</i></p> <p>Local Agent for Surety</p> <p>Name:</p> <p>Mailing address (principal place of business):</p>
<p>Bond</p> <p>Bond Amount: 100 percent of Contract Price</p> <p>Date of Bond:</p> <p>(Date of Bond cannot be earlier than Effective Date of Contract)</p>	<p>Telephone (Main):</p> <p><i>The address of the surety company to which any notice of claim should be sent may be obtained from the Texas Dept. of Insurance by calling the following toll-free number: 1-800-252-3439.</i></p>

Surety and Contractor intending to be legally bound and obligated to Owner do each cause this payment bond to be duly executed on its behalf by its authorized officer, agent, or representative. The Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally to this bond. The condition of this obligation is such that if the Contractor as Principal pays all claimants providing labor or materials to Contractor or to a Subcontractor in the prosecution of the Work required by the Contract then this obligation will be null and void; otherwise the obligation is to remain in full force and effect. Provisions of the bond shall be pursuant to the terms and provisions of Texas Government Code Chapter 2253 as amended and all liabilities on this bond shall be determined in accordance with the terms and provisions of said Chapter to the same extent as if it were copied at length herein. Venue lies exclusively in [specify name] County, Texas for any legal action.

Contractor as Principal	Surety
Signature: _____	Signature: _____
Name: _____	Name: _____
Title: _____	Title: _____
Email: _____	Email: _____
	<p><i>(Attach Power of Attorney and place surety seal below)</i></p>

END OF SECTION

00 73 00 SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement Section 00 72 00 "General Conditions." The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below.

The paragraph numbers used in the Supplementary Conditions correspond to the General Condition paragraphs they modify with the prefix "SC" added—for example, "Paragraph SC-4.05." modifies General Conditions Paragraph 4.05.

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

SC-1.01 *Defined Terms*

- A. The Owner's Project Team as defined in the Paragraph 1.01.A.45 of the General Conditions consists of the following organizations:
 - 1. Jefferson County, Texas, 1149 Pearl Street, 1st Floor, Beaumont, Texas 77701
 - 2. Freese and Nichols, Inc., 10497 Town and Country Way, Suite 500, Houston, Texas 77024
 - 3. Tolunay-Wong Engineers, 10710 S. Sam Houston Pkwy. W, Ste. 100, Houston, TX 77031
- B. Replace Defined Term #12, Construction Manager, with the following:

Construction Manager—The Jefferson County representative or staff assigned to manage the construction progress of the Project on behalf of the Owner (i.e. Jefferson County).
- C. Add as Defined Term #69: *County Front End Specifications* – The Jefferson County front end bid specification document to which the Division 00 and 01 and all Technical Specifications are attached to, titled "LEGAL NOTICE, Advertisement for Invitation for Bids, November 29, 2022".

ARTICLE 2 – PRELIMINARY MATTERS

SC-2.02 *Copies of Documents*

- A. Delete Paragraph 2.02.A in its entirety and insert the following in its place:
 - "A. Owner will furnish 1 printed copy of the Contract Documents (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction."

ARTICLE 5 – SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

SC-5.03 Subsurface and Physical Conditions

- A. This Supplementary Condition identifies the reports and drawings referenced in Paragraph 5.03 of the General Conditions related to subsurface and physical conditions.
 - 1. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Report Date	Technical Data
<i>Geotechnical Engineering Report Emergency Generator Building Crane Bayou Pumping Station Jefferson County Drainage District No. 7 Port Arthur, Texas by Tolunay- Wong Engineers, Inc.</i>	May 13, 2022	Appendix A – Geotechnical Report

SC-5.06 Hazardous Environmental Conditions at Site

- A. This Supplementary Condition identifies the reports and drawings referenced in Paragraph 5.06 of the General Conditions related to Hazardous Environmental Conditions at the Site.
 - 1. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely:

NONE
 - 2. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely:

NONE

ARTICLE 7 – CONTRACTOR’S RESPONSIBILITIES

SC-7.15 Indemnification

- A. Supplement Paragraph 7.15 by adding the following paragraph:
 - “C. Contractor’s obligations to indemnify or hold Owner’s Indemnitees harmless against losses, damages, or expenses specified in these General Conditions shall be subject to the applicable limitations of Chapter 130 of the Texas Civil Practice and Remedies Code.”

END OF SECTION

END OF EXHIBIT B

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00 73 46 WAGE DETERMINATION SCHEDULE

"General Decision Number: TX20230256 03/17/2023

Superseded General Decision Number: TX20220256

State: Texas

Construction Type: Building

County: Jefferson County in Texas.

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

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered	. Executive Order 14026	
into on or after January 30,	generally applies to the	
2022, or the contract is	contract.	
renewed or extended (e.g., an	. The contractor must pay	
option is exercised) on or	all covered workers at	
after January 30, 2022:	least \$16.20 per hour (or	
	the applicable wage rate	
	listed on this wage	
	determination, if it is	

	higher) for all hours
	spent performing on the
	contract in 2023.
<hr/>	
If the contract was awarded on	. Executive Order 13658
or between January 1, 2015 and	generally applies to the
January 29, 2022, and the	contract.
contract is not renewed or	. The contractor must pay all
extended on or after January	covered workers at least
30, 2022:	\$12.15 per hour (or the
	applicable wage rate listed
	on this wage determination,
	if it is higher) for all
	hours spent performing on
	that contract in 2023.
<hr/>	

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

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

Modification Number	Publication Date
0	01/06/2023
1	03/17/2023

ASBE0022-009 06/01/2022

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Duct, Pipe and Mechanical System Insulation).....	\$ 26.88	15.41

BOIL0074-003 01/01/2021

	Rates	Fringes
BOILERMAKER.....	\$ 29.47	24.10

BRTX0005-006 06/01/2022

	Rates	Fringes
BRICKLAYER.....	\$ 27.05	3.54

ELEC0479-005 09/26/2022

	Rates	Fringes
ELECTRICIAN.....	\$ 31.20	13.18

ENGI0450-002 04/01/2014

	Rates	Fringes
POWER EQUIPMENT OPERATOR Cranes.....	\$ 34.85	9.85

IRON0084-011 06/01/2022

	Rates	Fringes
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IRONWORKER, ORNAMENTAL.....\$ 26.76 7.88

* IRON0135-002 09/01/2022

Rates Fringes

IRONWORKER, STRUCTURAL.....\$ 34.35 14.44

PLUM0068-001 10/01/2022

Rates Fringes

PLUMBER.....\$ 33.81 11.63

PLUM0211-009 10/01/2021

Rates Fringes

PIPEFITTER.....\$ 37.03 12.56

SHEE0054-007 04/01/2020

Rates Fringes

SHEET METAL WORKER (Excludes
HVAC Duct Installation).....\$ 28.69 14.13

* SUTX2014-032 07/21/2014

Rates Fringes

CARPENTER.....\$ 17.98 3.72

CEMENT MASON/CONCRETE FINISHER...\$ 13.44 ** 0.00

FORM WORKER.....	\$ 13.02 **	0.00
IRONWORKER, REINFORCING.....	\$ 12.95 **	0.00
LABORER: Common or General.....	\$ 12.04 **	0.00
LABORER: Mason Tender - Brick...	\$ 12.90 **	0.00
LABORER: Mason Tender - Cement/Concrete.....	\$ 10.50 **	0.00
LABORER: Pipelayer.....	\$ 13.47 **	0.00
LABORER: Roof Tearoff.....	\$ 11.28 **	0.00
LABORER: Landscape and Irrigation.....	\$ 11.04 **	0.36
OPERATOR: Backhoe/Excavator/Trackhoe.....	\$ 18.65	0.00
OPERATOR: Bobcat/Skid Steer/Skid Loader.....	\$ 13.93 **	0.00
OPERATOR: Bulldozer.....	\$ 18.88	0.00
OPERATOR: Drill.....	\$ 16.22	0.34
OPERATOR: Forklift.....	\$ 17.69	0.00
OPERATOR: Grader/Blade.....	\$ 13.37 **	0.00
OPERATOR: Loader.....	\$ 13.55 **	0.94
OPERATOR: Mechanic.....	\$ 17.52	3.33

OPERATOR: Paver (Asphalt, Aggregate, and Concrete).....	\$ 16.03 **	0.00
OPERATOR: Roller.....	\$ 16.00 **	0.00
PAINTER (Brush, Roller, and Spray).....	\$ 16.75	4.51
ROOFER.....	\$ 15.40 **	0.00
SHEET METAL WORKER (HVAC Duct Installation Only).....	\$ 26.89	10.38
TILE FINISHER.....	\$ 12.00 **	0.00
TILE SETTER.....	\$ 16.17 **	0.00
TRUCK DRIVER: Dump Truck.....	\$ 12.39 **	1.18
TRUCK DRIVER: Flatbed Truck.....	\$ 19.65	8.57
TRUCK DRIVER: Semi-Trailer Truck.....	\$ 12.50 **	0.00
TRUCK DRIVER: Water Truck.....	\$ 12.00 **	4.11

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

=====

** Workers in this classification may be entitled to a higher
minimum wage under Executive Order 14026 (\$16.20) or 13658

(\$12.15). Please see the Note at the top of the wage determination for more information.

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

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

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

order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

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

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

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average

calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

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

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

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

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

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

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

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

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

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

The request should be accompanied by a full statement of the

interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

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

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

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

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END OF GENERAL DECISION

END OF SECTION

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01 11 00 SUMMARY OF WORK

PART 1 - GENERAL

1.01 SUMMARY

- A. Construct Work as described in the Contract Documents.
 - 1. Provide the materials, equipment, and incidentals required to make the Project completely and fully operable.
 - 2. Provide the labor, equipment, tools, and consumable supplies required for a complete Project.
 - 3. Provide the civil, architectural, structural, mechanical, electrical, instrumentation, and all other Work required for a complete and operable Project.
 - 4. Test and place the completed Project in operation.
 - 5. Provide the special tools, spare parts, lubricants, supplies, or other materials as indicated in the Contract Documents for the operation and maintenance of the Project.
 - 6. The Contract Documents do not indicate or describe all Work required to complete the Project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Construction Manager.
- B. Owner may pre-select or pre-purchase goods for this Project per Section 01 64 00 "Owner-Furnished Goods and Special Services." Install these goods and coordinate the performance of specified special services.

1.02 DESCRIPTION OF WORK

- A. Work is described in general, non-inclusive terms as:
 - 1. Construction of a new concrete building to house two generators complete with louvers, doors, lighting and electrical improvements.
 - 2. Installation of two (2) 200kW Generators with sub base fuel tanks, automatic transfer switch and associated wiring and controls.
 - 3. Electrical wiring, conduit, lighting, grounding and controls to support the new building and equipment.
 - 4. Replacement of the existing station motor control center.

1.03 WORK UNDER OTHER CONTRACTS

- A. Owner has no knowledge of work, other than the Work included in this Contract, which may impact construction scheduling, testing, and startup.

1.04 WORK BY OWNER

- A. Owner has no knowledge of work, other than the Work included in this Contract that may impact construction scheduling, testing, and startup.

1.05

1.05 CONSTRUCTION OF UTILITIES

- A. Existing utilities will be used for this Project. Coordinate with others performing Work associated with this Project.
- B. Power and Electrical Services:
 - 1. Owner will provide permanent power connections for the Site through the power utility unless indicated otherwise in the Contract Documents.
 - 2. Owner will pay for permits and for providing permanent power.
 - 3. Coordinate and cooperate with others performing this Work.
 - 4. Provide conduit, conductors, pull boxes, manholes, and other appurtenances for the installation of power cable between the property line and the transformer and between the transformer and the main power switch unless the Contract Documents indicate otherwise.
 - 5. Test conductors in accordance with the Specifications and requirements of the power utility and coordinate with the power utility to energize the system when ready.
 - 6. Pay for temporary power including construction cost, meter connection, fees, and permits.
 - 7. Contractor may use the permanent power source in lieu of temporary power source when permanent power is available at the Site.
 - a. Notify Construction Manager and Owner of intent to use the permanent power source.
 - b. Arrange with the power utility and pay the charges for connections and monthly charges for use of this power.
 - 8. Pay for the power consumed until the Project has been accepted as Substantially Complete unless noted otherwise.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 26 00 CHANGE MANAGEMENT

PART 1 - GENERAL

1.01 REQUESTS FOR CHANGE PROPOSAL

- A. Construction Manager will initiate Modifications by issuing a Request for Change Proposal (RCP).
 - 1. Construction Manager and Design Professional will prepare a description of proposed Modifications.
 - 2. Construction Manager will issue the Request for Change Proposal form to Contractor. A number will be assigned to the Request for a Change Proposal when issued.
 - 3. Return a Change Proposal in accordance with Paragraph 1.02 for evaluation by the OPT.

1.02 CHANGE PROPOSALS

- A. Submit a Change Proposal (CP) to the Construction Manager for Contractor initiated changes in the Contract Documents or in response to a Request for Change Proposal. Submit the Change Proposal and attach the forms provided by the Construction Manager.
 - 1. Use the Change Proposal form provided by the Construction Manager.
 - 2. Include with the Change Proposal:
 - a. A complete description of the proposed Modification if Contractor initiated or proposed changes to the OPT's description of the proposed Modification.
 - b. The reason the Modification is requested, if not in response to a Request for a Change Proposal.
 - c. A detailed breakdown of the cost of the change if the Modification requires a change in Contract Price. The itemized breakdown is to include:
 - 1) List of materials and equipment to be installed;
 - 2) Man hours for labor by classification;
 - 3) Equipment used in construction;
 - 4) Consumable supplies, fuels, and materials;
 - 5) Royalties and patent fees;
 - 6) Bonds and insurance;
 - 7) Overhead and profit;
 - 8) Field office costs;
 - 9) Home office cost; and
 - 10) Other items of cost.
 - d. Provide the level of detail outlined in the paragraph above for each Subcontractor or Supplier actually performing the Work if Work is to be provided by a

Subcontractor or Supplier. Indicate appropriate Contractor mark ups for Work provided through Subcontractors and Suppliers. Provide the level of detail outlined in the paragraph above for self-performed Work.

- e. Submit Change Proposals that comply with the General Conditions for Cost of Work.
 - f. Provide a revised schedule. Show the effect of the change on the Project Schedule and the Contract Times.
- B. Submit a Change Proposal to the Construction Manager to request a Field Order.
 - C. A Change Proposal is required for all substitutions or deviations from the Contract Documents.
 - D. Request changes to products in accordance with Section 01 33 02 "Shop Drawings."

1.03 CONSTRUCTION MANAGER WILL EVALUATE THE REQUEST FOR A MODIFICATION

- A. Construction Manager will issue a Modification per the General Conditions if the Change Proposal is acceptable to the Owner. Construction Manager will issue a Change Order or Contract Amendment for any changes in Contract Price or Contract Times.
 - 1. Change Orders and Contract Amendments will be sent to the Contractor for execution with a copy to the Owner recommending approval. A Work Change Directive may be issued if Work needs to progress before the Change Order or Contract Amendment can be authorized by the Owner.
 - 2. Work Change Directives, Change Orders, and Contract Amendments can only be approved by the Owner.
 - a. Work performed on the Change Proposal prior to receiving a Work Change Directive or approval of the Change Order or Contract Amendment is performed at the Contractor's risk.
 - b. No payment will be made for Work on Change Orders or Contract Amendments until approved by the Owner.
- B. Contractor may be informed that the Change Proposal is not approved and construction is to proceed in accordance with the Contract Documents.

1.04 EQUAL NON-SPECIFIED PRODUCTS

- A. The products of the listed manufacturers are to be furnished where the Specifications list several manufacturers and do not specifically list "or equal" or "or approved equal" products. Use of any products other than those specifically listed is a substitution. Follow the procedures in Paragraph 1.05 for a substitution.
- B. Contractor may submit other manufacturers' products that are in full compliance with the Specifications where Specifications list one or more manufacturers followed by the phrase "or equal" or "or approved equal."
 - 1. Submit a Shop Drawing as required by Section 01 33 02 "Shop Drawings" to document that the proposed product is equal or superior to the specified product.

2. Prove that the product is equal. It is not the OPT's responsibility to prove the product is not equal.
 - a. Indicate on a point-by-point basis for each specified feature that the product is equal to the Contract Document requirements.
 - b. Make a direct comparison with the specified manufacturer's published data sheets and available information. Provide this printed material with the Shop Drawing.
 - c. The decision of the Design Professional regarding the acceptability of the proposed product is final.
 3. Provide a certification that, in furnishing the proposed product as an equal, the Contractor:
 - a. Has thoroughly examined the proposed product and has determined that it is equal or superior in all respects to the product specified.
 - b. Has determined that the product will perform in the same manner and result in the same process as the specified product.
 - c. Will provide the same warranties and/or bonds as for the product specified.
 - d. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the product into the construction and will waive all claims for additional Work which may be necessary to incorporate the product into the Project which may subsequently become apparent.
 - e. Will maintain the same time schedule as for the specified product.
- C. A Change Proposal is not required for any product that is in full compliance with the Contract Documents. If the product is not in full compliance, it may be offered as a Substitution.

1.05 SUBSTITUTIONS

- A. Substitutions are defined as any product that the Contractor proposes to provide for the Project in lieu of the specified product. Submit a Change Proposal per Paragraph 1.02 along with documents required for a Shop Drawing as required by Section 01 33 02 "Shop Drawings" to request approval of a substitution.
- B. Prove that the product is acceptable as a substitute. It is not the Design Professional's responsibility to prove the product is not acceptable as a substitute.
 1. Indicate on a point-by-point basis for each specified feature that the product is acceptable to meet the intent of the Contract Documents requirements.
 2. Make a direct comparison with the specified Suppliers published data sheets and available information. Provide this printed material with the Shop Drawing.
 3. The decision of the Design Professional regarding the acceptability of the proposed substitute product is final.

- C. Provide a certification that, in making the substitution request, the Contractor:
 - 1. Has determined that the substituted product will perform in substantially the same manner and result in the same ability to meet the specified performance as the specified product;
 - 2. Will provide the same warranties and/or bonds for the substituted product as specified or as would be provided by the manufacturer of the specified product;
 - 3. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the substituted product into the Project and will waive all claims for additional Work which may be necessary to incorporate the substituted product into the Project which may subsequently become apparent; and
 - 4. Will maintain the same time schedule as for the specified product.
- D. Pay for review of substitutions in accordance with Section 01 33 02 "Shop Drawings."

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 29 00 APPLICATION FOR PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

- A. Submit Applications for Payment for completed Work and for materials and equipment in accordance with the General Conditions, the Supplementary Conditions, the Agreement, and this Section. The Contract Price is to include costs for:
1. Providing the Work in accordance with the Contract Documents;
 2. Installing Owner furnished equipment and materials, if any;
 3. Providing Work for alternates and allowances, if any;
 4. Providing Work for extra work items, if any and if authorized
 5. Commissioning, startup, training, and initial maintenance and operation;
 6. Acceptance testing at the manufacturer's facilities or at the Site;
 7. All home office overhead costs and expenses, including profit made directly or indirectly from the Project;
 8. Project management, contract administration, and field office and field operations staff including supervision, clerical support, and technology system support;
 9. Professional services including design fees, legal fees, and other professional services;
 10. Bonds and insurance;
 11. Permits, licenses, patent fees, and royalties;
 12. Taxes;
 13. Providing all documentation and Samples required by the Contract Documents;
 14. Facilities and equipment at the Site including:
 - a. Field offices, office furnishings, and all related office supplies, software, and equipment,
 - b. Storage facilities for Contractor's use and storage facilities for stored materials and equipment including spare parts storage,
 - c. Shops, physical plant, construction equipment, small tools, vehicles, and technology and telecommunications equipment,
 - d. Safety equipment and facilities to provide safe access and working conditions for workers and for others working at the Site,
 - e. Temporary facilities for power and communications,
 - f. Potable water and sanitation facilities, and
 - g. Mobilization and demobilization for all these facilities and equipment.
 15. Products, materials, and equipment stored at the Site or other suitable location in accordance with Section 01 31 00 "Project Management and Coordination";

16. Products, materials, and equipment permanently incorporated into the Project;
 17. Temporary facilities for managing water including facilities for pumping, storage, and treatment as required for construction and protection of the environment;
 18. Temporary facilities for managing environmental conditions and Constituents of Concern;
 19. Temporary facilities such as sheeting, shoring, bracing, formwork, embankments, storage facilities, working areas, and other facilities required for construction of the Project;
 20. Temporary and permanent facilities for protection of all overhead, surface, or underground structures or features;
 21. Temporary and permanent facilities for removal, relocation, or replacement of any overhead, surface, or underground structures or features;
 22. Products, materials, and equipment consumed during the construction of the Project;
 23. Contractor labor and supervision to complete the Project including that provided through Subcontractors or Suppliers;
 24. Correcting Defective Work during the Contract Times, during the Correction Period, or as required to meet any warranty provision of the Contract Documents;
 25. Risk associated with weather and environmental conditions, startup, and initial operation of facilities including equipment, processes, and systems;
 26. Contractor safety programs, including management, administration, and training;
 27. Maintenance of facilities including equipment, processes, and systems until operation is transferred to Owner;
 28. Warranties, extended or special warranties, or extended service agreements;
 29. Cleanup and disposal of any and all surplus materials; and
 30. Demobilization of all physical, temporary facilities not incorporated into the Project.
- B. Include the cost not specifically set forth as an individual payment item but required to provide a complete and functional system in the Contract Price.
- C. Provide written approval of the surety company providing performance and payment bonds for the Schedule of Values, Application for Payment form, and method of payment prior to submitting the first Application for Payment. Submit approval using the "Consent of Surety Company to Payment Procedures" form provided by the Construction Manager. Payment will not be made without this approval.
- D. Construction Manager may withhold processing the Applications for Payment if any of the following processes or documentation is not up to date:
1. Progress Schedule per Section 01 33 05 "Construction Progress Schedule."
 2. Project videos and photographs per Section 01 33 06 "Graphic Documentation."
 3. Record Documents per Section 01 31 13 "Project Administration."

1.02 SCHEDULE OF VALUES

- A. Divide the Contract Price into an adequate number of line items to allow more accurate determination of the earned value for each line item when evaluating progress payments. Submit a detailed Schedule of Values for the Project at least 10 days prior to submitting the first Application for Payment using forms provided by the Construction Manager.
- B. Do not apply for payment until the Schedule of Values has been approved by the Construction Manager.
- C. Divide the cost associated with each line item in the Schedule of Values into installation and materials components.
 - 1. Installation cost is to include all cost associated with the line item except materials cost.
 - 2. Materials cost is the direct cost (as verified by invoice values) for products, materials, and equipment to be permanently incorporated into the Project associated with the line item.
 - 3. Installation cost is to include all direct costs and a proportionate amount of the indirect costs for the Work associated with each line item. Include costs not specifically set forth as an individual payment item but required to provide a complete and functional system.
 - 4. The sum of materials and installation costs for all line items must equal the Contract Price.
- D. Use each unit price line item in the Agreement as a line item in the Schedule of Values. The sum of materials and installation costs for each line item for unit price contracts must equal the value of the line item in the Agreement. In addition to the installation cost described in Paragraph 1.02.C.3, installation costs for unit price items are to include costs for waste and overages.
 - 1. Installation and materials cost may be left as a single installation component if:
 - a. Contractor does not intend to request payment for stored materials for that line item; or
 - b. Work in the line item will be completed within a single payment period.
 - 2. Provide adequate detail to allow a more accurate determination of the earned value for installation costs, expressed as a decimal fraction of Work completed, for each line item.
 - 3. Installation cost line items may not exceed \$50,000.00. Items that are not subdivided into smaller units may only be included in the Application for Payment when Work on the entire unit is complete.
 - 4. Lump sum items may be divided into an estimated number of units to estimate earned value. The estimated number of units times the cost per unit must equal the lump sum amount for that line item.
 - 5. Include Contractor's overhead and profit in the installation costs each line item in proportion to the value of the line item to the Contract Price.

6. Include cost not specifically set forth as an individual payment item but required to provide a complete and functional system in the Contract Price for each item.
 7. Line items may be used to establish the value of Work to be added or deleted from the Project.
- E. Include a breakdown of both mobilization and demobilization costs in the Schedule of Values. The total cost for both mobilization and demobilization may not exceed 10 percent of the total Contract Price. Payment for mobilization and demobilization will be based on the earned value of Work completed. Payment for these costs will only be made for Work completed for the following:
1. Bonds and insurance;
 2. Transportation and setup for equipment;
 3. Transportation and/or erection of all field offices, sheds, and storage facilities;
 4. Salaries for preparation of documents required before the first Application for Payment; and
 5. Salaries for field personnel directly related to the mobilization of the Project.

1.03 SCHEDULE OF ANTICIPATED PAYMENTS

- A. Submit a schedule of the anticipated Application for Payments showing the anticipated application numbers, submission dates, and the amount to be requested for each Application for Payment on the form provided by the Construction Manager.
- B. Update the schedule of anticipated payments as necessary to provide a reasonably accurate indication of the funds required to make payments each month to the Contractor for Work performed.

1.04 ALTERNATES, ALLOWANCES, AND EXTRA WORK ITEMS

- A. Include line items and amounts for specified alternate Work and allowances for Work in the Agreement, if any, and as described in Section 01 23 10 "Alternates and Allowances."
- B. Include line items and amounts for Extra Work items in the Agreement, if any, and as described in Section 01 29 01 "Measurement and Basis for Payment."

1.05 RETAINAGE AND SET-OFFS

- A. Retainage will be withheld from each Application for Payment per the Agreement.
- B. Reduce payments for set-offs per the General Conditions as directed by the Construction Manager.

1.06 PROCEDURES FOR SUBMITTING AN APPLICATION FOR PAYMENT

- A. Submit a draft Application for Payment to the Construction Manager each month at least 20 days before the date established in the Agreement for Owner to make progress payments. Do not submit Applications for Payment more often than monthly. Review the

draft Application for Payment with the Construction Manager to determine concurrence with:

1. Values requested for materials and equipment, stored or incorporated into the Project as documented by invoices;
 2. The earned value for installation costs for each line item in the Application for Payment form expressed as a percent complete for that line item;
 3. The quantity of Work completed for each unit price item;
 4. Amount of retainage to be withheld; and
 5. Set-offs included in the Application for Payment.
- B. Submit Applications for Payment to the Construction Manager after agreement has been reached on the draft Application for Payment with the Construction Manager.
- C. Provide all information requested in the Application for Payment form. Do not leave any blanks incomplete. If information is not applicable, enter "N/A" in the space provided.
1. Number each application sequentially and include the dates for the application period.
 2. Complete the "Contract Time Summary" section on the Application for Payment form. If the Final Completion date shows the Project is more than 30 days behind schedule, revise the Schedule of Anticipated Payments to correspond to the updated schedule required per Section 01 33 05 "Construction Progress Schedule."
 3. Complete the "Summary of Earned Value and Set-offs" section on the Application for Payment form. Show the total amounts for earned value of original Contract performed, earned value for Work on approved Contract Amendments and Change Orders, retainage and set-offs.
 4. Sign and date the Contractor's Certification on the Application for Payment form that all Work, including materials, covered by this Application for Payment have been completed or delivered and stored in accordance with the Contract Documents, that all amounts have been paid for Work, materials, and equipment for which previous Payment has been made by the Owner, and that the current payment amount shown in this Application for Payment is now due.
- D. Submit attachments in Portable Document Format (PDF).
1. Generate attachments to the Application for Payment using the Excel spreadsheet provided by the Construction Manager.
 2. Submit PDF documents with adequate resolution to allow documents to be printed in a format equivalent to the document original. Documents are to be scalable to allow printing on standard 8-1/2 x 11 or 11 x 17 paper.

1.07 ADJUSTMENTS TO THE SCHEDULE OF VALUES IN THE APPLICATION FOR PAYMENT

- A. Submit a Change Proposal to request any changes to the Schedule of Values incorporated into the Application for Payment once approved. A Field Order will be issued by the Construction Manager to modify the Application for Payment form if approved.

- B. Payment for materials and equipment shown in the Application for Payment will be made for the total of associated invoice amounts, up to the value shown for materials in the Application for Payment for that line item.
 - 1. If the total amount for invoices for materials and equipment for a line item are less than the amount shown for the materials component of that line item in the Application for Payment, and it can be demonstrated that no additional materials or equipment are required to complete Work described in that item, the difference between the total invoice for materials and equipment and the materials component for that line item can be added to the installation component of that Work item.
 - 2. Costs for material and equipment in excess of the value shown in the Schedule of Values may not be paid for under other line items.

1.08 CONSTRUCTION MANAGER'S RESPONSIBILITY

- A. Construction Manager will review each draft Application for Payment with Contractor to reach an agreement on the amount to be recommended to Owner for payment. Contractor is to revise the Application for Payment to incorporate changes, if any, resulting from this review process.
- B. Construction Manager will review the Application for Payment to determine that the Application for Payment has been properly submitted and is in accordance with the agreed to draft Application for Payment.
- C. Construction Manager will either recommend payment of the Application for Payment to Owner or notify the Contractor of the reasons for not recommending payment. Contractor may make necessary corrections and resubmit the Application for Payment. Construction Manager will review resubmitted Application for Payment and reject or recommend payment of the Application for Payment to Owner as appropriate.
- D. Construction Manager's recommendation of the Application for Payment constitutes a representation that based on its experience and the information available:
 - 1. The Work has progressed to the point indicated;
 - 2. The quality of the Work is generally in accordance with the Contract Documents; and
 - 3. Requirements prerequisite to payment have been met.
- E. This representation is subject to:
 - 1. Further evaluation of the Work as a functioning whole;
 - 2. The results of subsequent tests called for in the Contract Documents; or
 - 3. Any other qualifications stated in the recommendation.
- F. Construction Manager does not represent by recommending payment that:
 - 1. Inspections made to check the quality or the quantity of the Work as it was performed were exhaustive or extended to every aspect of the Work in progress; or
 - 2. Other matters or issues that might entitle Contractor to additional compensation or entitle Owner to withhold payment to Contractor exist.

- G. Neither Construction Manager's review of Contractor's Work for the purposes of recommending payments nor Construction Manager's recommendation of payment imposes responsibility on the Construction Manager or Owner:
 - 1. To supervise, direct, or control the Work;
 - 2. For the means, methods, techniques, sequences, or procedures of construction, or safety precautions and programs;
 - 3. For Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;
 - 4. To make examinations to ascertain how or for what purposes Contractor has used the monies paid on account of the Contract Price; or
 - 5. To determine that title to the Work, materials, or equipment has passed to Owner free and clear of Liens.

1.09 FINAL APPLICATION FOR PAYMENT

- A. Include adjustments to the Contract Price in the final Application for Payment for:
 - 1. Approved Change Orders and Contract Amendments;
 - 2. Allowances not previously adjusted by Change Order;
 - 3. Deductions for Defective Work that have been accepted by the Owner;
 - 4. Penalties and bonuses;
 - 5. Deduction for all final set-offs; and
 - 6. Other adjustments if needed.
- B. Construction Manager will prepare a final Change Order reflecting the approved adjustments to the Contract Price which have not been covered by previously approved Change Orders and, if necessary, to reconcile estimated unit price quantities with actual quantities.
- C. Submit the final Application for Payment per the General Conditions, including the final Change Order. Provide the following with the final Application for Payment:
 - 1. Evidence of payment or release of Liens on the forms provided by the Construction Manager and as required by the General Conditions.
 - 2. Consent from surety to final payment.
- D. Final payment will also require additional procedures and documentation per Section 01 70 00 "Execution and Closeout Requirements."

1.10 PAYMENT BY OWNER

- A. Owner is to pay the amount recommended for monthly payments within 30 days after receipt of the Construction Manager's recommended Application for Payment.
- B. Final payment may take longer than 30 days since Owner's council must approve final payment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 29 01 MEASUREMENT AND BASIS FOR PAYMENT

PART 1 - GENERAL

1.01 PAYMENT FOR MATERIALS AND EQUIPMENT

- A. Payment will be made for materials and equipment materials properly stored and successfully incorporated into the Project less the specified retainage.
- B. Provide a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of Liens. Provide documentation of payment for materials and equipment with the next Application for Payment. Remove items from the tabulation of materials and equipment if this documentation is not provided with the next Application for Payment.
- C. Provide evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest.
- D. The Work covered by progress payments becomes the property of the Owner at the time of payment. The Contractor's obligations with regard to proper care and maintenance, insurance, and other requirements are not changed by this transfer of ownership until final acceptance in accordance with the General Conditions.
- E. Payment for materials and equipment does not constitute acceptance of the product.

1.02 MEASUREMENT AND BASIS FOR PAYMENTS ON LUMP SUM ITEMS

- A. Measurement for progress payments is the invoice value for stored materials and the earned value for all other cost for constructing each item. Earned value is expressed as the value of the Work completed divided by the total value of installation cost. The total amount paid will be equal to the total lump sum amount for that item.

1.03 MEASUREMENT AND BASIS FOR PAYMENTS ON UNIT PRICE ITEMS

- A. Measure the Work using the unit of measure indicated in this Section for each unit price line item. Payment will be made only for the actual measured unit and/or computed length, area, solid contents, number, and weight unless other provisions are made in the Contract Documents. Payment on a unit price basis will not be made for Work outside dimensions shown in the Contract Documents.
- B. Payment will be made for the actual quantity of Work completed and for materials and equipment stored during the payment period. Payment amount is the Work quantity measured per Paragraph A above multiplied by the unit price for that line item in the Agreement.

1.04 MEASUREMENT AND BASIS FOR PAYMENT FOR BASE ITEMS

- A. Item [A-01] - Mobilization:
 - 1. Measurement for payment is on a lump sum basis as work progresses. Mobilization is calculated on the base bid only and will not be paid for separately on any additive alternate items added to the Contract. Lump sum amount for mobilization shall not exceed 5% of the total base bid of the contract.

2. Payment for Mobilization shall be made upon presentation of a paid invoice for the payment or performance bonds and required insurance and upon verification of documented expenditures for contractor temporary facility setup. The combined amount for all these facilities will be no more than 10% of the mobilization lump sum or 1% of the total Contract amount, whichever is less.
 - a. When 1% of the adjusted Contract amount for construction Items is earned, 50% of the mobilization lump sum bid will be paid. Previous payments under this Item will be deducted from this amount.
 - b. When 5% of the adjusted Contract amount for construction Items is earned, 75% of the mobilization lump sum, will be paid. Previous payments under the Item will be deducted from this amount.
 - c. When 10% of the adjusted Contract amount for construction Items is earned, 90% of the mobilization lump sum bid or 10% of the total Contract amount, whichever is less, will be paid. Previous payments under this Item will be deducted from this amount,
 - d. Upon final acceptance, 97% of the mobilization lump sum bid will be paid. Previous payments under this Item will be deducted from this amount, and Payment for the remainder of the lump sum bid for "Mobilization" will be made after all submittals are received, final quantities have been determined and when any separate vegetative establishment and maintenance, test, and performance periods provided for in the Contract have been successfully completed.
- B. Item [A-02] – All other work
 1. All other work shall be paid by the lump sum.
 2. All other work shall include all equipment, materials, labor, machinery, small tools required to complete the work as described in the project manual and drawings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 31 00 PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Furnish resources required to complete the Project in accordance with the Contract Documents and within the Contract Times.
- B. Construct Project in accordance with current safety practices.
- C. Manage Site to allow access to Site and control construction operations.
- D. Construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.
- E. Provide temporary controls for pollution, management of water, and management of excess earth as required in Section 01 57 00 "Temporary Controls."

1.02 STANDARDS

- A. Perform Work to comply with:
 - 1. Requirements of the Contract Documents;
 - 2. Laws and Regulations; and
 - 3. Specified industry standards.

1.03 DOCUMENTATION

- A. Provide documents in accordance with Section 01 33 00 "Document Management."
- B. Provide copies of Supplier's printed storage instructions prior to furnishing materials or products and installation instructions prior to beginning the installation.
- C. Incorporate field notes, sketches, recordings, and computations made by the Contractor in Record Drawings per Section 01 31 13 "Project Administration."

1.04 PERMITS

- A. Obtain building permits for the Project from the local authorities having jurisdiction. Pay building permit fees and include these costs in the Contract Price.
- B. Obtain environmental permits required for construction at the Site.
- C. Provide required permits for transporting heavy or oversized loads.
- D. Provide other permits required to conduct any part of the Work.
- E. Arrange for inspections and certification by agencies having jurisdiction over the Work and include the cost for these inspections and certifications in the Contract Price.
- F. Make arrangements with private utility companies and pay fees associated with obtaining services or inspections.
- G. Retain copies of permits and licenses at the Site and comply with all regulations and conditions of the permit or license.

1.05 SAFETY REQUIREMENTS

- A. Manage safety to protect the safety and welfare of persons at the Site.
- B. Provide safe access to move through the Site. Provide protective devices to warn and protect from hazards at the Site.
- C. Provide safe access for those performing tests and inspections.
- D. Maintain a supply of personal protective equipment for visitors to the Site.
- E. Comply with latest provisions of the Occupational Health and Safety Administration (OSHA) and other Laws and Regulations.
- F. Cooperate with accident investigations. Provide two copies of all reports, including insurance company reports, prepared concerning accidents, injuries, or deaths related to the Project to the Construction Manager as Record Data per Section 01 31 13 "Project Administration."

1.06 ACCESS TO THE SITE

- A. Maintain access to the facilities at all times. Do not obstruct roads, pedestrian walks, or access to the various buildings, structures, stairways, or entrances. Provide safe access for normal operations during construction.
- B. Provide adequate and safe access for inspections. Leave ladders, bridges, scaffolding, and protective equipment in place until inspections have been completed. Construct additional safe access if required for inspections.
- C. Use roadways for construction traffic only with written approval of the appropriate representatives of each entity. Roadways may not be approved for construction traffic. Obtain written approval to use roads to deliver heavy or oversized loads to the Site. Furnish copies of the written approvals to the Construction Manager as Record Data per Section 01 31 13 "Project Administration."

1.07 CONTRACTOR'S USE OF THE SITE

- A. Limit the use of Site for Work and storage to those areas designated on the Drawings or approved by the Construction Manager. Coordinate the use of the Site with the Construction Manager.
- B. Provide security at the Site as necessary to protect against vandalism and loss by theft.
- C. Park construction equipment in designated areas only and provide spill control measures as discussed in Section 01 57 00 "Temporary Controls."
- D. Park employees' vehicles in designated areas only.
- E. Obtain written permission of the property owner before entering privately-owned land outside of the Owner's property, rights-of-way, or easements.
- F. Cooperate with public and private agencies with facilities operating within the limits of the Project. Provide 48 hours' notice to any applicable agency when Work is anticipated to proceed in the vicinity of any facility.

G. Conduct of Contractor's or Subcontractor's Employees:

1. Do not permit alcoholic beverages or illegal substances on the Site. Do not allow persons under the influence of alcoholic beverages or illegal substances to enter or remain on the Site at any time. Persons on Site under the influence of alcoholic beverages or illegal substances will be permanently prohibited from returning to the Site. Criminal or civil penalties may also apply.
2. Do not allow the use of offensive language or sexual harassment in any form. These actions will cause immediate and permanent removal of the offender from the premises. Criminal or civil penalties may apply.
3. Require workers to wear clothing that is inoffensive and meets safety requirements. Do not allow sleeveless shirts, shorts, or any exceedingly torn, ripped, or soiled clothing to be worn on the Site.
4. Do not allow the use, possession, concealment, transportation, promotion, or sale of the following prohibited items anywhere on the Site:
 - a. Firearms (including air rifles and pistols and BB or pellet guns) and ammunition;
 - b. Bows, crossbows, arrows, bolts, or any other projectile weapons;
 - c. Explosives of any kind, including fireworks;
 - d. Illegal knives;
 - e. Other weapons prohibited by state Laws and Regulations; and
 - f. Any other item that has been designed or intended to be used as a weapon.

No exceptions will be made for the possession of a firearm by a person that has a valid state-issued license to carry a firearm. Remove any of the prohibited items listed above from the Site immediately and permanently. Any person found to be in possession of any prohibited item must also be removed from the Site and may be reported to local law enforcement.

1.08 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

- A. Examine the Site and review the available information concerning the Site. Locate utilities, underground facilities, and existing structures. Verify the elevations of the structures adjacent to excavations. Report any discrepancies from information in the Contract Documents to the Construction Manager before beginning construction.
- B. Determine if existing structures, poles, piping, or other utilities at excavations will require relocation or replacement. Prepare a Plan of Action per Section 01 31 13 "Project Administration." Coordinate Work with local utility company and others for the relocation or replacement.
- C. Protect utilities, underground facilities and existing structures unless they are shown to be replaced or relocated on the Drawings. Restore damaged items to the satisfaction of the Owner and utility or property owner.
- D. Carefully support and protect all structures and/or utilities so that there will be no failure or settlement where excavation or demolition endangers adjacent structures and utilities. Do not take existing utilities out of service unless required by the Contract Documents or

approved by the Construction Manager. Notify and cooperate with the utility owner if it is necessary to move services, poles, guy wires, pipelines, or other obstructions.

- E. Protect existing trees and landscaping at the Site. Mark trees that may be removed during construction and review with the Construction Manager for approval before removing. Protect trees to remain from damage limiting activity, including stockpiling of materials within the drip line of the tree.
- F. Protect buildings from damage when handling material or equipment. Protect finished surfaces, including floors, doors, and jambs. Remove doors and install temporary wood protective coverings over jambs, if needed.

1.09 DISRUPTION TO SERVICES/CONTINUED OPERATIONS

- A. Owner's facilities are to continue in service as usual during the construction unless noted otherwise. Owner or utilities must be able to operate and maintain the facilities. Keep disruptions to existing utilities, piping, process piping, or electrical services to a minimum.
 - 1. Do not restrict access to critical valves, operators, or electrical panels.
 - 2. Do not store material or products inside structures unless authorized by the Construction Manager.
 - 3. Limit operations to the minimum amount of space needed to complete the specified Work.
 - 4. Maintain storm sewers and sanitary sewers in service at all times. Provide temporary service around the construction or otherwise construct the Work in a manner that flow is not restricted.
- B. Provide a Plan of Action in accordance with Section 01 35 00 "Special Procedures" if facilities must be taken out of operation.

1.10 FIELD VERIFICATION

- A. Perform complete field measurements prior to purchasing products or beginning construction for products required to fit existing conditions.
- B. Verify property lines, control lines, grades, and levels indicated on the Drawings.
- C. Verify pipe class, equipment capacities, existing electrical systems, and power sources for existing conditions.
- D. Check Shop Drawings and indicate the actual dimensions available where products are to be installed.
- E. Include field measurements in Record Documents as required in Section 01 31 13 "Project Administration."

1.11 REFERENCE DATA AND CONTROL POINTS

- A. Construction Manager will provide the following control points:
 - 1. Base line or grid reference points for horizontal control.
 - 2. Benchmarks for vertical control.

- B. Locate and protect control points prior to starting the Work and preserve permanent reference points during construction. Designated control points may be on an existing structure or monument. Do not change or relocate points without prior approval of the Construction Manager. Notify Construction Manager when a reference point is lost, destroyed, or requires relocation. Replace Project control points on the basis of the original survey. Control points or benchmarks damaged, disturbed or destroyed as a result of the Contractor's negligence will be restored by the Construction Manager. Owner will impose a set-off as compensation for the effort required.
- C. Provide complete engineering layout of the Work needed for construction.
 - 1. Provide competent personnel. Provide equipment including accurate surveying instruments, stakes, platforms, tools, and materials.
 - 2. Provide surveying with accuracy meeting the requirements established for Texas Coordinate System of 1983, South Central Zone 4204.
 - 3. Provide Record Data per Section 01 31 13 "Project Administration" and measurements per standards.

1.12 DELIVERY AND STORAGE

- A. Deliver products and materials to the Site in time to prevent delays in construction.
- B. Deliver packaged products to Site in original undamaged containers with identifying labels attached. Open cartons as necessary to check for damage and to verify invoices. Reseal cartons and store properly until used. Leave products in original packages or other containers until installed. If original packages or containers are damaged, repackage in containers and include packing slips, labels and other information from the original packaging.
- C. Deliver products that are too large to fit through openings to the Site in advance of the time enclosing walls and roofs are erected. Set in place, raised above floor on cribs or pallets.
- D. Assume full responsibility for the protection and safekeeping of products stored at the Site.
- E. Store products at locations acceptable to the Construction Manager and to allow Owner access to maintain and operate existing facilities.
- F. Store products in accordance with the Supplier's storage instructions immediately upon delivery. Leave seals and labels intact. Arrange storage to allow access for maintenance of stored items and for inspection. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.
- G. Provide additional storage areas as needed for construction. Store products subject to damage by elements in substantial weather-tight enclosures or storage sheds. Provide and maintain storage sheds as required for the protection of products. Provide temperature, humidity control, and ventilation within the ranges stated in the Supplier's instructions. Remove storage facilities at the completion of the Project.
- H. Protect the pipe interior. Keep all foreign materials such as dirt, debris, animals, or other objects out of the pipe during the Work.
- I. Provide adequate exterior storage for products that may be stored out-of-doors.

1. Provide substantial platforms, blocking, or skids to support materials and products above ground which has been sloped to provide drainage. Protect products from soiling or staining.
 2. Cover products subject to discoloration or deterioration from exposure to the elements, with impervious sheet materials. Provide ventilation to prevent condensation below covering.
 3. Store loose, granular materials on clean, solid surfaces, or on rigid sheet materials, to prevent mixing with foreign matter.
 4. Provide surface drainage to prevent erosion and ponding of water.
 5. Prevent mixing of refuse or chemically injurious materials or liquids with stored materials.
 6. Pipes and conduits stored outdoors are to have open ends sealed to prevent the entrance of dirt, moisture, and other injurious materials. Protect PVC pipe from ultraviolet light exposure.
 7. Store products to prevent wind damage.
- J. Protect and maintain mechanical and electrical equipment in storage.
1. Provide Supplier's service instructions on the exterior of the package.
 2. Service equipment on a regular basis as recommended by the Supplier. Maintain a log of maintenance services. Submit the log as Record Data per Section 01 31 13 "Project Administration" when Owner assumes responsibility for maintenance and operation.
 3. Provide power to and energize space heaters for all equipment for which these devices are provided.
 4. Provide temporary enclosures for all electrical equipment, including electrical systems on mechanical devices. Provide and maintain heat in the enclosures until equipment is energized.
- K. Maintain storage facilities. Inspect stored products on a weekly basis and after periods of severe weather to verify that:
1. Storage facilities continue to meet specified requirements;
 2. Supplier's required environmental conditions are continually maintained; and
 3. Products that can be damaged by exposure to the elements are not adversely affected.
- L. Replace any stored item damaged by inadequate protection or environmental controls.
- M. Payment may be withheld for any products not properly stored.

1.13 CLEANING DURING CONSTRUCTION

- A. Provide positive methods to minimize raising dust from construction operations and provide positive means to prevent air-borne dust from discharging into the atmosphere. Control dust and dirt from demolition, cutting, and patching operations.

- B. Clean the Site as Work progresses and dispose of waste materials, keeping the Site free from accumulations of waste or rubbish. Provide containers at the Site for waste collection. Do not allow waste materials or debris to blow around or off of the Site. Control dust from waste materials. Transport waste materials with as few handlings as possible.
- C. Comply with Laws and Regulations. Do not burn or bury waste materials. Remove waste materials, rubbish, and debris from the Site and legally dispose of these at public or private disposal facilities.

1.14 MAINTENANCE OF ROADS, DRIVEWAYS, AND ACCESS

- A. Maintain roads and streets in a manner that is suitable for safe operations of public vehicle during all phases of construction unless the Owner approves a street closing. Do not close public roads overnight. Coordinate and arrange for emergency vehicle access when streets are to be closed.
- B. Submit a Notification by Contractor for Owner's approval of a street closing. The request must state:
 - 1. The reason for closing the street.
 - 2. How long the street will remain closed.
 - 3. Procedures to be taken to maintain the flow of traffic.
- C. Obtain permits and permissions of the entity that owns the road prior to any Work and provide a copy of the permit or permission Record Data per Section 01 31 13 "Project Administration."
- D. Construct temporary detours, including by-pass roads around construction, with adequately clear width to maintain the free flow of traffic at all times. Maintain barricades, signs, and safety features around the detour and excavations. Maintain barricades, signs, and safety features around the Work in accordance with all provisions of the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD).
- E. Assume responsibility for any damage resulting from construction along roads or drives.

1.15 BLASTING

- A. Blasting is not allowed for any purpose.

1.16 ARCHAEOLOGICAL REQUIREMENTS

- A. Cease operations immediately and contact the Owner for instructions if historical or archaeological artifacts are found during construction.
- B. Conduct all construction activities to avoid adverse impact of the sites where significant historical or archaeological artifacts are found or identified as an area where other artifacts could be found.
 - 1. Obtain details for working in these areas from regulatory agencies.
 - 2. Maintain confidentiality regarding the site(s) of artifacts.
 - 3. Adhere to the requirements of applicable local, state, and federal Laws and Regulations.

4. Notify the Construction Manager and any local, state, or federal agency as required by applicable Laws and Regulations.
- C. Do not disturb archaeological sites.
1. Obtain the services of a qualified archaeological specialist to instruct construction personnel on how to identify and protect archaeological finds on an emergency basis.
 2. Coordinate activities to permit archaeological work to take place within the area.
 - a. Attempt to archaeologically clear areas needed for construction as soon as possible.
 - b. Provide a determination of priority for such areas.
- D. Assume responsibility for any unauthorized destruction that might result to such sites by construction personnel, and pay all penalties assessed by state or federal agencies for non-compliance with these requirements.
- E. Contract Times will be modified to compensate for delays caused by such archaeological finds. No additional compensation will be paid for delays.

1.17 ENDANGERED SPECIES RESOURCES

- A. Do not perform any activity that is likely to destroy or adversely modify the habitat or jeopardize the continued existence of a threatened or endangered species as listed or proposed for listing under the Federal Endangered Species Act (ESA) or applicable state Laws and Regulations.
- B. Cease Work immediately in the area of the encounter and notify the Construction Manager if a threatened or endangered species is encountered during construction. Construction Manager will implement actions in accordance with the ESA and applicable state statutes. Resume construction in the area of the encounter when authorized to do so by the Construction Manager.

1.18 COORDINATION

- A. Coordinate the efforts of various trades having interdependent responsibilities for Work.
- B. Conceal ducts, pipes, wiring, and other non-finish items in finished areas, except as otherwise shown. Coordinate locations of concealed items with finish elements. Install access panel or doors where units requiring access for maintenance or operation are concealed behind finished surfaces.
- C. Coordinate architectural reflected ceiling plans with the exact location of items installed in suspended ceilings. Request clarification from the Construction Manager prior to proceeding with fabrication or installation of an item if it appears that a conflict exists.
- D. Coordinate the installation of items to be installed later, including:
 1. Accepted alternates.
 2. Products purchased using allowances.
 3. Work by others.
 4. Owner-supplied, Contractor-installed items.

- E. Sequence, coordinate, and integrate the various elements of mechanical, electrical, and other systems, materials, and equipment. Comply with the following requirements:
 - 1. Coordinate mechanical and electrical systems, equipment, and materials installation with other building components.
 - 2. Verify all dimensions by field measurements.
 - 3. Arrange for chases, slots, and openings in other building components during progress of construction.
 - 4. Coordinate the installation of required supporting devices, sleeves, embedded items, and other structural components to be set in concrete before concrete is placed.
 - 5. Install systems, materials, and equipment to provide the maximum headroom possible where mounting heights are not detailed or dimensioned.
 - 6. Coordinate the connection of systems with exterior underground and overhead utilities and services. Comply with the Laws and Regulations and requirements of franchise service companies. Provide required connection for each service.
 - 7. Install systems, materials, and equipment to conform with approved Shop Drawings, Product Data, and Operation and Maintenance Data. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Adjust routing of piping, ductwork, utilities, and location of equipment as needed to resolve spatial conflicts between the various trades. Document changes in the indicated routings in the Record Documents per Section 01 31 13 "Project Administration."
 - 8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
 - 9. Install systems, materials, and equipment to facilitate servicing, maintenance, and repair or replacement of components.
 - 10. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

1.19 CUTTING AND PATCHING

- A. Perform cutting, fitting, and patching required to complete the Work or to:
 - 1. Uncover Work to provide for installation of new Work or the correction of Defective Work.
 - 2. Provide routine penetrations of non-structural surfaces for installation of mechanical, electrical, and plumbing Work.
 - 3. Uncover Work that has been covered prior to observation by the Construction Manager.
- B. Submit Notification by Contractor in accordance with Section 01 31 13 "Project Administration" to the Construction Manager in advance of performing any cutting which affects:
 - 1. Work of any other contractor or the Owner;

2. Structural integrity of any structure or system of the Project;
 3. Integrity or effectiveness of weather exposed or moisture resistant structure or systems;
 4. Efficiency, operational life, maintenance, or safety of any structure or system; or
 5. Appearance of any structure or surfaces exposed occasionally or constantly to view.
- C. Include in request:
1. Location and description of affected Work;
 2. Reason for cutting, alteration, or excavation;
 3. Effect on the Work of any separate contractor or Owner;
 4. Effect on the structural or weatherproof integrity of the Work;
 5. Description of proposed Work, including:
 - a. Scope of cutting, patching, or alteration;
 - b. Trades that will perform the Work;
 - c. Products proposed for use; and
 - d. Extent of refinishing to be performed.
 6. Alternatives to cutting and patching;
 7. Written authorization from any separate contractor whose Work would be affected; and
 8. Date and time Work will be uncovered or altered.
- D. Inspect existing conditions prior to starting the Work, including elements subject to damage or movement during cutting and patching. Uncover elements where required for an adequate inspection. Notify the Construction Manager of any conditions that negatively impact the ability to perform cutting and patching. Contractor is deemed to have accepted the existing conditions and assumed the risk associated with completing the Work when cutting or patching is started after the inspection.
- E. Provide adequate support to maintain the structural integrity of facilities, structures, or elements that could be affected by cutting, patching or installing new Work. Provide devices and methods to protect facilities, structures, or elements from damage that could be affected by Contractor's efforts. Provide protection from the weather for portions of the Project that may be exposed by cutting and patching.
- F. Make cuts or penetrations using methods that prevent damage to other Work and provide proper surfaces for patching and repairs.
- G. Fit and adjust installed products to comply with specified products, functions, tolerances, and finishes.
- H. Patch or repair facilities, structures or elements to provide completed Work per the Contract Documents.
- I. Fit Work air-tight to pipes, sleeves, ducts, conduit, and other penetrations through the surfaces. Where fire rated separations are penetrated, fill the space around the pipe with

materials with physical characteristics equivalent to fire resistance requirements of penetrated surface. Provide firestop inserts inside pipes, sleeves, ducts, conduit, and other penetrations when required by fire resistance requirements.

- J. Patch finished surfaces and building components using new products specified for the original installation. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:
 - 1. For continuous surfaces, refinish to the nearest intersection.
 - 2. For an assembly, refinish the entire unit.

1.20 PRELIMINARY OCCUPANCY

- A. Owner may deliver, install, and connect equipment, furnishings, or other apparatus in buildings or other structures. These actions do not indicate acceptance of any part of the building or structure and does not affect the start of warranties or correction periods.
- B. Protect the Owner's property after installation is complete.
- C. Owner may use any product for testing or to determine that the product meets the requirements of the Contract Documents. This use does not constitute acceptance by OPT. These actions do not indicate acceptance of any part of the product and does not affect the start of warranties or correction periods.

1.21 OCCUPANCY

- A. Owner has the right to occupy or operate any portion of the Project that is ready for use after notifying the Contractor of its intent to do so.
- B. Testing of equipment and appurtenances including specified test periods, training, and startup does not constitute acceptance for operation.
- C. Owner may accept the facility for continued use after startup and testing at the option of the Owner. If acceptance is delayed at the option of the Owner, shut down facilities per approved operation and maintenance procedures.
- D. The execution of bonds is understood to indicate the consent of the surety to these provisions for occupancy of the structures and use of equipment.
- E. Provide an endorsement from the insurance carrier permitting occupancy of the structures and use of equipment during the remaining period of construction.
- F. Conduct operations to ensure the least inconvenience to the Owner and general public.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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01 31 13 PROJECT ADMINISTRATION

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. Administer contract requirements to construct the Project. Provide documentation per the requirements of this Section. Provide information as requested by the OPT.

1.02 DOCUMENTATION

- A. Provide documents in accordance with Section 01 33 00 "Document Management."

1.03 COMMUNICATION DURING THE PROJECT

- A. Construction Manager is to be the first point of contact for all parties on matters concerning this Project.
- B. Construction Manager will coordinate correspondence concerning:
 - 1. Contract administration;
 - 2. Clarification and interpretation of the Contract Documents;
 - 3. Contract modifications;
 - 4. Observation of Work and testing; and
 - 5. Claims.
- C. Construction Manager will normally communicate only with the Contractor. Any required communication with Subcontractors or Suppliers will only be with the direct involvement of the Contractor.
- D. Direct written communications to the Construction Manager at the address indicated at the pre-construction conference. Include the following with communications as a minimum:
 - 1. Name of the Owner;
 - 2. Project name;
 - 3. Contract title;
 - 4. Project number;
 - 5. Date; and
 - 6. A reference statement.
- E. Submit communications on the forms referenced in this Section or in Section 01 33 00 "Document Management."

1.04 PROJECT MEETINGS

- A. Pre-Construction Conference:
 - 1. Attend a pre-construction conference;
 - 2. The location of the conference will be determined by the Construction Manager;

3. The time of the conference will be determined by the Construction Manager, but will be after the Notice of Award is issued and not later than 15 days after the Notice to Proceed is issued;
 4. OPT, Contractor's project manager and superintendent, representatives of utility companies, and representatives from major Subcontractors and Suppliers may attend the conference; and
 5. Provide and be prepared to discuss:
 - a. Preliminary construction schedule per Section 01 33 05 "Construction Progress Schedule";
 - b. Preliminary Schedule of Documents per Section 01 33 00 "Document Management";
 - c. Schedule of Values and anticipated schedule of payments per Section 01 29 00 "Application for Payment Procedures";
 - d. List of Subcontractors and Suppliers;
 - e. Contractor's organizational chart as it relates to this Project; and
 - f. Letter indicating the agents of authority for the Contractor and the limit of that authority with respect to the execution of legal documents, contract modifications, and payment requests.
- B. Progress Meetings:
1. Attend meetings with the Construction Manager, Design Professional, and Owner.
 - a. Meet monthly or as requested by the Construction Manager to discuss the Project.
 - b. Meet at the Site or other location as designated by the Construction Manager.
 - c. Contractor's superintendent and other key personnel are to attend the meeting. Other individuals may be requested to attend to discuss specific matters.
 - d. Notify the Construction Manager of any specific items to be discussed a minimum of 1 week prior to the meeting.
 2. Provide information as requested by the Construction Manager, Design Professional or Owner concerning this Project. Prepare to discuss:
 - a. Status of overall project schedule;
 - b. Contractor's detailed schedule for the next month;
 - c. Anticipated delivery dates for equipment;
 - d. Coordination with the Owner;
 - e. Status of documents;
 - f. Information or clarification of the Contract Documents;
 - g. Claims and proposed modifications to the Contract;
 - h. Field observations, problems, or conflicts; and

- i. Maintenance of quality standards.
 3. Construction Manager will prepare a record of meeting proceedings. Review the record of the meeting and notify the Construction Manager of any discrepancies within 10 days of the date the record of the meeting is provided. The record will not be corrected after the 10 days have expired. Corrections will be reflected in the record of the following meeting.
- C. Pre-Documentation and Pre-Installation Meetings:
 1. Conduct pre-documentation and pre-installation meetings as required in the individual technical Specifications or as determined necessary by the Construction Manager (for example, instrumentation, roofing, concrete mix design, etc.).
 2. Set the time and location of the meetings when ready to proceed with the associated Work. Submit a Notification by Contractor in accordance with Paragraph [1.07] for the meeting 2 weeks before the meeting. OPT must approve of the proposed time and location.
 3. Attend the meeting and require the participation of appropriate Subcontractors and Suppliers in the meeting.
 4. Construction Manager will prepare a record of meeting proceedings. Review the record of the meeting and notify the Construction Manager of any discrepancies within 10 days of the date the record of the meeting is provided. The record will not be corrected after the 10 days have expired. Corrections will be reflected in the record of the following meeting.
- D. Weekly Coordination Meetings: Meet on a weekly basis with the Construction Manager or designated on-site representative of the OPT to discuss Work planned for the following week, review coordination issues, testing required, or other issues. Records of these meetings are not required.

1.05 REQUESTS FOR INFORMATION

- A. Submit a Request for Information to the Construction Manager to obtain additional information or clarification of the Contract Documents.
 1. Submit a separate Request for Information for each item on the form provided by the Construction Manager.
 2. Attach adequate information to permit a response without further clarification. Construction Manager will return requests that do not have adequate information to the Contractor for additional information. Contractor is responsible for all delays resulting from multiple reviews due to inadequate information.
 3. A response will be made when adequate information is provided. The response will be made on the Request for Information form provided by the Construction Manager.
- B. Response to a Request for Information is given to provide additional information, interpretation, or clarification of the requirements of the Contract Documents, and does not modify the Contract Documents.
 1. Submit a Change Proposal per Section 01 26 00 "Change Management" if a contract modification is suggested or required.

- C. Use the Decision Register to document decisions made at meetings and actions to be taken in accordance with Paragraph 1.06.
- D. Use the Action Item Register to document assignments for actions to be taken in accordance with Paragraph 1.06.

1.06 DECISION AND ACTION ITEM REGISTER

- A. Construction Manager will maintain a Decision Register to document key decisions made during meetings, telephone conversations, or visits to the Site using the format provided by the Construction Manager:
 - 1. Review the Decision Register prior to each regular meeting.
 - 2. Report any discrepancies to the Construction Manager for correction or discussion at the next monthly meeting.
- B. Construction Manager will maintain an Action Item Register in conjunction with the Decision Register to track assignments made during meetings, telephone conversations or visits to the Site using the format provided by the Construction Manager:
 - 1. Review the Action Item Register prior to each regular meeting.
 - 2. Report actions taken after the previous progress meeting on items in the register assigned to the Contractor or through the Contractor to a Subcontractor or Supplier to the Construction Manager. Report on status of progress 1 week prior to each progress meeting established in Paragraph 1.04 to allow Construction Manager to update the register prior to the Progress Meetings.
 - 3. Be prepared to discuss the status at each meeting.
- C. Decisions or action items in the register that require a change in the Contract Documents will have the preparation of a Modification as an action items if appropriate. The Contract Documents can only be changed by a Modification.

1.07 NOTIFICATION BY CONTRACTOR

- A. Notify the Construction Manager of:
 - 1. Need for testing;
 - 2. Intent to work outside regular working hours;
 - 3. Request to shut down facilities or utilities;
 - 4. Proposed utility connections;
 - 5. Required observation by Construction Manager, Engineer, or inspection agencies prior to covering Work; and
 - 6. Training.
- B. Provide notification a minimum of 2 weeks in advance to allow OPT time to respond appropriately to the notification.
- C. Use the Notification by Contractor form provided by the Construction Manager.

1.08 REQUESTS FOR MODIFICATIONS

- A. Submit requests for Modifications per Section 01 26 00 "Change Management."

1.09 PLAN OF ACTION

- A. Submit a written Plan of Action for approval for shutting down essential services. These include:
 - 1. Electrical power;
 - 2. Control power;
 - 3. Communications equipment; and
 - 4. Other designated functions.
- B. Describe the following in the Plan of Action:
 - 1. Scheduled dates for construction;
 - 2. Work to be performed;
 - 3. Utilities, piping, or services affected;
 - 4. Length of time the service or utility will be disturbed;
 - 5. Procedures to be used to carry out the Work;
 - 6. Plan of Action to handle emergencies;
 - 7. List of manpower, equipment, and ancillary supplies;
 - 8. Backups for key pieces of equipment and key personnel; and
 - 9. Contingency plan that will be used if the original schedule cannot be met.
- C. Submit plan 2 weeks prior to beginning the Work.

1.10 RECORD DATA

- A. Submit information required by the Contract Documents that is not related to a product as Record Data using the form provided by the Construction Manager.

1.11 RECORD DOCUMENTS

- A. Maintain one complete set of printed Record Documents at the Site including:
 - 1. Drawings;
 - 2. Specifications;
 - 3. Addenda;
 - 4. Modifications;
 - 5. Product Data and approved Shop Drawings;
 - 6. Construction photographs;
 - 7. Test Reports;

8. Clarifications and other information provided in Request for Information responses; and
 9. Reference standards.
- B. Store printed Record Documents and Samples in the Contractor's field office.
1. Record Documents are to remain separate from documents used for construction.
 2. Provide files and racks for the storage of Record Documents.
 3. Provide a secure storage space for the storage of Samples.
 4. Maintain Record Documents in clean, dry, legible conditions, and in good order.
 5. Make Record Documents and Samples available at all times for inspection by the OPT.
- C. Maintain an electronic record of Specifications and Addenda to identify products provided in PDF format.
1. Reference the Product Data number, Shop Drawing number, and O&M manual number for each product and item of equipment furnished or installed.
 2. Reference Modifications by type and number for all changes.
- D. Maintain an electronic record of Drawings in PDF format.
1. Reference the Product Data number, Shop Drawing number, and O&M manual number for each product and item of equipment furnished or installed.
 2. Reference Modifications by type and number for all changes.
 3. Record information as construction is being performed. Do not conceal any Work until the required information is recorded.
 4. Mark drawings to record actual construction.
 - a. Depths of various elements of the foundation in relation to finished first floor datum or the top of walls.
 - b. Horizontal and vertical locations of underground utilities and appurtenances constructed, and existing utilities encountered during construction.
 - c. Location of utilities and appurtenances concealed in the Work. Refer measurements to permanent structures on the surface. Include the following equipment:
 - 1) Piping;
 - 2) Ductwork;
 - 3) Equipment and control devices requiring periodic maintenance or repair;
 - 4) Valves, unions, traps, and tanks;
 - 5) Services entrance;
 - 6) Feeders; and
 - 7) Outlets.
 - d. Changes of dimension and detail.

- e. Changes by Modifications.
 - f. Information in Requests for Information or included in the Decision Register.
 - g. Details not on the original Drawings. Include field verified dimensions and clarifications, interpretations, and additional information issued in response to Requests for Information.
5. Mark Drawings with the following colors:
- a. Highlight references to other documents, including Modifications in blue.
 - b. Highlight mark ups for new or revised Work (lines added) in yellow.
 - c. Highlight items deleted or not installed (lines to be removed) in red.
 - d. Highlight items constructed per the Contract Documents in green.
6. Submit Record Documents to Construction Manager for review and acceptance 30 days prior to Final Completion of the Project.
- E. Applications for Payment will not be recommended for payment if Record Documents are found to be incomplete or not in order. Final payment will not be recommended without complete Record Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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01 33 00 DOCUMENT MANAGEMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Submit documentation as required by the Contract Documents and as requested by the Construction Manager.
- B. Use the Project Management Information System (PMIS) provided by the Construction Manager Software for the PMIS is FNiManager which has the following system requirements:
 - 1. Operating Systems: Windows 7 or later and OS X v10.8 or later.
 - 2. Supported Internet Browsers: Internet Explorer 11.0 or later, Google Chrome 70.0 or later, Firefox 63.0 or later, Safari 11.0 or later, and Microsoft Edge 17.0 or later.
 - 3. Screen Resolution: The recommended screen resolution is 1280 x 1024 or higher. The minimum screen resolution required to support all features is 1024 x 768.

1.02 QUALITY ASSURANCE

- A. Submit legible, accurate, complete documents presented in a clear, easily understood manner. Documents not meeting these criteria will be returned without review as “Not Approved.”

1.03 CONTRACTOR’S RESPONSIBILITIES

- A. Review documents prior to submission. Make certifications as required by the Contract Documents and as indicated on Construction Manager provided forms.
- B. Provide a Schedule of Documents to list the documents that are to be submitted and the dates on which documents are to be sent to the Construction Manager for review. Use the form provided by the Construction Manager for this list.
- C. Incorporate the dates for processing documents into the Progress Schedule required by Section 01 33 05 “Construction Progress Schedule.”
 - 1. Provide documents in accordance with the schedule so construction of the Project is not delayed.
 - 2. Allow a reasonable time for the review of documents when preparing the Progress Schedule. Assume a 14-day review cycle for each document unless a longer period of time is indicated in the Contract Documents or agreed to by Construction Manager and Contractor.
 - 3. Schedule delivery of review documents to provide all information for interrelated Work at one time.
 - 4. Allow adequate time for processing documents so construction of the Project is not delayed.

1.04 FORMS AND WORKFLOWS

- A. Use the forms or workflow process provided by the Construction Manager for project documentation.

1.05 DOCUMENT PREPARATION AND DELIVERY PROCEDURES

- A. Deliver documents in electronic format as directed by the Construction Manager.
 - 1. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
 - 2. Deliver all documents in Portable Document Format (PDF).
 - a. Create PDF document using Bluebeam Revu software.
 - b. Create PDF documents from native format files unless files are only available from scanned documents.
 - c. Rotate pages so that the top of each document appears at the top of the monitor screen when opened in PDF viewing software.
 - d. Provide PDF document with adequate resolution to allow documents to be printed in a format equivalent to the document original. Documents are to be scalable to allow printing on standard 8-1/2 x 11 or 11 x 17 paper.
 - e. Submit color PDF documents where color is required to interpret the document.
 - f. Create or convert documents to allow text to be selected for comments or searched using text search features. Run scanned documents through Optical Character Recognition (OCR) software if necessary.
 - g. Flatten markups in documents to prevent markups made by Contractor from being moved or deleted. Flatten documents to allow markup recovery.
 - h. Use Bluebeam Revu software to reduce file size using default settings except the option for “Drop Metadata”. Uncheck the “Drop Metadata” box when reducing file size.
 - i. Add footers to each document with the name of the Project.

1.06 DOCUMENT NUMBERING

- A. Assign a document number to the Contractor originated document to allow tracking of the document during the review process.
 - 1. Assign the number consisting of a prefix, a sequence number, and a letter suffix. Prefixes will be as follows:

Prefix	Description
AP	Application for Payment
CP	Change Proposal
CTR	Certified Test Report
EIR	Equipment Installation Report
GD	Graphic Documentation

Prefix	Description
NBC	Notification by Contractor
O&M	Operation and Maintenance Manuals
PD	Product Data
RD	Record Data
RFI	Request for Information
SD	Shop Drawing
SCH	Schedule of Progress

2. Issue sequence numbers in chronological order for each type of document as directed by the Construction Manager.
 3. Issue numbers for resubmittals that have the same number as the original document followed by an alphabetical suffix indicating the number of times the same document has been sent to the Construction Manager for processing. For example: SD-025 A represents Shop Drawing number 25 and the letter "A" designates this is the second time this document has been sent for review.
 4. Clearly note the document number on each page or sheet of the document.
 5. Correct assignment of numbers is essential since different document types are processed in different ways.
- B. Include reference to the Drawing number and/or Specification Section, detail designation, schedule, or location that corresponds with the data submitted on the Document Transmittal form. Other identification may also be required, such as layout drawings or schedules to allow the reviewer to determine where a particular product is to be used.

1.07 DOCUMENTATION

- A. Furnish documents as indicated in the individual Specification Sections. Submit documents per the procedures described in the Contract Documents.
- B. Submit documents per the Specification Sections shown in the following table:

Document Type	Specification Section
Application for Payment	01 29 00
Certified Test Report	01 33 02 for approval of product 01 40 00 to demonstrate compliance
Change Management	01 26 00
Equipment Installation Report	01 75 00
Graphic Documentation	01 33 06
Notification by Contractor	01 31 13
Operation & Maintenance Manuals	01 33 04
Product Data	01 33 03
Progress Schedules	01 33 05
Record Data	01 31 13
Request for Information	01 31 13
Schedule of Values	01 29 00
Shop Drawing	01 33 02

Document Type	Specification Section
Substitutions	01 26 00
Suppliers and Subcontractors	01 31 13 01 33 03

1.08 Electronic Documents Protocol

- A. The parties shall follow the provisions in this Section, referred to as the Electronic Documents Protocol (“EDP”), for exchange of electronic transmittals.
- B. Basic Requirements:
1. Except as otherwise stated elsewhere in the Contract Documents, the OPT and Contractor will send and accept Electronic Documents sent by Electronic Means using the protocols provided in this Section.
 2. The contents of the information in any Electronic Document will be the responsibility of the transmitting party. Electronic Documents may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, and are subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.
 3. Provisions of this Contract regarding Electronic Documents must be incorporated into other agreements or subcontracts on the Project. Nothing in this paragraph reduces or eliminates requirements:
 - a. to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations;
 - b. to comply with any applicable Law or Regulation governing the signing and sealing of design documents and related Modifications or the signing and electronic transmission of any other documents; or
 - c. to comply with the notice requirements.
 4. When sending Electronic Documents by Electronic Means the sending party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient’s use of software application packages, operating systems, or computer hardware differing from those used in the drafting or sending Electronic Documents.
- C. System Infrastructure for Electronic Document Exchange:
1. Contractor will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions (“System Infrastructure”) at its own cost. System Infrastructure must comply with these requirements.
 2. The maximum size of an email attachment for exchange of Electronic Documents under this EDP is 10 MB. Attachments larger than that may be exchanged by using large file transfer functions or physical media.
 3. Contractor assumes full and complete responsibility for its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, or otherwise enabling its System Infrastructure, including operating systems and software.

4. Contractor is responsible for its own system operations, security, back-up, archiving, audits, printing resources, and other Information Technology (“IT”) for maintaining operations of its System Infrastructure during the Project, including coordination with individual(s) or entity responsible for managing its System Infrastructure and capable of addressing routine communications and other IT issues affecting the exchange of Electronic Documents.
 5. Contractor will operate and maintain industry-standard, industry-accepted, ISO standard, commercial-grade security software and systems that are intended to protect others from: software viruses and other malicious software like worms, trojans, adware; data breaches; loss of confidentiality; and other threats in the transmission to or storage of information from the other parties, including transmission of Electronic Documents by physical media such as CD/DVD/flash drive/hard drive. Contractor will not be liable to others for any breach of system security to the extent that Contractor maintains and operates required security software and systems.
 6. In the case of disputes, conflicts, or modifications to the use of Electronic Documents required to address issues affecting System Infrastructure, Contractor and OPT will cooperatively resolve the issues; but, failing resolution, OPT is authorized to make and require reasonable and necessary changes meet its original intent. Contractor may submit a Change Proposal if the changes cause additional cost or time to Contractor that could not have reasonably been anticipated.
 7. Contractor and OPT are both responsible for their own back-up and archive of documents sent and received during the term of the contract. Contractor and OPT remain solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract as each party deems necessary for its own purposes.
 8. If a Contractor or OPT receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.
 9. OPT will operate a project information management system (Project Website) for use of OPT and Contractor during the Project for exchange and storage of Project-related communications and information. Except as otherwise provided in this Contract, use of the Project Website will be mandatory for exchange of Project documents, communications, submittals, and other Project-related information.
- D. Software Requirements:
1. OPT and Contractor will each acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic

Documents received from the other party (and if relevant from third parties), using the following software formats:

Document	Document Format
Email	.htm, .rtf, or .txt without formatting that impair legibility of content on screen or in printed copies
Submittals	Bluebeam PDF
Applications for Payment	Bluebeam PDF and Microsoft® Excel
Progress Schedules	PDF and Schedule in Schedule in Native Format
Layouts and drawings to be submitted to Owner for future use and modification	Autodesk® AutoCAD .dwg format
Document submitted to OPT for future word processing use and modification	Microsoft® Word
Spreadsheets and data submitted to OPT for future data processing use and modification	Microsoft® Excel
Photographs	.jpg or .jpeg
Videos	.mp4, .mpeg, or .avi

2. Software will be the version currently published at the time Contract is signed, unless a specific software version is listed in the Supplementary Conditions. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or convert to comply with this Section.
3. The parties agree not to intentionally edit, reverse engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a software data format, including Portable Document Format (PDF), intended by sender not to be modified, unless the receiving party obtains the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.

E. Requests by Contractor for Electronic Documents in Other Formats:

1. Release of any Electronic Documents developed during the design process (including Contract Documents, Technical Data, Drawings, and computer models) in formats other than those identified in this Section will be at the discretion of the OPT.
2. To the extent determined by OPT, release of Electronic Documents and other project information requested by Contractor (“Request”) in formats other than those identified in this Section will be subject to the provisions of Owner’s response to the Request, and to the following conditions:
 - a. The content included in the Electronic Documents covered by the Request was prepared by Design Professional as an internal working document or electronic computer model solely for Design Professional’s purposes and not for any construction processes and is being provided to Contractor on an “AS IS” basis without any warranties of any kind, including, any implied warranties of fitness

for any purpose. Contractor is advised and acknowledges that the content may not be suitable for Contractor's application or may require substantial modification and independent verification by Contractor. The content may include limited resolution of models, not-to-scale schematic representations and symbols, use of notes to convey design concepts in lieu of accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other devices that may affect subsequent reuse.

- b. Electronic Documents containing text, graphics, metadata, or other types of data that are provided by Design Professional to Contractor under the Request are only for convenience of Contractor. Any conclusion or information obtained or derived from such data will be at the Contractor's sole risk and Contractor waives any claims against the Design Professional or Owner arising from use of data in Electronic Documents covered by the Request.
 - c. **CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS THE OWNER AND DESIGN PROFESSIONAL AND THEIR SUBCONSULTANTS FROM ALL CLAIMS, DAMAGES, LOSSES, AND EXPENSES, INCLUDING ATTORNEYS' FEES AND DEFENSE COSTS ARISING OUT OF OR RESULTING FROM THE CONTRACTOR'S USE, ADAPTATION, OR DISTRIBUTION OF ANY ELECTRONIC DOCUMENTS PROVIDED UNDER THE REQUEST.**
 - d. Contractor agrees not to sell, copy, transfer, forward, give away or otherwise distribute this information (in source or modified file format) to any third party without the direct written authorization of Design Professional, unless such distribution is specifically identified in the Request and is limited to the Contractor's subcontractors. Contractor warrants that subsequent use by the Contractor's subcontractors complies with all terms of the Contract Documents and the Owner's response to Request.
3. In the event that Owner elects to provide or directs Design Professional to provide to Contractor any Contractor-requested Electronic Document versions of project information that is not explicitly identified in the Contract Documents as being available to Contractor, Owner shall be reimbursed by Contractor on an hourly basis for any costs necessary to create or otherwise prepare the data in a manner deemed appropriate by Design Professional in accordance with the General Conditions.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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01 33 02 SHOP DRAWINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. Shop Drawings are required for those products that cannot adequately be described in the Contract Documents to allow fabrication, erection, or installation of the product without additional detailed information from the Supplier.
- B. Submit Shop Drawings as required by the Contract Documents and as reasonably requested by the Construction Manager to:
 - 1. Record the products incorporated into the Project;
 - 2. Provide detailed information for the products proposed for the Project regarding their fabrication, installation, commissioning, and testing; and
 - 3. Allow the Design Professional to advise the Owner if products proposed for the Project by the Contractor conform, in general, to the design concepts of the Contract Documents.
- C. Contractor’s responsibility for full compliance with the Contract Documents is not relieved by the review of Shop Drawings, Samples, or mockups.
- D. Submit a Change Proposal per Section 01 26 00 “Change Management” to request modifications to the Contract Documents, including those for approval of “or equal” products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures. Deviations from the Contract Documents can only be approved by Change Order or Field Order.

1.02 QUALITY ASSURANCE

- A. Submit legible, accurate, and complete documents presented in a clear, easily understood manner. Shop Drawings not meeting these criteria will not be approved.
- B. Demonstrate that the proposed products are in full compliance with the design criteria and requirements of the Contract Documents, or will be if deviations requested per Paragraph 1.11 are approved.
- C. Furnish and install products that fully comply with the information included in the Shop Drawings.

1.03 CONTRACTOR’S RESPONSIBILITIES

- A. Furnish Shop Drawings for products as indicated in Section 01 33 01 “Document Register” or in the individual Specification Sections.
- B. Shop Drawings are required for the following items:

Specification Section	Shop Drawing Description
03 11 00	Concrete Forming
03 32 00	Reinforcing Steel

Specification Section	Shop Drawing Description
05 52 13	Pipe and Tube Railings
06 10 00	Rough Carpentry
23 34 23	HVAC Power Ventilators
23 35 16	Engine Exhaust Piping and Specialties
26 05 19	Equipment Wiring Systems
26 05 26	Grounding and Bonding
26 05 29	Supporting Devices
26 05 33	Conduits
26 24 16	Panelboards and Switchboards
26 28 16	Low Voltage Enclosed Circuit Breakers and Switches
26 32 13	Diesel Engine Generator Sets
26 36 00	Transfer Switches
26 51 00	Interior Lighting

- C. Include Shop Drawings in the Document Register required by Section 01 33 00 “Document Management” to indicate the Shop Drawings to be submitted, the dates on which Shop Drawings are to be sent to the Construction Manager for review, and proposed dates that the product will be incorporated into the Project.
- D. Incorporate the dates for processing Shop Drawings into the Progress Schedule required by Section 01 33 05 “Construction Progress Schedule.”
1. Submit Shop Drawings in accordance with the schedule so construction of the Project is not delayed.
 2. Submit Shop Drawings for interrelated Work at one time.
 3. Allow adequate time for ordering, fabricating, delivering, and installing products so construction of the Project is not delayed.
- E. Complete the following before submitting a Shop Drawing or Sample:
1. Prepare and review the Shop Drawing or Sample. Coordinate the Shop Drawing or Sample with other Shop Drawings and Samples, with the requirements of the Work, and the Contract Documents;
 2. Determine and verify specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to Shop Drawings and Samples;
 3. Determine and verify the suitability of materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 4. Determine and verify information relative to Contractor’s responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

- F. Determine and verify:
 - 1. Field measurements, quantities, and dimensions are shown on the Shop Drawing and are accurate;
 - 2. Location of existing structures, utilities, and equipment related to the Shop Drawing have been shown and conflicts between the products, existing structures, utilities, and equipment have been identified;
 - 3. Conflicts that impact the installation of the products have been brought to the attention of the Construction Manager;
 - 4. Shop Drawing is complete for its intended purpose; and
 - 5. Conflicts between the Shop Drawing related to the various Subcontractors and Suppliers have been resolved.
- G. Review Shop Drawings prior to submitting to the Construction Manager. Certify that all Shop Drawings have been reviewed by the Contractor and are in strict conformance with the Contract Documents as modified by Addenda, Change Order, Field Order, or Contract Amendment when submitting Shop Drawings except for deviations specifically brought to the Construction Manager's attention on an attached Shop Drawing Deviation Request form in accordance with Paragraph 1.11.
- H. Fabrication or installation of any products prior to the approval of Shop Drawings is done at the Contractor's risk. Defective products may be rejected at the Owner's option.
- I. Payment will not be made for products for which Shop Drawings or Samples are required until these are approved by the Construction Manager and Design Professional.

1.04 DOCUMENTATION

- A. Provide adequate information in Shop Drawings and with Samples so the Design Professional can:
 - 1. Assist the Owner in selecting colors, textures, or other aesthetic features.
 - 2. Compare the proposed features of the product with the specified features and advise Owner that the product does, in general, conform to the Contract Documents.
 - 3. Compare the performance features of the proposed product with those specified and advise the Owner that the product does, in general, conform to the performance criteria specified in the Contract Documents.
 - 4. Review required certifications, guarantees, warranties, and service agreements for compliance with the Contract Documents.
- B. Include a complete description of the material or equipment to be furnished, including:
 - 1. Type, dimensions, size, arrangement, model number, and operational parameters of the components;
 - 2. Weights, gauges, materials of construction, external connections, anchors, and supports required;
 - 3. Performance characteristics, capacities, engineering data, motor curves, and other information necessary to allow a complete evaluation of mechanical components;

4. All applicable standards;
 5. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns, and coordination drawings;
 6. Wiring and piping diagrams and related controls;
 7. Mix designs for concrete, asphalt, or other materials proportioned for the Project; and
 8. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the document that the measurements represent actual dimensions obtained at the Site.
- C. Submit Shop Drawings that require coordination with other Shop Drawings for fabrication at the same time. Shop Drawings requiring coordination with other Shop Drawings will not be approved until a complete package is submitted, unless approved by the Construction Manager.
- D. Submit information for all of the components and related equipment required for a complete and operational system in one Submittal.
1. Include electrical, mechanical, and other information required to indicate how the various components of the system function together as a system.
 2. Provide certifications, warranties, and written guarantees and service contracts with the document package for review when these are required.

1.05 SPECIAL CERTIFICATIONS AND REPORTS

- A. Provide all required special certifications, reports, and other documentation with the Shop Drawings as specified in the individual Specification Sections which may include:
1. Certified Test Reports (CTR): A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the Specifications. This report is to demonstrate that the product, when installed, will meet the requirements of the Contract Documents and is part of the Shop Drawing. Field tests may be performed by the Owner to determine that in place materials or products meet the same quality as indicated in the CTR submitted as part of the Shop Drawing.
 2. Certification of Local Field Service (CLS): A certified letter stating that field service is available from a factory or supplier approved service organization located within a 300-mile radius of the Site. Include the names, addresses, and telephone numbers of approved service organizations with the certificate.
 3. Certification of Adequacy of Design (CAD): A certified letter from the manufacturer of the equipment stating that the equipment has been designed to be structurally stable and to withstand all imposed loads without deformation, failure, or adverse effects to the performance and operational requirements of the unit. The letter must state that mechanical and electrical components have been adequately sized to be fully operational for the conditions specified or normally encountered by the product's intended use.
 4. Certification of Applicator/Subcontractor (CSQ): A certified letter stating that the applicator or subcontractor proposed to perform a specified function is duly

designated as factory authorized and trained for the application of the specified product.

1.06 WARRANTIES AND GUARANTEES

- A. Provide all required warranties, guarantees, and related documents with the Shop Drawing. The effective date of warranties and guarantees will be the date of Substantial Completion.
- B. Identify all extended warranties which are defined as any guarantee of performance for the product or system beyond the one-year correction period described in the General Conditions. Issue the warranty certificate in the name of the Owner. Provide a warranty bond for extended warranties if required by the individual Specification Sections.
- C. Include an additional copy of equipment warranties in operation and maintenance manuals.
- D. Provide a copy of all warranties in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

1.07 EXTENDED SERVICE AGREEMENTS

- A. Provide Extended Service Agreements and related documents with the Product Data. An Extended Service Agreement is a contract between the Owner and an approved Subcontractor or Supplier to provide service and or maintenance beyond that required to fulfill requirements for warranty repairs, or to perform routine maintenance for a definite period beyond the one-year correction period specified in the General Conditions.
- B. An Extended Service Agreement does not relieve the Contractor from obligations under the one-year correction period or warranty provisions specified in the General Conditions.
- C. An Extended Service Agreement does not relieve the Contractor from obligations under the maintenance bond, if a maintenance bond is required by the Contract.
- D. Requirements for the Extended Service Agreement are described in the Specification Sections for each piece of equipment or system requiring an Extended Service Agreement.
- E. Enter into a contract with the service provider and assign the service contract to the Owner on the date Substantial Completion. Once assigned to the Owner, Contract requirements for the Extended Service Agreement will be complete and will not extend the Contract between the Owner and Contractor.
- F. Owner may require that a performance bond be provided for the Extended Service Agreement. Provide a separate bond meeting the same requirements as those for the Contractor's performance bond if required. The bond will be in the amount of the Extended Service Agreement.
- G. Include an additional copy of Extended Service Agreements in operation and maintenance manuals.
- H. Provide a copy of Extended Service Agreements in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

1.08 SHOP DRAWING SUBMITTAL PROCEDURES

- A. Submit Shop Drawings to the Construction Manager. Send all documents in digital format for processing.
1. Provide all information requested. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
 2. Submit all documents in Portable Document Format (PDF) as required by Section 01 33 00 "Document Management." Provide color PDF documents where color is required to interpret the Shop Drawing. Provide Samples and color charts per Paragraph 1.09.
 3. Submit each specific product, class of material, or equipment system separately so these can be tracked and processed independently. Do not submit Shop Drawings for more than one independent system in the same Submittal.
 4. Submit items specified in different Specification Sections separately unless they are part of an integrated system.
 5. Define abbreviations and symbols used in Shop Drawings.
 - a. Use terms and symbols in Shop Drawings consistent with the Contract Drawings.
 - b. Provide a list of abbreviations and their meaning as used in the Shop Drawings.
 - c. Provide a legend for symbols used on Shop Drawings.
 6. Mark Shop Drawings to reference:
 - a. Related Specification Sections;
 - b. Drawing number and detail designation;
 - c. Equipment designation or name;
 - d. Schedule references;
 - e. System into which the product is incorporated; and
 - f. Location where the product is incorporated into the Project.
- B. Use the following conventions to markup Shop Drawings for review:
1. Make comments and corrections in the color blue. Add explanatory comments to the markup.
 2. Highlight items in black (redact) that are not being furnished when the Supplier's standard drawings or information sheets are provided so that only the products to be provided are in their original color.
 3. Make comments in yellow where selections or decisions by the Design Professional are required, but such selections do not constitute a deviation from the Contract Documents. Add explanatory comments to the markup to indicate the action requested of the Design Professional.
 4. Make comments in orange that are deviation requests. Include the deviation request number on the Shop Drawing that corresponds to the deviation request on the Shop

Drawing Deviation Request form. Include explanatory comments in the Shop Drawing Deviation Request form.

5. Mark dimensions with the prefix "FD" to indicate field verified dimensions on the Shop Drawings.
- C. Designate a document as requiring priority treatment to place the review of the Shop Drawing ahead of other Shop Drawings previously delivered. Shop Drawings are typically reviewed in the order received, unless Contractor requests that a different priority be assigned. Priority Shop Drawings will be reviewed before other Shop Drawings already received but not yet reviewed. Use of this priority designation for Shop Drawings may delay the review of Shop Drawings previously submitted. Contractor is responsible for delays resulting from the use of the priority designation status on Shop Drawings.
- D. Complete the certification required by Paragraph 1.03.G.

1.09 SAMPLE AND MOCKUP SUBMITTAL PROCEDURES

- A. Submit color charts and Samples for every product requiring color, texture, or finish selection.
 1. Submit color charts and Samples only after Shop Drawings for the products have been approved.
 2. Deliver all color charts and Samples at one time.
 3. Provide Samples of adequate size to clearly illustrate the functional characteristics of the product, with integrally related parts and attachment devices.
 4. Indicate the full range of color, texture, and patterns.
 5. Deliver color charts and Samples to the field office and store for the duration of the Project.
 6. Notify the Construction Manager that color charts and Samples have been delivered for approval using the Notification by Contractor form.
 7. Submit color charts and Samples not less than 30 days prior to when these products are to be ordered or released for fabrication to comply with the Project schedule.
 8. Remove Samples that have not been approved. Submit new Samples following the same process as for the initial Sample until Samples are approved.
 9. Dispose of Samples when related Work has been completed and approved and disposal is approved by the Construction Manager. At Owner's option, Samples will become the property of the Owner.
- B. Construct mockups for comparison with the Work being performed.
 1. Construct mockups from the actual products to be used in construction per the detailed specifications.
 2. Construct mockups of the size and in the area indicated in the Contract Documents.
 3. Construct mockups complete with texture and finish to represent the finished product.
 4. Notify the Construction Manager that mockups have been constructed and are ready for approval using the Notification by Contractor form. Allow 2 weeks for Construction

Manager to approve of the mockup before beginning the Work represented by the mockup.

5. Remove mockups that have not been approved. Construct new mockups following the same process as for the initial mockup until mockup is approved.
6. Protect mockups until Work has been completed and accepted by the Construction Manager.
7. Dispose of mockups when related Work has been completed and disposal is approved by the Construction Manager.

1.10 REQUESTS FOR DEVIATION

- A. Submit a Change Proposal per Section 01 26 00 "Change Management" to request modifications to the Contract Documents, including those for approval of "or equal" products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures.
- B. Provide a Shop Drawing with the Change Proposal that clearly identifies deviations for any product or component of the product that does not fully comply with the Contract Documents using the Shop Drawing Deviation Request form provided by the Construction Manager. Mark deviations on the Shop Drawing per Paragraph 1.09.B.
- C. Include a description of why the deviation is required and the impact on Contract Price or Contract Times. Include the amount of any cost savings to the Owner for deviations that result in a reduction in cost.
- D. Identify each deviation request as a separate item. Include all requested deviations that must be approved as a group together and identify them as a single item.
- E. Construction Manager will issue a Field Order or Change Order to approve acceptable deviations. Approval of a requested Shop Drawing deviation by the Design Professional on the Shop Drawings Deviation Request form indicates approval of the requested deviation only on its technical merits as generally conforming to the Contract Documents. Deviations from the Contract Documents can only be approved by a Modification issued by the Construction Manager.

1.11 CONSTRUCTION MANAGER AND DESIGN PROFESSIONAL RESPONSIBILITIES

- A. Shop Drawings will be received by the Construction Manager. Construction Manager will log the documents and forward to the Design Professional for review per this Section for general conformance with the Contract Documents.
 1. Design Professional's review and approval will be only to determine if the products described in the Shop Drawing or Sample will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
 2. Design Professional's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.

3. Design Professional's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
- B. Comments will be made on items called to the attention of the Design Professional for review and comment. Any marks made by the Design Professional do not constitute a blanket review of the document or relieve the Contractor from responsibility for errors or deviations from the Contract requirements.
1. Design Professional will respond to Contractor's markups by either making markups directly in the Shop Drawing file using the color red or by attaching a Document Review Comments form with review comments keyed to the Drawings or Shop Drawing Deviation Request.
 2. Shop Drawings that are reviewed will be returned with one or more of the following status designations:
 - a. Approved: Shop Drawing is found to be acceptable as submitted.
 - b. Approved as Noted: Shop Drawing is approved so long as corrections or notations made by Design Professional are incorporated into the Shop Drawing.
 - c. Not Approved: Shop Drawing or products described are not acceptable.
 - d. Cancelled: This action indicates that for some reason, the Shop Drawing is to be removed from consideration and all efforts regarding the processing of that document are to cease.
 3. Shop Drawings will also be designated for one of the following actions:
 - a. Documents Filed: Shop Drawing is acceptable without further action and has been filed as a record document.
 - b. Shop Drawing Not Required: A Shop Drawing was not required by the Contract Documents. Resubmit the document per Section 01 33 03 "Product Data."
 - c. Cancelled: This action indicates that for some reason, the Shop Drawing is to be removed from consideration and all efforts regarding the processing of that document are to cease.
 - d. Revise and Resubmit: Shop Drawing has deviations from the Contract Documents, significant errors, or is inadequate and must be revised and resubmitted for subsequent review.

Actions "a" through "c" will close out the Shop Drawing review process and no further action is required as a Shop Drawing. Action "d" requires follow up action to close out the review process.
 4. Drawings with a significant or substantial number of markings by the Contractor may be marked "Approved as Noted." These drawings are to be revised to provide a clean record of the document. Proceed with ordering products as the documents are revised.
 5. Dimensions or other data that do not appear to conform to the Contract Documents will be marked as "At Variance With" (AVW) the Contract Documents or other information provided. The Contractor is to make revisions as appropriate to comply with the Contract Documents.

- C. Bring deviations to the Shop Drawings to the attention of the Design Professional for approval by using the Shop Drawing Deviation Request form. Use a single line for each requested deviation so the Status and Action for each deviation can be determined for that requested deviation. If approval or rejection of a requested deviation will impact other requested deviation, then all related deviations should be included in that requested deviation line so the status and action can be determined on the requested deviation as a whole.
- D. Requested deviations will be reviewed as a possible Modification to the Contract Documents.
 - 1. A requested deviation will be marked as “Not Approved” if the requested deviation is unacceptable. Contractor is to revise and resubmit the Shop Drawing with corrections for approval.
 - 2. A Field Order will be issued by the Construction Manager for deviations approved by the Design Professional if the requested deviation is acceptable and if the requested deviation will not result in a change in Contract Price or Contract Times. Requested deviations from the Contract Documents may only be approved by Field Order.
 - 3. A requested deviation will not be approved if the requested deviation is acceptable but the requested deviation will or should result in a change in Contract Price or Contract Times. Submit any requested deviation that requires a change in Contract Price or Contract Times as a Change Proposal for approval prior to resubmitting the Shop Drawing.
- E. Contractor is to resubmit a complete Shop Drawing incorporating revisions until it is acceptable and marked “Approved” or “Approved as Noted” and is assigned an action per Paragraph 1.12.B.3 that indicates that the Shop Drawing process is closed.
- F. Information that is submitted as a Shop Drawing that should be submitted as Product Data or other type of document, or is not required may be returned without review, or may be deleted. No further action is required and the Shop Drawing process for this document will be closed.

1.12 RESUBMISSION REQUIREMENTS

- A. Make all corrections or changes required by the Design Professional in the document and resubmit to the Construction Manager until approved.
- B. Resubmit a complete Shop Drawing for each resubmittal. The last approved Shop Drawing must not rely on previous submissions. The final Shop Drawing is to provide a complete record for the Owner’s records.
- C. Revise initial drawings or data and resubmit as specified for the reviewed document.
 - 1. Highlight or cloud in green those revisions which have been made in response to the previous reviews by the Design Professional. This will include changes previously highlighted or clouded in yellow to direct attention to Design Professional to items requiring selections, decisions by the Design Professional or highlighted or clouded in orange for a requested deviation from the Contract Documents, or comments in red made by the Construction Manager.

2. Highlight and cloud new items in yellow where selections or decisions by the Design Professional are required, but such selections do not constitute a deviation from the Contract Documents. Add explanatory comments to the markup to indicate the action to be taken by the Design Professional.
 3. Highlight and cloud new items in orange that are deviation requests. Include the deviation request number on the Shop Drawing that corresponds to the deviation request on the Shop Drawing Deviation Request form. Numbering for these new items is to start with the next number following the last Shop Drawing deviation requested. Include explanatory comments in the Shop Drawing Deviation Request form.
- D. Pay for excessive review of Shop Drawings.
1. Excessive review of Shop Drawings is defined as any review required after the original review has been made and the first resubmittal has been checked to see that corrections have been made.
 2. Review of Shop Drawings or Samples will be an additional service requiring payment by the Contractor if the Contractor submits a substitution for a product for which a Shop Drawing or Sample has previously been approved, unless the need for such change is beyond the control of Contractor.
 3. Cost for additional review time will be billed to the Owner by the Design Professional for the actual hours required for the review of Shop Drawings by Design Professional and in accordance with the rates listed in Section 00 73 00 "Supplementary Conditions."
 4. A set-off will be included in each Application for Payment to pay the cost for the additional review. The set-off will be based on invoices submitted to the Owner for these services.
 5. Need for more than one resubmission or any other delay in obtaining Design Professional's approval of Shop Drawings will not entitle the Contractor to an adjustment in Contract Price or an extension of Contract Times.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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01 33 03 PRODUCT DATA

PART 1 - GENERAL

1.01 SUMMARY

- A. Submit Product Data as required by the Contract Documents and as reasonably requested by the Construction Manager. Provide Product Data for all products unless a Shop Drawing is required for the same item.
- B. Submit Product Data to provide documents that allow the Owner to:
 - 1. Record the products incorporated into the Project;
 - 2. Record detailed information about products regarding their fabrication, installation, commissioning, and testing; and
 - 3. Provide replacement or repair of products at some future date.
- C. Contractor’s responsibility for full compliance with the Contract Documents is not relieved by the receipt or cursory review of Product Data.
- D. Submit a Change Proposal per Section 01 26 00 “Change Management” to request modifications to the Contract Documents, including those for approval of “or equal” products when specifically allowed by the Contract Documents or as a substitution for specified products or procedures. Deviations from the Contract Documents can only be made by an approved Change Order or Field Order.

1.02 QUALITY ASSURANCE

- A. Submit legible, accurate, and complete documents presented in a clear, easily understood manner. Product Data not meeting these criteria will not be accepted and must be resubmitted.

1.03 CONTRACTOR’S RESPONSIBILITIES

- A. Product Data is required for the following items:

Specification Section	Product Data Description
03 30 00	Cast In Place Concrete
07 52 16	Styrene-Butadiene-Styrene (Sbs) Modified Bituminous Membrane Roofing
07 62 00	Sheet Metal Flashing and Trim
07 92 00	Joint Sealants
08 11 13	Hollow Metal Doors and Frames
08 33 23	Overhead Coiling Doors
08 90 00	Louvers and Vents
09 91 00	Painting
10 44 01	Fire Extinguishers
23 05 29	Hangers and Supports for HVAC Piping and Equipment
23 34 23	HVAC Power Ventilators
26 05 33	Conduit

Specification Section	Product Data Description
26 05 33.16	Boxes
26 05 53	Electrical Identifications
26 05 73	Power System Studies
26 22 13	Low Voltage Distribution Transformers
26 24 16	Panelboards and Switchboards
26 24 19	Motor Control Centers
26 27 26	Wiring Devices
26 28 16	Low Voltage Enclosed Circuit Breakers and Switches
26 32 13	Diesel Engine Drive Generators
26 36 00	Automatic Transfer Switches
26 43 13	Surge Protection Device for Low-Voltage Electrical Power Circuits
26 51 00	Interior Lighting
26 56 00	Exterior Lighting
31 05 13	Soils for Earthwork

- B. Include Product Data in the Document Register required by Section 01 33 00 “Document Management” to indicate the Product Data to be submitted, the dates on which documents are to be sent to the Construction Manager for review, and proposed dates that the product will be incorporated into the Project.
- C. Complete the following before submitting Product Data:
1. Prepare Product Data and coordinate with Shop Drawings, Samples, Product Data for related products, and with the requirements of the Contract Documents;
 2. Determine and verify specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information;
 3. Determine and verify the suitability of materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 4. Determine and verify information relative to Contractor’s responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
- D. Determine and verify:
1. Field measurements, quantities, and dimensions are shown on the Product Data and are accurate;
 2. Location of existing structures, utilities, and equipment related to the Product Data have been shown and conflicts between the products, existing structures, utilities, and equipment have been brought to the attention of the Construction Manager;
 3. Conflicts that impact the installation of the products have been brought to the attention of the Construction Manager;
 4. Product Data is complete for its intended purpose; and

5. Conflicts between the Product Data related to the various Subcontractors and Suppliers have been resolved.
- E. Review Product Data prior to submitting to the Construction Manager. Certify that all Product Data has been reviewed by the Contractor and is in strict conformance with the Contract Documents as modified by Addenda, Change Order, Field Order, or Contract Amendment when submitting Product Data.

1.04 DOCUMENTATION

- A. Include a complete description of the material or equipment to be furnished, including:
 1. Type, dimensions, size, arrangement, model number, and operational parameters of the components;
 2. Weights, gauges, materials of construction, external connections, anchors, and supports required;
 3. Performance characteristics, capacities, engineering data, motor curves, and other information necessary to allow a complete evaluation of mechanical components;
 4. All applicable standards;
 5. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns, and coordination drawings;
 6. Wiring and piping diagrams and related controls;
 7. Mix designs for concrete, asphalt, or other materials proportioned for the Project; and
 8. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the document that the measurements represent actual dimensions obtained at the Site.
- B. Submit information for all components and related equipment required for a complete and operational system in one submittal.
 1. Include electrical, mechanical, and other information required to indicate how the various components of the system function together as a system.
 2. Provide certifications, warranties, and written guarantees and service contracts with the document package for review when these are required.

1.05 SPECIAL CERTIFICATIONS AND REPORTS

- A. Provide all required certifications with the Product Data as specified in the individual Specification Sections:
 1. Certified Test Reports (CTR): A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the Specifications. This report is to demonstrate that the product when installed will meet the requirements of the Contract Documents and is part of the Product Data. Field tests may be performed by the Owner to determine that in place materials or products meet the same quality as indicated in the CTR submitted as part of the Product Data.
 2. Certification of Local Field Service (CLS): A certified letter stating that field service is available from a factory or supplier approved service organization located within a

300-mile radius of the Site. Include the names, addresses, and telephone numbers of approved service organizations with the certificate.

3. Certification of Adequacy of Design (CAD): A certified letter from the manufacturer of the equipment stating that the equipment has been designed to be structurally stable and to withstand all imposed loads without deformation, failure, or adverse effects to the performance and operational requirements of the unit. The letter must state that mechanical and electrical components have been adequately sized to be fully operational for the conditions specified or normally encountered by the product's intended use.
4. Certification of Applicator/Subcontractor (CSQ): A certified letter stating that the applicator or subcontractor proposed to perform a specified function is duly designated as factory authorized and trained for the application of the specified product.

1.06 WARRANTIES AND GUARANTEES

- A. Provide all required warranties, guarantees, and related documents with the Product Data. The effective date of warranties and guarantees will be the date of Substantial Completion.
- B. Identify all Extended Warranties which are defined as any guarantee of performance for the product or system beyond the one-year correction period described in the General Conditions. Issue the warranty certificate in the name of the Owner. Provide a warranty bond for extended warranties if required by Specification Sections.
- C. Include an additional copy of equipment warranties in operation and maintenance manuals.
- D. Provide a copy of all warranties in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

1.07 EXTENDED SERVICE AGREEMENTS

- A. Provide Extended Service Agreements and related documents with the Product Data. An Extended Service Agreement is a contract between the Owner and an approved Subcontractor or Supplier to provide service and or maintenance beyond that required to fulfill requirements for warranty repairs, or to perform routine maintenance for a definite period beyond the one-year correction period specified in the General Conditions.
- B. An Extended Service Agreement does not relieve the Contractor from obligations under the one-year correction period or Warranty provisions specified in the General Conditions.
- C. An Extended Service Agreement does not relieve the Contractor from obligations under the maintenance bond, if a maintenance bond is required by the Contract.
- D. Requirements for the Extended Service Agreement are described in the Specification Sections for each piece of equipment or system requiring an Extended Service Agreement.
- E. Enter into a contract with the service provider and assign the service contract to the Owner on the date of Substantial Completion. Once assigned to the Owner, Contract requirements for the Extended Service Agreement will be complete and will not extend the Contract between the Owner and Contractor.

- F. Owner may require that a performance bond be provided for the Extended Service Agreement. Provide a separate bond meeting the same requirements as those for the Contractor's performance bond if required. The bond will be in the amount of the Extended Service Agreement.
- G. Include an additional copy of Extended Service Agreements in operation and maintenance manuals.
- H. Provide a copy of Extended Service Agreements in a separate document in accordance with Section 01 70 00 "Execution and Closeout Requirements."

1.08 PRODUCT DATA SUBMITTAL PROCEDURES

- A. Submit Product Data to the Construction Manager. Send all documents in digital format for processing.
 - 1. Provide all information requested. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
 - 2. Submit all documents in Portable Document Format (PDF) as required by Section 01 33 00 "Document Management." Provide color PDF documents where color is required to interpret the Product Data.
 - 3. Submit each specific product, class of material, or equipment system separately so these can be tracked and processed independently. Do not submit Product Data for more than one system in the same Submittal.
 - 4. Submit items specified in different Specification Sections separately unless they are part of an integrated system.
 - 5. Define abbreviations and symbols used in Product Data.
 - a. Use terms and symbols in Product Data consistent with the Contract Drawings.
 - b. Provide a list of abbreviations and their meaning as used in the Product Data.
 - c. Provide a legend for symbols used on Product Data.
 - 6. Mark Product Data to reference:
 - a. Related Specification Sections;
 - b. Drawing number and detail designation;
 - c. Equipment designation or name;
 - d. Schedule references;
 - e. System into which the product is incorporated; and
 - f. Location where the product is incorporated into the Project.
- B. Complete the certification required by Paragraph 1.03.F.

1.09 CONSTRUCTION MANAGER AND DESIGN PROFESSIONAL RESPONSIBILITIES

- A. Product Data will be received by the Construction Manager, logged, and provided to Owner as the Project record.

1. Product Data may be reviewed to see that the information provided is adequate for the purpose intended. Product Data not meeting the requirements of Paragraph 1.02 may not be approved.
 2. Product Data is not reviewed for compliance with the Contract Documents. Comments may be returned if deviations from the Contract Documents are noted during the cursory review performed to see that the information is adequate.
 3. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the review of Product Data. Contract modifications can only be approved by a Change Order or Field Order.
- B. Construction Manager may take the following action in processing Product Data:
1. File Product Data as received if the cursory review indicates that the document meets the requirements of Paragraph 1.02. Document will be marked "Filed as Received" and "Documents Filed." No further action is required on that Product Data.
 2. Not approve the Product Data for one of the following reasons:
 - a. The documentation requirements of the Contract Documents indicate that the document submitted as Product Data should have been submitted as a Shop Drawing. The Product Data will be marked "Not Approved" and "Submit as Shop Drawing." No further action is required on this document as Product Data and the Product Data process will be closed. Resubmit the document as a Shop Drawing per Section 01 33 02 "Shop Drawings."
 - b. The cursory review indicates that the document does not meet the requirements of Paragraph 1.02. The Product Data will be marked "Not Approved" and "Revise and Resubmit." Contractor is to resubmit the Product Data until it is acceptable and marked "Filed as Received." When Product Data is filed, no further action is required and the Product Data process will be closed.
 - c. The Product Data is not required by the Contract Documents nor is applicable to the Project. The Product Data will be marked "Not Approved" and "Cancelled." No further action is required and the Product Data process will be closed.
- C. Contractor is to resubmit the Product Data until it is acceptable and marked "Filed as Received."

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 33 04 OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

- A. Prepare a complete and detailed operation and maintenance manual (manual) for each type and model of equipment or product furnished and installed under this Contract.
- B. Prepare manuals in the form of an instruction manual for the Owner. The manuals are to be suitable for use in providing the operation and maintenance instructions required by Section 01 79 00 "Training of Operation and Maintenance Personnel."
- C. Provide complete and detailed information specifically for the products or systems provided for this Project. Include the information required to operate and maintain the product or system.
- D. Manuals are to be provided in addition to any information packed with or attached to the product when delivered. Remove information packed with or attached to the product and include this information as an attachment to the manual.
- E. Include cost for manuals provided by Suppliers and Subcontractors as described in this Section in the Cost of Work for that equipment item.

1.02 DOCUMENTATION

- A. Submit manuals in accordance with Section 01 33 00 "Document Management." Attach a copy of the Operation and Maintenance Manual Review Report form provided by the Construction Manager to each manual with pertinent information completed.
- B. Provide one preliminary electronic copy of the manual to the Construction Manager for review within 15 days after review of any equipment submittal by the OPT.
- C. Provide one electronic copy and three printed copies of the final manual after:
 - 1. Preliminary manuals have been approved;
 - 2. Field test records have been incorporated into the manual; and
 - 3. Record Documents per Section 01 31 13 "Project Administration" have been approved and have been incorporated in the final manual.
- D. Provide copies of the manufacturer's warranties, guarantees, or service agreements in accordance with Section 01 70 00 "Execution and Closeout Requirements."

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide digital files for each manual as specified in Paragraph 2.02.
 - 1. Use filenames that correspond to the equipment designation shown in the Contract Documents or other equipment designations provided by the OPT.
 - 2. Submit a preliminary version of the electronic manual for review. Provide a final version of the manual incorporating OPT's comments.

- B. Provide printed copies of each manual as specified in Paragraph 2.03.

2.02 ELECTRONIC MANUAL FORMAT

- A. Manual contents are to be submitted in electronic format to the Construction Manager.
- B. Provide individual electronic files for each manual.
 1. Maximum file size is 75 MB. If manual is greater than maximum allowable file size, provide individual files for each major section of manual.
 2. Acceptable file types for written documents are Portable Document File (PDF) or provide manual text in Microsoft Word. Provide drawings in native format and PDF format. All files must be compatible with the latest software version available.
 3. Filename must identify the equipment location, equipment manufacturer, and date equipment placed in service, e.g. JCC1-Pump Room-Manufacturer-200503.pdf.
 4. Each electronic file must contain a table of contents at the beginning of the file which includes hypertext links or bookmarks to navigate the file contents per section/chapter.
 5. Scanned images of written documents are not acceptable. Document must allow character selection. Text within a file must be transferable to other documents.
 6. Drawing files must have the ability to turn on/off drawing layers within the file.

2.03 PRINTED MANUAL FORMAT

- A. Printed copies of each manual are to be submitted as follows:
 1. Print manuals on heavy, first quality 8-1/2 x 11 paper.
 - a. Reduce drawings and diagrams to 8-1/2 x 11 paper size.
 - b. When reduction is not practical, fold drawings and place each separately in a clear, super heavy weight, top loading polypropylene sheet protector designed for three-ring binder use. Provide a typed identification label on each sheet protector.
 - c. Punch paper for standard three-ring binders.
 2. Place manuals in heavy duty presentation, d-ring binders with clear front, back, and spine covers.
 3. Identify each manual by placing a printed cover sheet in the front cover of the binder and as the first page in the manual. The first page is to be placed in a clear polypropylene sheet protector. The information on first page and the cover page are to include:
 - a. Name of Owner;
 - b. Project name;
 - c. Volume number; and
 - d. Table of contents.
 4. Insert the name of the Project and volume number into the spine covers.

5. Sheet lifters are to be provided.
6. Minimum size is 2-inch capacity. Maximum size is 3-inch capacity. Fill binders to only three-fourths of its indicated capacity to allow for addition of materials to each binder by the Owner.
7. Provide index tabs for each section of the manual. Indexes are to be constructed of heavy-duty paper with a reinforced binding edge. The designation on each index tab is to correspond to the number and letter assigned in the Table of Contents.
8. Manuals for several products or systems may be provided in the same binder. Correlate the data into related groups when multiple products or systems are included in the same binder.
 - a. Sections for each product or system must be included in the same binder.
 - b. Sections must be in numerical order from volume to volume.

PART 3 - EXECUTION

3.01 MANUAL ORGANIZATION AND CONTENTS

- A. Provide a table of contents listing each section of the manual for each product or system.
 1. Assign a number and letter to each section in the manual.
 - a. The number is to correspond to the Owner's equipment numbering system or other system designated in the Contract Documents.
 - b. The letter assigned will represent the part of the manual, consistent with the manual contents as required by this Section.
 2. Identify each product or system using the nomenclature shown in the Contract Documents. Provide a cross reference to the Owner's numbering system and designations for equipment indicated in the Contract Documents if these are different.
- B. Include only the information that pertains to the product described. Annotate each sheet to:
 1. Clearly identify the specific product or component installed;
 2. Clearly identify the data applicable to the installation; and
 3. Delete or strike through references to inapplicable information.
- C. Supplement manual information with drawings as necessary to clearly illustrate relations of component parts of equipment and systems, and control and flow diagrams.
- D. Manuals for several products or systems may be provided in the same binder.
- E. Fill binders to only three-fourths of its indicated capacity to allow for addition of information by the Owner.

3.02 EQUIPMENT AND SYSTEMS MANUAL CONTENT

- A. Provide the following information in the first tabbed section of each manual:
 1. A description of the unit and component parts and how it functions.

2. Operating instructions for pre-startup, startup, normal operations, regulation, control, shutdown, emergency conditions, and limiting operating conditions.
 3. The sequence of operation by the controls manufacturer. Provide control diagrams by the manufacturer, modified to reflect the as-built, as-installed condition.
 4. Include general assembly contract drawings, sections, and photographic views as necessary to completely depict and properly identify the equipment. Indicate the dimensions, weight, capacity, and design conditions for the equipment.
- B. Include detailed information to allow for the proper installation, calibration, testing, preventative, and corrective maintenance procedures in the second section of the manual or of each section of the manual information if the manual covers a multi-component equipment system. This information should include the following:
1. Maintenance instructions including assembly, installation, alignment, clearances, tolerances, and interfacing equipment requirements, adjustment, and checking instructions. Include any special rigging required to place the equipment into place, and any special test equipment required to place the equipment in service.
 2. A safety subsection which addresses all safety and tag-out procedures necessary to safely operate and maintain the equipment.
 3. Lubrication schedule and lubrication procedures. Include a cross reference for recommended lubrication products.
 4. Troubleshooting guide.
 5. A table showing the schedule of routine maintenance requirements and seasonal work which is not performed at a set frequency. Preventative maintenance tasking must address:
 - a. Daily/weekly inspections performed by operations personnel;
 - b. Routine preventative maintenance scheduled weekly, monthly, quarterly, semi-annually, or annually through major overhauls by maintenance personnel; and
 - c. Predictive maintenance work such as alignment, analysis of the equipment, vibration, flow, oil sampling, etc.
 6. Description of sequence of operation by the control manufacturer.
 7. Warnings for detrimental maintenance practices.
 8. Detailed corrective maintenance procedures including:
 - a. Detail equipment for complete disassembly and assembly;
 - b. Cross-sectional drawings or exploded views with all parts numbered to correspond with the numbers in the parts list to permit identification of the various parts;
 - c. A table of normal clearances, diameters, thickness of new parts, and limits permissible for wearing parts; and
 - d. List torque settings for nuts, bolts, and fasteners when critical to the equipment's performance.

- C. Include all necessary diagrammatic piping and wiring diagrams and miscellaneous contract drawings and equipment in the third section of the manual or of each section of the manual if the manual covers a multi-component equipment system.
- D. Provide spare parts information in the fourth section of the manual including:
 - 1. Part numbers for ordering new parts;
 - 2. Assembly illustrations showing an exploded view of the complex parts of the product;
 - 3. Predicted life of parts subject to wear;
 - 4. List of the manufacturer's recommended spare parts, current prices with effective date, and number of parts recommended for storage;
 - 5. Directory of a local source of supply for parts with company name, address, and telephone number;
 - 6. Complete nomenclature and list of commercial replacement parts; and
 - 7. Complete list of spare parts, spare equipment, tools, and materials that are turned over to the Owner.
- E. Provide statistical information from the original equipment manufacturer as to performance such as pump curves, flow charts insulation resistance, calibration, or test data sheets in the fifth section of the manual, including all field testing records used to verify actual performance.
- F. Provide equipment name plate data installed on equipment and valves and equipment data sheets as required and furnished by the Owner in the sixth section of the manual.
- G. Provide a copy of warranties and the date the warranty expires for equipment in the seventh section of the manual.

3.03 ELECTRICAL AND ELECTRONICS SYSTEMS MANUAL

- A. Provide all of the information listed in Paragraph 3.02 as appropriate and include the following information:
 - 1. Control schematics and point to point wiring diagrams prepared for field installation;
 - 2. Circuit directories of panel boards and terminal strips and as installed color coded wiring diagrams; and
 - 3. Other information as may be required by the individual Specification Sections.

3.04 ARCHITECTURAL PRODUCTS MANUAL

- A. Provide the following information:
 - 1. Information required for ordering replacement products;
 - 2. Instructions for care and maintenance;
 - 3. List of the manufacturer's recommended lubricants;
 - 4. The manufacturer's recommendations for types of cleaning agents and methods;

5. Cautions against cleaning agents and methods that are detrimental to the product;
and
 6. Recommended maintenance and cleaning schedule.
- B. Final balancing reports for mechanical systems.
 - C. Other information as may be required by the individual Specification Sections.

3.05 LIST OF SERVICE ORGANIZATIONS

- A. Provide a directory of authorized service organizations with company name, address, telephone number, email address, and the contact person for warranty repair.

END OF SECTION

01 33 05 CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.01 SUMMARY

- A. Prepare and submit a Progress Schedule for the Work and update the schedule on a monthly basis for the duration of the Project.
- B. Provide Progress Schedule in adequate detail to allow Owner to monitor progress and to relate submittal processing to sequential activities of the Work.
- C. Incorporate Contract Milestones into the schedule and show activities leading to achievement of these milestones.
- D. Assume complete responsibility for maintaining the progress of the Work per the Progress Schedule submitted.

1.02 DOCUMENTATION

- A. Submit the schedules to the Construction Manager. Send all documents in digital format for processing.
- B. Do not leave any blanks incomplete. If information is not applicable, enter NA in the space provided.
- C. Provide schedules, schedule updates and revisions to the Construction Manager in electronic format in its originating software and in Portable Document Format (PDF) as required by Section 01 33 00 "Document Management."
- D. Submit a preliminary Progress Schedule at the pre-construction conference.
- E. Submit a detailed Progress Schedule at least 10 days prior to the first payment request.
- F. Submit Progress Schedule updates monthly within 10 days after submitting Applications for Payment to indicate the progress made on the Project to the closing date for the Application for Payment. Failure to submit Progress Schedules will cause delay in the review and approval of subsequent Applications for Payment.

1.03 PROGRESS SCHEDULE REQUIREMENTS

- A. Progress Schedule is to be in adequate detail to:
 - 1. Ensure adequate planning, scheduling, and reporting during the execution of the Work;
 - 2. Ensure the coordination of the Work of the Contractor and the various Subcontractors and Suppliers;
 - 3. Monitor the progress of the Work; and
 - 4. Evaluate the impact of proposed changes to the Contract Times and Project Schedule.
- B. Provide personnel with 5 years' minimum experience in scheduling construction work comparable to this Project. Prepare the Progress Schedule using acceptable scheduling software.

- C. Provide the Progress Schedule in the form of a computer-generated critical path schedule which includes Work to be performed on the Project. It is intended that the Progress Schedule accomplish the following:
1. Give early warning of delays in time for correction.
 2. Provide detailed plans for the execution of the Work in the form of future activities and events in sequential relationships.
 3. Establish relationships of significant planned Work activities and provide a logical sequence for planned Work activities.
 4. Provide continuous current status information.
 5. Allow analysis of the Contractor's program for the completion of the Project.
 6. Permit schedules to be revised when the existing schedule is not achievable.
 7. Log the progress of the Work as it actually occurs.
- D. Provide a time-scaled horizontal bar chart which indicates graphically the Work scheduled at any time during the Project. The chart is to indicate:
1. Complete sequence of construction by activity;
 2. Identification of the activity by structure, location, and type of Work;
 3. Chronological order of the start of each item of Work;
 4. The activity start and stop dates;
 5. The activity duration; and production rates used to determine the duration;
 6. Successor and predecessor relationships for each activity;
 7. A clearly indicated single critical path; and
 8. Projected percentage of completion, based on dollar value of the Work included in each activity as of the first day of each month.
- E. Provide a Progress Schedule for Submittals:
1. Indicate the specific dates each document is to be delivered to the Construction Manager.
 2. Allow a reasonable time to review each document, taking into consideration the size and complexity of the document, other documents being processed, and other factors that may affect review time.
 3. Include time for making revisions to the Shop Drawings and resubmitting the Shop Drawing for at least a second review.
 4. Assume a 14-day review cycle for each time a Shop Drawing is submitted for review unless a longer period is indicated in the Contract Documents or provided by the Construction Manager.
 5. Contractor is responsible for delays associated with additional time required to review incomplete or erroneous documents and for time lost when documents are submitted for products that do not meet specification requirements.

1.04 PROGRESS SCHEDULE REVISIONS

- A. Revise the Progress Schedule if it appears that the schedule no longer represents the actual progress of the Work.
 - 1. Submit a Plan of Action for schedule recovery if the Progress Schedule or earned value analysis indicates that the Project is more than 30 days behind schedule. The report is to include:
 - a. Number of days behind schedule;
 - b. Narrative description of the steps to be taken to bring the Project back on schedule; and
 - c. Anticipated time required to bring the Project back on schedule.
 - 2. Submit a revised Progress Schedule indicating the action that the Contractor proposes to take to bring the Project back on schedule.
- B. Revise the Progress Schedule to indicate any adjustments in Contract Times approved by a Modification.
 - 1. Include a revised Progress Schedule with Change Proposals if a change in Contract Times is requested.
 - 2. Construction Manager will deem any Change Proposal that does not have a revised Progress Schedule and request for a change in Contract Times as having no impact on the ability of the Contractor to complete the Project within the Contract Times.
- C. Updating the Progress Schedule to reflect actual progress is not considered a revision to the schedule.
- D. Applications for Payment will not be recommended for payment without a revised Progress Schedule and if required, the report indicating the Contractor's plan for bringing the Project back on schedule.

1.05 FLOAT TIME

- A. Define float time as the amount of time between the earliest start date and the latest start date of a chain of activities on the construction schedule.
- B. Float time is not for the exclusive use or benefit of either the Contractor or Owner.
- C. Where several subsystems each have a critical path, the subsystem with the longest time of completion is the critical path and float time is to be assigned to other subsystems.
- D. Schedule completion date must be the same as the Contract completion date. Time between the end of construction and the Contract completion date is float time.

1.06 MODIFICATION OF CONTRACT TIMES

- A. Contract Times cannot be changed by the submission of a Progress Schedule. Contract Times can only be modified by a Change Order or Contract Amendment.
- B. Submit a Change Proposal for any proposed change in Contract Times, and include justification for the change in accordance with the provisions of the Contract Documents.

1.07 NEAR-TERM LOOK AHEAD SCHEDULES

- A. Provide a near-term look ahead schedule (NTLA Schedule) every 30 days, typically at periodic coordination meetings, using the form provided by the Construction Manager which shows the days of planned activity for the following:
 - 1. Submittals to be provided and day of anticipated return;
 - 2. Equipment and material deliveries;
 - 3. Arrival and departure of key construction equipment; and
 - 4. Activities for the Contractor and each Subcontractor.
- B. Coordinate NTLA Schedule with Project Schedule. Submit a report with each NTLA Schedule identifying deviations from the Project Schedule.
- C. Submit a report of near-term work planned in the previous NTLA Schedule that was delayed or not executed by marking actual activity on the previous near term look ahead schedule. Provide explanation of why planned work was not executed and plan to execute in the future and regain time lost.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 33 06 GRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Furnish an adequate number of photographs of the Site to clearly depict the completed Project.
 - 1. Provide aerial photographs of the completed Project from an angle and height to include the entire Site.
 - 2. Provide a minimum of four different views.
 - 3. Photograph a panoramic view of the entire Site.
 - 4. Photograph all significant areas of completed construction.
 - 5. Do not take completion photographs until all construction trailers, excess materials, trash, and debris have been removed.
 - 6. Employ a professional photographer approved by the Construction Manager to photograph the Project.
- B. Provide video recordings of the Site.
 - 1. Record the condition of all existing facilities in or abutting the construction area (right-of-way) including streets, curb and gutter, utilities, driveways, fencing, landscaping, etc., prior the beginning of construction. Provide one copy of the dated and labeled recording to the Construction Manager before the start of construction. Provide additional recording as directed by the Construction Manager if the recording provided is not considered suitable for the purpose of recording pre-existing conditions.
 - 2. Provide a video recording of the Site after the Project is complete and all construction trailers, excess materials, trash, and debris have been removed. Provide a 360-degree view of the Project from a consistent height and angle.
 - 3. Format must allow photographic still shots to be extracted from the video recording.
- C. All photographs and video recordings are to become the property of the Owner. Photographs or recordings may not be used for public or private publication or display without the written consent of the Owner.
- D. Unmanned Aerial Vehicles used for aerial photography must be registered and piloted by licensed individuals in accordance with Laws and Regulations.

1.02 DOCUMENTATION

- A. Submit photographic documentation in accordance with Section 01 33 00 "Document Management."

1.03 QUALITY ASSURANCE

- A. Provide clear photographs and video recordings taken with proper exposure. View photographs and video recordings in the field and take new photographs or video

recordings immediately if photos of an adequate print quality cannot be produced or video quality is not adequate. Provide photographs with adequate quality and resolution to permit enlargements.

PART 2 - PRODUCTS

2.01 PHOTOGRAPHS

- A. Provide photographs in digital format with a minimum resolution of 1280x960, accomplished without a digital zoom.
- B. Take photographs at locations acceptable to the Construction Manager.
- C. Provide a digital copy of each photograph taken.
- D. Identify each photograph with:
 - 1. Name of the Project.
 - 2. Date, time, location, and orientation of the exposure.
 - 3. Description of the subject of photograph.

2.02 VIDEO RECORDING

- A. Provide video recordings in digital format that can be played with Windows Media Player in full screen mode without loss of resolution.
- B. Identify Project on video by audio or visual means.
- C. Provide video with file size that does not exceed 1 GB.
- D. Provide video resolution of at least 1080p.
- E. The quality of the video must be adequate to determine the existing conditions of the construction area. Camera panning must be performed while at rest; do not pan the camera while walking or driving. Camera pans should be performed at intervals to clearly view the entire construction area.
- F. Construction stationing is to be annotated in the video.
- G. The entire construction area recording must be submitted at once. Sections submitted separately will not be accepted.
- H. Site components must be video recorded in an organized sequential order with major components identified.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 35 00 SPECIAL PROCEDURES

PART 1 - GENERAL

1.01 CONSTRUCTION SEQUENCE

- A. Perform the Work as required to complete the entire Project within the Contract Times and in the sequence stipulated below:

Sequence No.	Description	Predecessor Condition
1	<i>Contractor shall assign a safety manager that should be present continuously during the process.</i>	A safety manager should be present during the complete duration of the project.
2	<i>The contractor shall install a temporary MCC inside the pumps station just across the room from the existing MCC. Exact location and conduit route should be coordinated with the engineer. This temporary MCC shall include a Manual Transfer Switch to be fed from a temporary generator. (See Sequence No. 4)</i>	Coordinate with owner the exact location and the conditions where the temporary MCC will be installed.
3	<i>The contractor shall provide power to the temporary MCC from the proposed main panel to be installed inside the pump station. This includes a new 400A breaker to feed the temporary MCC.</i>	Step No. 2 shall be finished before providing the power to the temporary MCC.
4	<i>The contractor shall provide a temporary 200KW generator to provide backup power to the temporary MCC.</i>	This could be installed in parallel to step No. 3.
5	<i>The contractor shall be responsible to provide a Pre-Work Walk to go through the detailed Step Plan for approval of the engineer and the Safety Manager assigned to this project.</i>	Step No. 4 could be developed and approved at any moment. This is the planning stage to move the load from one MCC to another.
6	<i>Contractor shall coordinate with owner the order of the load to be transferred to the temporary MCC. Special consideration shall be given to the load that has redundancy.</i>	This Step could be performed in conjunction with Step No. 4.
7	<i>The contractor shall provide a detailed Step Plan of the procedure to replace the existing MCC that includes, but without limitation, the safety procedures (Including the Lock Out-Tag Out), the risk and the mitigation action for every step.</i>	This Step could be performed in conjunction with Step No. 4.

Sequence No.	Description	Predecessor Condition
8	The contractor shall leave a complete operating system and must test all the equipment connected to the new MCC.	
9	The contractor shall perform all the tests on the generators, the selector switch and transfer switch. The emergency system shall be in good operating conditions and approved as per the specifications and manufacturer's recommendations.	After the installation of the generators, selector switch and the automatic transfer switch.
10	The contractor shall remove all temporary equipment installed during the process including, but not limited to, temporary MCC, temporary generator, cables and conduits.	After the MCC has and the generator system have been commissioned (Steps 8 & 9).

B. Complete Work within the specified Milestones for these items:

Description	Milestone Date
N/A	

C. Consider the sequences, duration limitations, and governing factors outlined in this Section to prepare the schedule for the Work.

D. Perform the Work not specifically described in this Section as required to complete the entire Project within the Contract Times.

1.02 CRITICAL OPERATIONS

A. Owner has identified critical operations that must not be out of service longer than the designated maximum out of service time and/or must be performed only during the designated times. These have been identified in the table below:

Critical Operation	Max. Time Out of Operation (Dry Weather)	Max. Time Out of Operation (Wet Weather)	Liquidated Damages (\$/hour)
Drainage Pumping	48 hours	1 hour	\$500 (Dry Weather) \$10,000 (Wet Weather)

B. Submit a written Plan of Action per Section 01 31 13 "Project Administration" for approval for critical operations.

- C. Service interruptions to critical operations must be approved by the Owner a minimum of three days prior to their occurrence and may be revoked if weather patterns indicate drainage pumping will be needed during the outage.
- D. Work affecting critical operations is to be performed on a 24-hour a day basis until Owner's normal operations have been restored.
- E. Provide additional manpower and equipment as required to complete the Work affecting critical operations within the allotted time.
- F. Liquidated damages will be assessed if Work on critical operations is not completed within the time indicated.
 - 1. These items are critical to the pumping operations at the Crane Bayou PS.
 - 2. Loss of ability to pump can subject the community to flooding, loss of life and property damage and subject the Owner to liability resulting from these damages.
 - 3. Liquidated damages have been established for each critical operation.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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PART 1 - GENERAL

1.01 OVERVIEW

- A. Quality management refers to the overall process of delivering a completed Project to the Owner that complies with the requirements of the Contract Documents. Quality management applies to documentation, products, services, and the Work.
- B. Contractor is responsible for the quality of documentation, products, services, and the Work provided.
 - 1. Contractor is to integrate quality control procedures into the execution of the Work that are adequate to produce a Project that meets the requirements of the Contract Documents, while minimizing loss of time and increased costs. Contractor is solely responsible for time and cost impacts of correcting Defective Work.
 - 2. Contractor is to provide all testing and inspection required to control the quality of the Work in progress to determine that completed Work will comply with the requirements of the Contract Documents.
 - 3. Contractor is to provide verification or acceptance testing as required by the Contract Documents to demonstrate that the completed Work complies with the requirements of the Contract Documents, except for those test that the Owner has determined are to be conducted independent of the Contractor and identified as Owner testing in the Owner's Quality Management Plan.

1.02 STANDARDS

- A. Provide testing laboratories that comply with the American Council of Independent Laboratories (ACIL) "Recommended Requirements for Independent Laboratory Qualifications."
- B. Perform testing in accordance with the published standards and procedures for testing listed in the Specifications and applicable Laws and Regulations.

1.03 DOCUMENTATION

- A. Provide documentation which includes:
 - 1. Contractor's Quality Management Plan that establishes the methods of ensuring compliance with the Contract Documents. Submit this plan as Product Data per Section 01 31 13 "Project Administration."
 - 2. A statement of qualifications for any proposed testing laboratory that includes a list of the engineers and technical staff that will provide testing services on the Project, descriptions of the qualifications of these individuals, list of tests that can be performed, equipment used with date of last certification, and a list of recent projects for which testing has been performed with references for those projects.
 - 3. Certified Test Reports for products to be incorporated into the Project. Provide reports to indicate that the proposed products comply with the Contract Documents or indicate that the proposed products do not comply with the Contract Documents and

why those products do not comply. Submit Certified Test Reports as part of a Shop Drawing submitted per Section 01 33 02 "Shop Drawings."

4. Certified Test Reports for inspections and testing required in this Section and in other Sections of the Specifications. Provide reports to indicate that the Work complies with the Contract Documents or indicate that the Work does not comply with the Contract Documents and why the Work does not comply. Submit these test reports on forms provided by the Construction Manager per Section 01 33 00 "Document Management."
5. Certified Test Reports of Defective Work and Certified Test Reports documenting that successful corrective action has produced Work that complies with the Contract Documents. Maintain a register listing Defective Work and record when corrective action has produced Work that complies with the Contract Documents. Present this Defective Work register as part of the Quality Report at progress meetings as described in Paragraph 1.05.E. Incorporate this register in the closeout documentation per Section 01 70 00 "Execution and Closeout Requirements" to demonstrate that all Defective Work has been corrected.

1.04 OWNER'S QUALITY MANAGEMENT ACTIVITIES

- A. Owner may perform its own verification testing independent of the Contractor. The Owner's Quality Management Plan describes the Owner's anticipated verification testing program for this Project. The preliminary testing plan is shown in Paragraph 3.04. This plan outlines the anticipated testing in general terms and may not reflect the actual testing performed by the Owner. Actual testing will depend on the Contractor's means, methods, and procedures of construction which will not be known until the Contractor submits the Contractor's Quality Control Plan (CQCP) to the Construction Manager. There is no guarantee that all testing in the preliminary OQMP included in the Bidding/Proposal Documents will be performed by the Owner. Contractor will arrange and pay for all production control testing deemed necessary by the Contractor to produce quality results.
- B. Quality management activities of the Owner are for verifying the results of the Contractor's Work complies with the requirements of the Contract Documents. Performance or non-performance of verification activities by the Owner:
 1. Does not relieve the Contractor of its responsibility to provide Work and furnish products that comply with the requirements of the Contract Documents;
 2. Does not relieve the Contractor of its responsibility to provide adequate quality control measures to produce quality documents, products, services, or Work;
 3. Does not relieve the Contractor of its responsibility for damage to or loss of Work or products before Owner's acceptance; and
 4. Does not affect the continuing rights of the Owner after acceptance of the completed Work.
- C. The Work is subject to observations or testing at any time by the OPT. Products which have been tested or inspected and accepted by the Owner at a supply source or staging area may be inspected or tested again by the OPT before, during, or after incorporation into the Work and rejected if products do not comply with the Contract Documents.

- D. Verification testing performed by the OPT will be paid for by the Owner, except for testing related to Defective Work as discussed in Paragraph 3.03.

1.05 CONTRACTOR'S RESPONSIBILITIES

- A. Review the OQMP and provide a Contractor's Quality Control Plan (CQCP) outlining testing to be provided by the Contractor per Paragraph 1.07.
- B. Implement the CQCP to provide Work that complies with the requirements of the Contract Documents.
 - 1. Provide quality documents meeting the requirements of the Contract Documents.
 - 2. Provide services meeting the requirements of the Contract Documents.
 - 3. Provide the services of a Construction Materials Inspection and Testing (CMIT) provider meeting the requirements of this Section to provide testing required by the Contract Documents to demonstrate that products proposed for the Project in Shop Drawings and Product Data fully comply with the Contract Documents.
 - 4. Inspect and test products to be incorporated into the Project to identify defects before installing them. Do not install Defective products. Conspicuously mark Defective products and remove from the Site. If products are installed before the defect is recognized, remove the Defective products, mark them as Defective and remove them from the Site when the defect is recognized.
 - 5. Integrate production quality control measures into construction activities to produce Work meeting the requirements of the Contract Documents. Inspect self-performed Work and the Work of Subcontractors and Suppliers to identify defects. Correct or replace Defective Work.
 - 6. Provide facilities, equipment, and Samples required for inspections and tests.
 - a. Give the Construction Manager adequate notice before proceeding with Work that would interfere with inspections or testing.
 - b. Notify the Construction Manager and CMIT provider prior to the time that testing is required, providing adequate lead time to allow arrangements for inspections or testing to be performed.
 - c. Do not proceed with Work that would impact the ability to correct defects, or with Work that would require that it be removed to correct defects, until testing is complete, and test results indicate that the corrected Work is acceptable.
 - d. Provide safe access for all CMIT activities, including those to be conducted as part of the Owner's Quality Management Program.
 - e. Cooperate fully with the performance of sampling, inspection, and testing. Provide personnel to assist with sampling or to assist in making inspections and field tests.
 - f. Provide Samples and products in adequate quantities for testing at the Site or at the production source of the product for testing.
 - g. Provide facilities required to store and cure test Samples.

- h. Provide calibrated scales and measuring devices for OPT's use in performing inspections and testing.
 - i. Provide adequate lighting to allow OPT observations.
 - j. Make Contract Documents available to testing agencies when requested.
- C. Perform tests as indicated in Contract Documents. All verification testing is to be observed by the Construction Manager or its designated representative.
- D. Submit test reports to the Construction Manager.
- E. Provide an update on quality control activities performed the previous month and planned for the coming month at monthly progress meetings required by Section 01 31 13 "Project Administration."
- F. Determine testing or inspections required to implement the CQCP. Include costs for additional testing and inspections required to meet the Contractor's quality control obligations in the Contract Price.

1.06 CONTRACTOR'S QUALITY CONTROL MANAGER

- A. Provide a Quality Control Manager for the Project. Quality Control Manager must have authority to reject Defective Work, redirect the efforts of the Contractor, Subcontractor and Suppliers to correct Defective Work, and implement steps to prevent future Defective Work.
- B. The resident superintendent or an approved assistant can serve as Quality Control Manager, provided other duties will allow adequate time to serve in this capacity.
- C. An individual other than the resident superintendent must serve as Quality Control Manager. The person named as Quality Control Manager, while working under the supervision of the Contractor's superintendent, must have time to direct project quality control efforts and take appropriate action as required. Quality control duties must take priority over any other assigned duties.
- D. An individual other than the resident superintendent is to serve as Quality Control Manager. This individual is to have authority equal to that of the resident superintendent and serve fulltime as the Contractor's Quality Control Manager. Quality Control Manager must have the authority to stop work that will not produce Work that complies with the Contract Documents and authorize Defective Work to be removed and corrected independent of the actions or direction of the resident superintendent.

1.07 CONTRACTOR'S QUALITY CONTROL PLAN

- A. Provide a CQCP that describes testing and inspections for Work performed at the Site and at remote locations. Include Work by Subcontractors and Suppliers. The CQCP is to include:
 - 1. A description of the quality control organization, including an organization chart showing lines of authority to control the quality of Work.
 - 2. Documentation describing name, qualifications (in resume format), duties, responsibilities, and level of authority of the Quality Control Manager.

3. The name, qualifications (in resume format), duties, responsibilities, and authorities of other persons assigned a quality control function.
 4. Procedures for scheduling, reviewing, certifying, and managing documentation including documentation provided by Subcontractors and Suppliers.
 5. Control, verification, and acceptance testing procedures for each specific test. Include:
 - a. Name of tests to be performed;
 - b. Specification paragraph requiring test;
 - c. Parameters of Work to be tested;
 - d. Test frequency;
 - e. Persons responsible for each test; and
 - f. Applicable industry testing standards and laboratory facilities to be used for the test.
 6. Incorporate the testing specified in the OQMP into the CQCP, specifically identifying the tests or inspections that will be provided by the OQMP;
 7. Procedures for tracking and documenting quality management efforts per Paragraph 1.03.
 8. Reporting procedures which incorporate the use of forms provided by the Construction Manager.
 9. The name of the proposed testing laboratories along with documentation of qualifications per Paragraph 1.03.
- B. Use the Contractor's Quality Control Plan Checklist provided by the Construction Manager to review the CQCP before submitting and include a copy of the completed checklist with the CQCP. Do not begin Work until the CQCP is accepted. Submit an interim plan covering only the portion of Work to be performed if the Contractor plans to begin Work prior to submitting the complete CQCP for the Project. Do not begin Work on other parts of the Project until the complete CQCP is accepted.
 - C. Meet with the OPT 7 days after CQCP is submitted and before start of construction to discuss the CQCP.
 - D. Notify the Construction Manager of any changes to the CQCP or quality control personnel.

1.08 CONTRACTOR'S USE OF OWNER'S TEST REPORTS

- A. Contractor will receive copies of all test reports documenting the Owner's verification tests. Contractor is entitled to rely on the accuracy of these tests results and use these as part of its quality control efforts.
- B. Contractor may submit a Change Proposal if the Owner's testing program deviates significantly from the OQMP. Contractor must demonstrate that actual testing and inspection costs were incurred implementing the CQCP as a result of Owner's decision to not provide testing described in the OQMP.

1.09 LIMITATION OF AUTHORITY OF THE TESTING LABORATORY

- A. The testing laboratory representatives are limited to providing testing services and interpreting the results of the test performed.
- B. The testing laboratory is not authorized to:
 - 1. Alter the requirements of the Contract Documents;
 - 2. Accept or reject any portion of the Work;
 - 3. Perform any of the duties of the Contractor; or
 - 4. Direct or stop the Work.

1.10 TEST REPORTS

- A. Certified Test Reports are to be prepared for all tests.
 - 1. Tests performed by testing laboratories may be submitted on their standard test report forms if acceptable to the Owner using the process directed by the Construction Manager. These reports must include the following:
 - a. Name of the Owner, Project title and number, and name of the Contractor;
 - b. Name, address, and telephone number of the laboratory;
 - c. Name and signature of the laboratory personnel performing the test;
 - d. Description of the product being sampled or tested;
 - e. Date and time of sampling, inspection, and testing;
 - f. Date the report was issued;
 - g. Description of the test performed;
 - h. Weather conditions and temperature at time of test or sampling;
 - i. Location at the Site or structure where the test was taken;
 - j. Standard or test procedure used in making the test;
 - k. A description of the results of the test;
 - l. Statement of compliance or non-compliance with the Contract Documents; and
 - m. Interpretations of test results, if appropriate.
 - 2. Submit reports on tests performed by the Contractor, Subcontractors, or Suppliers as directed by the Construction Manager.
 - 3. OPT will prepare test reports on tests performed by the OPT.
- B. Submit test reports as directed by the Construction Manager within 24 hours of completing the test. Flag tests reports with results that do not comply with Contract Documents for immediate attention. Notify the Construction Manager, using acceptable means other than the test report, immediately of any test that fails to comply with the Contract Documents.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Handle and protect test specimens of products and construction materials at the Site in accordance with recognized test procedures. Provide facilities for storing, curing, and processing test specimens as required by test standards to maintain the integrity of Samples. Transport test specimens in a manner to prevent damage to specimens while in transit.

PART 2 - PRODUCTS

2.01 TESTING APPARATUS

- A. Furnish testing apparatus and related accessories necessary to perform the tests.

2.02 SAMPLE PRODUCTS

- A. Provide Samples of products in adequate quantity for testing.

PART 3 - EXECUTION

3.01 IMPLEMENTING CONTRACTOR'S QUALITY CONTROL PLAN

- A. Perform quality control observations and testing as required in each Section of the Specifications and where indicated on the Drawings.
- B. Include the phases listed below for each definable work task. A definable work task is one which is separate and distinct from other tasks, has separate control requirements, may be provided by different trades or disciplines, or may be work by the same trade in a different environment.
 - 1. Planning Phase: Perform the following before beginning each definable work task:
 - a. Review the Contract Documents.
 - b. Review documents the Contractor will submit and determine that they are complete in accordance with the Contract Documents.
 - c. Check to ensure that all materials and/or equipment have been tested, submitted, and approved.
 - d. Examine the work area to ensure that all required preliminary Work has been completed and complies with the Contract Documents.
 - e. Examine required materials, equipment, and sample Work to ensure that they are on hand, conform to Contract Documents, Shop Drawings and Product Data, and are properly stored.
 - f. Review requirements for quality control inspection and testing.
 - g. Discuss procedures for controlling quality of the Work. Document construction tolerances and workmanship standards for the work task.
 - h. Check that the portion of the plan for the Work to be performed incorporates document review comments.

- i. Discuss results of planning phase with the Construction Manager. Conduct a meeting attended by the Construction Manager, Quality Control Manager, superintendent, other quality control personnel as applicable, and the foreman responsible for the work task. Instruct applicable workers as to the acceptable level of workmanship required to meet the requirements of the Contract Documents. Document the results of the planning phase actions by separate meeting minutes prepared by the Quality Control Manager and attached to the quality control report.
 - j. Do not move to the next phase unless results of investigations required for the planning phase indicate that requirements have been met.
 - 2. Work Phase: Complete this phase after the planning phase.
 - a. Notify the Construction Manager at least 1 week in advance of beginning the Work and discuss the review of the planning phase effort to indicate that requirements have been met.
 - b. Check the Work to ensure that it is in full compliance with the Contract Documents.
 - c. Verify adequacy of controls to ensure full compliance with the Contract Documents. Verify required control inspection and testing is performed.
 - d. Verify that established levels of workmanship meet acceptable workmanship standards. Compare with required Sample panels as appropriate.
 - e. Repeat the work phase for each new crew to work on-site, or any time acceptable specified quality standards are not being met.
 - 3. Follow-Up Phase: Perform daily checks to ensure control activities, including control testing, are providing continued compliance with contract requirements.
 - a. Make checks daily and record observations in the quality control documentation.
 - b. Conduct follow-up checks and correct all defects prior to the start of additional work tasks that may be affected by the Defective Work. Do not build upon nor conceal Defective Work.
 - c. Conduct a review of the Work at least 1 month prior to the expiration of the correction period prescribed in the General Conditions with the OPT. Correct defects as noted during the review.
- C. Conduct additional planning and work phases if:
 - 1. The quality of on-going Work is unacceptable;
 - 2. Changes are made in applicable quality control staff, on-site production supervision, or crews;
 - 3. Work on a task is resumed after a substantial period of inactivity; or
 - 4. Other quality problems develop.

3.02 DEFECTIVE WORK

- A. Immediately correct any Defective Work or notify the Construction Manager why the Work is not to be corrected immediately and when corrective action will be completed.
- B. Work performed that is connected or adjacent to Defective Work or Work that would have to be removed to correct Defective Work is also considered to be Defective. Contractor is responsible for all costs associated with replacing any acceptable Work that must be removed, or might be damaged by corrective actions.
- C. Document Defective Work, corrective actions taken to correct defects, and that corrected Work complies with the Contract Documents.
- D. Implement countermeasures to prevent future Defective Work.
- E. No payment will be made for Defective Work. Remove Work from the Application for Payment if Work paid for on a previous Application for Payment is found to be Defective.
- F. Owner will withhold payment for Defective Work or Work that has not been tested or inspected in accordance with the CQCP, OQCP, or the Contract Documents.

3.03 VERIFICATION TESTING FOR CORRECTED DEFECTS

- A. Provide verification testing on corrected Work when corrective action is complete to demonstrate that the corrected Work complies with the Contract Documents. Conduct the same tests or inspections used to determine that the original Work was Defective. Different tests or methods may be used if approved by the Owner. Document that Defective Work has been corrected with the Construction Manager.
- B. Pay for verification testing until Work meets quality requirement set forth in the Contract Documents. OPT may perform verification testing as part of the Owner’s Quality Management Program and impose a set-off to recover the cost for this testing.

3.04 OWNER’S PRELIMINARY QUALITY CONTROL PLAN

Spec. Section	Test / Frequency	OPT or Contractor
03 30 00	Compressive strength. One set of three cylinders for each concrete placement with one additional set of cylinders for each 50 yards in a single placement.	OPT
09 91 00	Protective coatings testing	OPT
26 32 13	Generator Factory testing	OPT
23 05 96	Testing, Adjusting and Balancing	Contractor

END OF SECTION

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01 40 01 IBC SPECIAL INSPECTIONS

PART 1 - GENERAL

1.01 OVERVIEW

- A. The purpose of this Section is to provide the Owner and the Contractor with an understanding of what constitutes special inspections as defined by the International Building Code (IBC), Chapter 17, "Special Inspections and Tests," and the Contractor's requirements per IBC and role in enabling the Owner to perform the inspections, and provide the Owner with a Statement of Special Inspection specific to this Project's Special Inspection requirements.
- B. IBC Special Inspections are not a substitute for other testing required elsewhere in the Contract Documents.
- C. IBC Special Inspections may not be performed by the Contractor, unless the Contractor and Owner are the same entity.

1.02 CONTRACTOR RESPONSIBILITIES

- A. Enable the OPT to conduct the required IBC Special Inspections as outlined below in "Special Inspection Activities by the Owner."
 - 1. Set up pre-construction meeting and coordinate with OPT, prior to beginning construction, regarding the specific inspection needs and requirements that will be performed as part of these Special Inspections.
 - 2. Provide complete access to the Site and make Contract Documents available at the Site.
 - a. Provide and pay for all means necessary to enable inspection access at each location requiring inspection. This includes ladders, scaffolding, trench boxes/shielding, fall protection, adequate lighting, adequate ventilation, and designated area(s) for storing inspector equipment and test Samples. All required access must be in accordance with OSHA.
 - b. Protect Special Inspection test specimens of products and construction materials at the Site in accordance with recognized test procedures.
 - c. Provide sample materials needed to perform tests.
 - 3. Notify the Construction Manager a minimum of 2 working days in advance of when construction activities requiring testing will be performed or when construction activities will limit and/or prevent inspector(s) from observing construction Work already performed.
 - a. Provide adequate notice before proceeding with Work that would interfere with sampling, testing, or other required verification.
 - b. Notify the Construction Manager prior to the time that sampling or testing is required. Lead time is to be adequate to allow arrangements to be made for testing.
 - c. Do not proceed with any Work until tests indicate that the Work is acceptable.

- d. Notify the Construction Manager when schedules change as soon as a delay is expected.
 4. Provide adequate quantities of representative product to be tested to the laboratory at the designated location.
 - B. Submit the following documentation as Product Data in accordance with Section 01 31 13 "Project Administration":
 1. A schedule that establishes the approximate major and/or critical inspection Milestones. Provide a revised schedule for alterations to the schedule.
 2. Contractor's test and inspection log described in Paragraph **3.01** at Substantial Completion.
 3. If the "Special Inspections for Wind Resistance" table and/or the "Special Inspections for Seismic Resistance" table is included in the Structural Statement of Special Inspections (Attachment A), then each Contractor responsible for the construction of the components listed must submit the documentation required by IBC Section 1704.4, "Contractor Responsibility."
 - C. Special Inspection activities are for the purpose of monitoring the results of the Contractor's Work to see that it is in compliance with the requirements of the Contract Documents.
 - D. Special Inspection testing requirements mentioned in this Section do not release the Contractor from providing Contractor required testing specified elsewhere in the Contract Documents.
 1. Provide all testing documentation required by the Contract Documents.
 2. Pay for testing performed to verify Work performed to cure Defective Work complies with the Contract Documents.
 - E. Special Inspection activities or non-performance of Special Inspection activities do not:
 1. Relieve the Contractor of its responsibility to perform Work and furnish materials and products and constructed Work conforming to the requirements of the Contract Documents.
 2. Relieve the Contractor of its responsibility for providing adequate quality control measures.
 3. Relieve the Contractor of its responsibility for damage to or loss of the material, product, or Work before Owner's acceptance.
 4. Constitute or imply Owner's acceptance.
 5. Affect the continuing rights of the Owner after Owner's acceptance of the completed Work.
 - F. All materials and products are subject to Owner's verification testing. Material or products which have been tested or observed by Owner at a supply source or staging area may be re-observed or re-tested by Owner at any time and rejected if they do not comply with the Contract Documents.

1.03 SPECIAL INSPECTION ACTIVITIES BY THE OWNER

- A. OPT will provide registered design professionals for special inspection to meet the requirements of **2015** IBC Chapter 17, Structural Tests and Special Inspections, adopted by the Jefferson County, Texas. The registered design professional in responsible charge (RDPIRC) will coordinate and provide IBC special inspections during construction on the types of work listed below. Additionally, the OPT will employ one or more approved agencies to perform inspections and tests during construction on the types of work listed in the Statement of Special Inspection.
- B. The OPT will perform the following:
 - 1. Permit: As required by the Building Official for permit issuance, submit the Statement of Special Inspection shown in Attachment A.
 - 2. Preconstruction: Submit names and qualifications of each individual inspector scheduled to perform these inspections to the Building Official prior to the start of construction. Minimum requirements for inspectors must be as indicated in the Statement of Special Inspection.
 - 3. Inspections: The RDPIRC will forward a copy of all inspection and test reports to the Building Official. Discrepancies must be brought to the immediate attention of the Contractor and Construction Manager.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 TEST AND INSPECTION REGISTER

- A. Contractor Test and Inspection Register: Include the following:
 - 1. Date Owner was notified of impending construction Work that requires testing and/or that would interfere with subsequent inspections.
 - 2. Name of person notified and the means of notification.
 - 3. Date construction Work in question was completed.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain an up-to-date copy of the Contractor Test and Inspection Register at the Site and with Record Documents. Post changes and revisions as they occur. Provide access to the Contractor Test and Inspection Register for RDPIRC, OPT, and AHJ reference during normal working hours.

3.02 REPAIR AND PROTECTION

- A. General:
 - 1. On completion of inspections and tests, repair damaged construction and restore substrates and finishes.
 - 2. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched

areas and extend restoration in adjoining areas with durable seams that are invisible as possible.

- B. Protect construction exposed by or for special inspection activities.

END OF SECTION

ATTACHMENT A

STRUCTURAL STATEMENT OF SPECIAL INSPECTIONS

This Statement of Special Inspections has been prepared in accordance with International Building Code 2015 Chapter 17 by the Structural Engineer of Record for the following Project:

Project Name: _____

Location: _____

Owner: _____

Structural Engineer of Record: _____

Design Professional in Responsible Charge: _____

Special Inspector for _____ : _____

Special Inspector for _____ : _____

Special Inspector for _____ : _____

Abbreviations

Inspectors

AWS-CWI: An American Welding Society/American Institute of Steel Construction certified welding inspector.

AWS/AISC-SSI: An American Welding Society certified structural steel inspector.

ACI: An American Concrete Institute certified technician, certified in the applicable construction type.

EIT: An Engineer-In-Training, a graduate engineer who has passed the Fundamentals of Engineering exam, and is under the direct supervision of a PE.

NICET: A National Institute for Certification in Engineering Technologies certified technician, certified in the applicable construction type.

PE: A licensed professional engineer and/or a structural engineer (SE) competent in the area of construction being inspected.

Specifications

ACI 318: American Concrete Institute Building Code Requirements for Structural Concrete.

AISC 360: American Institute of Steel Construction, Specification for Structural Steel Buildings.

ASTM: ASTM International (American Society for Testing and Materials).

AWS: American Welding Society

RCSC: RCSC Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts.

Common Words

C: Continuous observation of specified construction activity.

P: Periodic observation of specified construction activity.

CFSF: Cold formed steel framing.

CD: Contract Documents and/or Shop Drawings (if item is performance specified).

Special Inspector Qualifications

Special Inspectors minimum qualifications are listed below for each area of competency.

Applicable IBC Section	Minimum Inspector Qualifications	Remarks
1704.2.5 & 1705.10 Fabricated Items	N/A	Inspection of a fabrication facility is not required if the fabricator is exempt per IBC. Exemption typically requires a manufacturer be certified by an independent organization (e.g. AISC, IAS, SJI, or NPCA).
1705.2 Steel Construction	AWS-CWI AWS/AISC-SSI, PE, or EIT	All welds must be inspected by an AWS-CWI.
1705.3 Concrete Construction	ACI or NICET, PE, or EIT AWS-CWI	All welds must be inspected by an AWS-CWI.
1705.3 Post-Installed Concrete Anchors	PE	Professional engineer performing inspection must have knowledge of post-installed anchor installation requirements and experience in the design and specifying post-installed anchors.
1705.4 Masonry Construction	ACI or NICET, PE, or EIT AWS-CWI	All welds must be inspected by an AWS-CWI.
1705.5 Wood Construction	Inspector, PE, or EIT	Inspector must have a minimum of 5 years of related experience.
1705.6 Soils	ACI, NICET, PE, or EIT	
1705.7 Driven Deep Foundations	NICET, PE, or EIT	
1705.8 Cast-in-Place Deep Foundations	NICET, PE, or EIT	
1705.9 Helical Pile Foundations	NICET, PE, or EIT	
1705.11 Wind Resistance	PE and AWS- CWI	All welds must be inspected by an AWS-CWI.
1705.12 Seismic Resistance	PE and AWS- CWI	All welds must be inspected by an AWS-CWI.
1705.13 Seismic Resistance Testing	TBD	TBD

Steel Construction

The inspection requirements for this type of construction include structural steel and metal deck cold formed steel framing.

Verification and Inspection	Frequency		Remarks
	C	P	
Material Verification of Cold-Formed Steel Deck	-	X	Identification markings to conform to ASTM standards specified in approved construction documents.
	-	X	Review manufacturer's certified test reports.
Steel Deck Installation	-	X	Verify fastener size, type, and spacing is in conformance with CD.
	-	X	Verify standard and special details have been accurately constructed in accordance with CD.
Inspection Tasks Prior to Welding	-	-	Refer to AISC 360, Table N5.4-1 QA requirements.
Inspection Tasks During Welding	-	-	Refer to AISC 360, Table N5.4-2 QA requirements.
Inspection Tasks After Welding	-	-	Refer to AISC 360, Table N5.4-3 QA requirements.
Inspection Tasks Prior to Bolting	-	-	Refer to AISC 360, N5.6 and Table N5.6-1 QA requirements.
Inspection Tasks During Bolting	-	-	Refer to AISC 360, N5.6 and Table N5.6-2QA requirements.
Inspection Tasks After Bolting	-	-	Refer to AISC 360, N5.6 and Table N5.6-3 QA requirements.
Steel Embedded in Concrete	X	-	Prior to placement of concrete verify anchor rods and other embedments supporting structural steel. As a minimum, the diameter, grade, type and length of anchor rod or embedded item, and the extent/depth of embedment into concrete.
Connections and Framing Details	-	X	Verify compliance with CD: including braces and stiffening members, member locations, and application of joint details and applicable notes at each connection.
Cold-Formed Steel Trusses	-	X	Where a cold-formed steel truss clear span is 60 ft. or greater, verify temporary installation bracing and permanent bracing for both the truss and truss members is in accordance with approved Shop Drawings.
Open-Web Steel Joists and Joist Girders	-	X	Check end connections and bridge is in accordance with approved Shop Drawings and CD.
Fabrication	-	X	If fabricator is audited by an independent agency for each of the items above, then no manufacturer plant verification is required. If fabricator is not exempt, then review fabrication operations and quality control procedures per IBC and AISC, and for each product in accordance with the inspection items noted above.

Concrete Construction

The inspection requirements for this type of construction include cast-in-place concrete.

Verification and Inspection	Frequency		Remarks
	C	P	
Formwork	-	X	Verify formwork for shape, location and dimensions of the concrete member being formed are in conformance with CD.
Reinforcing Steel Material and Type	-	X	Verify size of bars and/or stressing strands, ASTM standard, and grade are in conformance with CD.
Reinforcing Steel Position	-	X	Verify quantity and spacing of bars and/or stressing strands, concrete clear cover on all sides. Verify lap splice type, location, and size. Verify no welding of reinforcing except where specifically noted.
Welding of Reinforcing Steel	X	-	Verify material being welded is ASTM A706 and per CD. Verify personnel, equipment, materials, and welds per AWS D1.4. Provide 100% visual inspection of all welds.
Cast-In-Place Anchors	-	X	Verify size, type, position, and embedment prior to concrete placement. Verify position after concrete placement.
Cast-In-Place Anchors	X	-	Verify placement and consolidation of concrete around anchors.
Mix Design	-	X	Verify batch plant tickets' mix number matches approved mix design for each mix design and application.
Fresh Concrete Samples	X	-	At the same time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete. Sample per ASTM C31, C143, C231 (or C173), C1064. Refer to Section 03 33 00 "Cast-In-Place Concrete"
Placement Technique	X	-	At the time of concrete or shotcrete placement, verify that proper application techniques are being implemented per the CD and ACI 301.
Curing Technique	-	X	Verify that approved means of curing and extreme weather protection are implemented in accordance with the CD.
Prestressed Concrete	X	-	Verify in-situ concrete strength prior to stressing. Refer to CD requirements. Verify application of prestressing forces. Observe grouting of bonded tendons.
Shore Removal	-	X	Verify in-situ concrete strength prior to stressing. Refer to CD requirements.
Fabrication of Precast Members	-	X	If fabricator is audited by an independent agency for each of the items above, then no manufacturer plant verification is required for precast members. If fabricator is not exempt, then review fabrication operations and quality control procedures, and for each product in accordance with the inspection items noted above.

Verification and Inspection	Frequency		Remarks
	C	P	
Erection of Precast Members	-	X	Verify conformance with the CD including welded connections, grouting, and bolting. Where welded connections are specified, verify personnel, equipment, materials, and welds per AWS D1.1. Provide 100% visual inspection of all welds.

Post-Installed Concrete Anchors

For each construction personnel, anchor type, diameter, and embedment the inspection of initial anchors placed must be continuous based on the requirements below. With the exception of anchors that are upwardly inclined, continuously load in tension, after initial anchor placement inspections have been performed, then inspector may perform quality assurance on a periodic basis.

Any change in personnel or anchor type must require an initial continuous inspection as indicated here.

Verification and Inspection	Frequency		Remarks
	C	P	
Inspection Tasks Prior to Anchor Hole Drilling	-	X	Verify all personnel are qualified to install anchors. Installation of adhesive anchors horizontally or upwardly inclined must be performed by personnel certified by an acceptable program.
	-	X	Verify Contractor has manufacturer’s printed installation instructions (MPII) on-site and available for reference by construction personnel.
	-	X	If manufacturer does not have a representative on-site, then special inspector must review MPII with Contractor personnel prior to beginning construction.
	-	X	Verify edge distance limitations indicated in CD’s and existing reinforcing locations compared to proposed anchor hole locations.
	-	X	Verify drill bit diameter matches MPII for anchor diameter indicated in CD’s. Special inspector does not need to be present during actual drilling of holes.
Inspection Tasks After Drilling Prior to Anchor Placement	-	X	Verify every hole diameter is in accordance with MPII and verify embedment is in accordance with CD’s and hole depth is in accordance with MPII (hole depth may need to exceed embedment depth, refer to MPII).
	-	X	Verify cleaning operations are in accordance with CD’s and MPII.
	-	X	Verify anchor type, material, diameter, and length.
	-	X	Where adhesive anchors are specified: verify adhesive type is per CD’s, adhesive expiration date, and adhesive dispensing equipment is per MPII.
	-	X	Verify that for horizontal and upwardly inclined adhesive anchors have all MPII required installation items (e.g. piston-plug)

Verification and Inspection	Frequency		Remarks
	C	P	
Inspection Tasks During Anchor Placement	-	X	Verify that all anchors are installed in accordance with MPII.

Masonry Construction – Level B Quality Assurance

The inspection requirements for this type of construction include load bearing and reinforced concrete masonry construction.

Verification and Inspection	Frequency		Remarks
	C	P	
Grout and Mortar Mixes	-	X	Verify grout and mortar mixes on-site match the CD and approved submittals.
CMU Units	-	X	Verify CMU units on-site match the CD and approved submittals.
Mortar Joints	-	X	Verify application of mortar at head and bed joints, joint dimensions, and tooled joint surface are as specified in the CD.
Reinforcement	-	X	Verify the correct use of rebar positioners and the position of reinforcing bars matches what is specified in the CD. Verify the correct ASTM, grade, and spacing are being used.
Welding of Reinforcement	X	-	Verify ASTM A706 reinforcing bars are being used and welding is in accordance with AWS D1.4. Provide 100% visual inspection of all welds.
Joint Reinforcement	-	X	Verify joint reinforcement is of the type and size specified and is installed in accordance with the CD.
Member Sizes	-	X	Verify size and location of structural elements per TMS 402-13, Article 5.1 and CD.
Anchors	-	X	Verify anchor size, grade, type, location, and spacing. Verify grouted cells are provided where required for cast-in-place and post-installed anchors.
Reinforcement Lap Splices	-	X	Verify lap lengths being used. If laps are welded, then provide continuous observation, and verify personnel, equipment, materials, and welds per AWS D1.4. Provide 100% visual inspection of all welds.
Prior to Grouting	-	X	Verify grout space is clean, protrusions of mortar into cell cavity are less than 1/2 in., minimum grout space dimensions are provided, and reinforcing and connectors are correctly located as specified in CD.
Grouting	X	-	Verify compliance with code and construction documents.
Grout Slump	-	X	Verify correct slump per ASTM C143 for each lift, but not less than one test per 2 cu. yd. and grout is consolidated per TMS 402-13, Article 3.2.1.
Cold Weather	-	X	Verify protection of masonry during cold weather in accordance with the CD.

Soils

The inspection requirements for this type of construction include structural fill and compacted fill, and shallow footings slabs-on-grade.

Verification and Inspection	Frequency		Remarks
	C	P	
Subgrade for Shallow Footings	-	X	Verify that materials below shallow foundations are adequate to achieve the design bearing capacity, excavations are extended to the proper depth, and have reached the proper material.
Backfill Materials	-	X	Perform classification and testing of compacted fill materials. Test per ASTM D422, D1140, and D698 as required to verify fill materials are in accordance with the CD.
Subgrade Preparation	-	X	Verify the use of proper subgrade preparation per the CD, including but not limited to proof rolling and scarifying.
Compaction	X	-	Verify proper fill materials, densities, and lift thicknesses during placement and compaction of fill is in accordance with the CD. Test density of each lift per ASTM D698.

Driven Deep Foundation Elements

The inspection requirements for this type of construction include driven sheet piles and precast concrete piles.

Verification and Inspection	Frequency		Remarks
	C	P	
Member	X	-	Verify element materials, sizes and lengths comply with the CD requirements.
Testing	X	-	Determine capacities of test elements and conduct additional testing as required by CD's
Driving	X	-	Observe driving operations and maintain complete and accurate records for each element driven.
Accuracy	X	-	Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration for each foot driven, determine required penetrations to achieve design capacity, record tip elevations and document any damage to foundation elements.
Re-tapping	X	-	Observe re-tapping operations and maintain complete and accurate records for each element re-tapped.
Concrete	-	-	Verify all concrete elements are in accordance with the Concrete Construction table above.
Steel	-	-	Verify all steel elements are in accordance with the Steel Construction Table above.

Cast-in-Place Deep Foundation Elements

The inspection requirements for this type of construction include drilled shafts.

Verification and Inspection	Frequency		Remarks
	C	P	
Drilling	X	-	Observe drilling operations and maintain complete and accurate records for each element. Including ground surface elevation at time of drilling, depth of each strata penetrated, final depth, description of bearing strata and depth of bearing strata penetration below casings if applicable.
Accuracy	X	-	Verify placement locations and plumbness, confirm element diameter(s), and lengths are per the CD.
Concrete	X	-	Verify all concrete elements in accordance with the Concrete Construction table above.

Special Inspections for Wind Resistance

Designated System Component		

Special Inspections for Seismic Resistance

Designated System Component		

END OF ATTACHMENT A

01 50 00 TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide temporary facilities, including OPT's field office, Contractor's field offices, storage sheds, workshops, and other facilities needed to complete the Work.
- B. Provide temporary utilities needed to support the operation of the facilities and construction activities.
- C. Provide and maintain temporary project identification signs for Owner.
- D. Provide temporary informational signs to identify key elements of construction and direct the flow of traffic.
- E. Provide a weatherproof kiosk for display of permits and other notices required by Laws and Regulations.

1.02 DOCUMENTATION

- A. Submit a Shop Drawing, in accordance with Section 01 33 02 "Shop Drawings," showing a scaled office floor plan prior to installation of OPT's field office. Include details for:
 - 1. Telephone equipment;
 - 2. Internet equipment;
 - 3. Computer equipment;
 - 4. Security/alarm systems; and
 - 5. Office furniture and appliances.

1.03 QUALITY ASSURANCE

- A. Inspect and test each utility before using facilities. Arrange for all required inspections and tests by regulatory agencies, and obtain required certifications and permits for use of facilities.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Transport, unload, and set up all temporary buildings and utilities.

1.05 JOB CONDITIONS

- A. Locate buildings and sheds at the Site as indicated or as approved by the OPT.
- B. Prepare the Site by removing trees, brush, or debris and performing demolition or grubbing needed to clear a space adequate for the structures.
- C. Provide Contractor's temporary facilities and utilities in time to avoid delays in the performance of the Work.

- D. Provide OPT's field office, complete and ready for occupancy, and use no later than 7 days after the Notice to Proceed. Applications for Payment will not be processed until OPT's field office facilities are completed and approved.
- E. Provide and maintain temporary facilities and utilities.
- F. Operate temporary facilities in a safe and efficient manner.
 - 1. Restrict loads on utilities to operate within their designed or designated capacities.
 - 2. Provide sanitary conditions. Prevent public nuisance or hazardous conditions from developing or existing at the Site.
 - 3. Prevent freezing of pipes, flooding, or the contamination of water.
 - 4. Maintain site security and protection of the facilities.
- G. Remove temporary facilities and utilities when construction is complete and removal is approved by the Construction Manager.

PART 2 - PRODUCTS

2.01 SIGN MATERIALS

- A. Provide wood or metal signs in sound condition, structurally adequate to withstand wind and weather.
- B. Provide 3/4-inch exterior grade A/D face veneer plywood with medium density overlay for sign surface.
- C. Provide galvanized or stainless steel bolts, brackets, fasteners, and other hardware.
- D. Provide exterior quality coatings.

2.02 CONTRACTOR'S FIELD OFFICE

- A. Furnish a field office of adequate size for Contractor's use.
- B. Subcontractors may provide their own field offices only when space is available on the Site and the OPT agrees to its size, condition, and location.

2.03 TEMPORARY STORAGE BUILDINGS

- A. Furnish storage buildings of adequate size to store any materials or equipment delivered to the Site that might be affected by weather.

2.04 TEMPORARY SANITARY FACILITIES

- A. Provide sanitary facilities at the Site for the entire duration of the Project. Maintain these facilities in a clean and sanitary condition at all times, and comply with the requirements of the local health authority. On large sites, provide portable toilets at such locations so that no point at the Site will be more than 600 feet from a toilet.
- B. Use these sanitary facilities. Do not use restrooms within existing or Owner-occupied buildings.

2.05 TEMPORARY HEAT

- A. Provide heating devices needed to protect buildings during construction. Provide fuel needed to operate the heating devices and attend the heating devices at all times they are in operation, including overnight operations.

2.06 TEMPORARY UTILITIES

- A. Provide the temporary utilities for administration, construction, testing, disinfection, and startup of the Work, including electrical power, water, and telephone. Pay all costs associated with furnishing temporary utilities.
 - 1. Provide a source of temporary electrical power of adequate size for construction procedures.
 - a. Use existing power systems where spare capacity is available. Provide temporary power connections that do not adversely affect the existing power supply. Submit connections to the Construction Manager for approval prior to installation.
 - b. Provide electrical pole and service connections that comply with Laws and Regulations and the requirements of the power company.
 - 2. Provide temporary water.
 - 3. Provide telephone service to the Site and install telephones inside the Contractor's and OPT's field offices.
- B. Provide power for construction and storage. Provide power to energize space heaters for stored electrical equipment.

2.07 WATER FOR CONSTRUCTION

- A. Provide temporary water. Potable water may be purchased from the Owner by obtaining a water meter from the Owner and transporting water from a water hydrant. Non-potable water may be used for hydraulic testing of non-potable basins or pipelines. Include the cost of water in the Contract Price.

PART 3 - EXECUTION

3.01 LOCATION OF TEMPORARY FACILITIES

- A. Locate temporary facilities in areas approved by the Construction Manager. Construct and install signs at locations approved by the Construction Manager. Install informational signs so they are clearly visible.

3.02 PROJECT IDENTIFICATION SIGNS

- A. Arrange for a professional sign painter to paint and erect a sign for the Site in accordance with the sign information provided in the Contract Documents or provided by Owner. Sign will include identification of the OPT and Contractor (including appropriate logos, as required) and other Project information as determined by the Construction Manager. Paint sign on a 4-foot by 8-foot by 3/4-inch exterior grade plywood board. Frame plywood with 2

x 4 wood frame and mount on not less than two 4 x 4 posts. House plywood board in a channel routed 1/2 inch deep in the 2 x 4 frame. Shoulder, glue, and screw corners.

3.03 TEMPORARY LIGHTING

- A. Provide temporary lighting inside buildings once buildings are weatherproof.
- B. Provide exterior security lighting.
- C. Provide lighting that is adequate to perform Work within any space. Temporary lights may be removed once the permanent lighting is in service.
- D. Provide portable flood lights at any time that Work will be performed outside the structure at night. Provide adequate lighting at any location Work is being performed.

3.04 DRINKING WATER

- A. Provide all field offices with potable water. Provide a dispenser and cooling apparatus if bottled drinking water is provided.
- B. Pay for water services and maintain daily.

3.05 CONSTRUCTION FENCE

- A. Install and maintain a chain-link construction fence around the Site and off-site storage yards. Fence must be a minimum 6 feet high. Provide gates with padlocks.

3.06 REMOVAL OF TEMPORARY FACILITIES

- A. Remove temporary buildings, sheds, and utilities at the conclusion of the Project and restore the Site to original condition or finished condition in accordance with the Drawings.
- B. Remove informational signs upon completion of construction.
- C. Remove project identification signs, framing, supports, and foundations upon completion of the Project.

3.07 MAINTENANCE AND JANITORIAL SERVICE

- A. Provide janitorial service for the OPT's field office on a weekly basis or as requested. Empty trash receptacles daily or as needed.
- B. Maintain signs and supports in a neat, clean condition. Repair damage to structures, framings, or signs.
- C. Repair any damage to Work caused by placement or removal of temporary signage.
- D. Service, maintain, and replace, if necessary, the field office computer equipment throughout the Project as required by the OPT including replacement cartridges for all office equipment.

END OF SECTION

01 57 00 TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide labor, materials, equipment, and incidentals necessary to construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.
- B. Construct temporary impounding works, channels, diversions, furnishing, and operation of pumps, installing piping and fittings, and other construction for control of conditions at the Site. Remove temporary controls at the end of the Project.

1.02 DOCUMENTATION

- A. Provide Shop Drawings in accordance with Section 01 33 02 "Shop Drawings."
- B. Provide copies of notices, records, and reports required by the Contract Documents or Laws and Regulations as Product Data in accordance with Section 01 31 13 "Project Administration."

1.03 QUALITY ASSURANCE

- A. Construct and maintain temporary controls with adequate workmanship using durable materials to provide effective environmental management systems meeting the requirements of the Contract Documents and Laws and Regulations. Use materials that require minimal maintenance to prevent disruption of construction activities while providing adequate protection of the environment.
- B. Periodically inspect systems to determine that they are meeting the requirements of the Contract Documents.

1.04 POLLUTION CONTROL

- A. Prevent the contamination of soil, water, or atmosphere by the discharge of noxious substances from construction operations. Provide adequate measures to prevent the creation of noxious air-borne pollutants. Prevent dispersal of pollutants into the atmosphere. Do not dump or otherwise discharge noxious or harmful fluids into drains or sewers, nor allow noxious liquids to contaminate public waterways in any manner.
- B. Provide equipment and personnel and perform emergency measures necessary to contain any spillage.
 - 1. Contain chemicals in protective areas and do not dump on soil. Dispose of such materials at off-site locations in an acceptable manner.
 - 2. Excavate contaminated soil and dispose at an off-site location if contamination of the soil does occur. Fill resulting excavations with suitable backfill and compact to the density of the surrounding undisturbed soil.
 - 3. Provide documentation to the Owner which states the nature and strength of the contaminant, method of disposal, and the location of the disposal site.

4. Comply with Laws and Regulations regarding the disposal of pollutants.
- C. Groundwater or run-off water which has come into contact with noxious chemicals, sludge, or contaminated soil is considered contaminated. Do not allow contaminated water to enter streams or water courses, leave the Site in a non-contained form, or enter non-contaminated areas of the Site.
1. Construct temporary holding ponds or take other precautions and measures as required to contain the contaminated water and pump to a designated storage area.
 2. Wash any equipment used for handling contaminated water or soil within contaminated areas three times with uncontaminated water prior to using such equipment in an uncontaminated area. Dispose of wash water used to wash such equipment as contaminated water.

1.05 EARTH CONTROL

- A. Remove excess soil, spoil materials, and other earth not required for backfill. Control stockpiled materials to eliminate interference with Contractor and Owner's operations.
- B. Dispose of excess earth off the Site. Provide written approval from the property owner for soils deposited on private property as Product Data per Section 01 31 13 "Project Administration." Obtain approval of the OPT if this disposal impacts the use of Site or other easements.

1.06 AIR POLLUTION CONTROL

- A. Air Pollution Watch Days:
1. Air Pollution Watch Days (APWD) may occur in the following times:
 - a. Typical Ozone Season: May 1 through October 31.
 - b. Critical Emission Time: 6:00 a.m. to 10:00 a.m.
 2. Watch Days:
 - a. State or local environmental regulatory agencies, in coordination with the National Weather Service, may designate the following day as an APWD by 3:00 p.m. on the prior afternoon.
 - b. Begin work after 10:00 a.m. on designated APWD if work requires the use of heavy construction equipment for run times in excess of 1 hour prior to 10:00 a.m. Heavy construction equipment may be used prior to 10:00 a.m. if equipment is certified by EPA as "Low Emitting" or equipment burns Ultra Low Sulfur Diesel (ULSD), diesel emulsions, or alternative fuels such as CNG.
- B. Obtain air permit for construction activities per requirements of Laws and Regulations.

1.07 TEMPORARY STORMWATER POLLUTION CONTROL

- A. Provide temporary stormwater pollution control per Section 01 57 23 "Temporary Stormwater Pollution Control."

1.08 MANAGEMENT OF WATER

- A. Manage water resulting from rains or ground water at the Site. Maintain trenches and excavations free of water at all times.
- B. Lower the water table in the construction area by acceptable means if necessary to maintain a dry and workable condition at all times. Provide drains, sumps, casings, well points, and other water control devices as necessary to remove excess water.
- C. Provide continuous operation of water management actions. Maintain standby equipment to provide proper and continuous operation for water management.
- D. Ensure that water drainage does not damage adjacent property. Divert water into the same natural watercourse in which its headwaters are located, or other natural stream or waterway as approved by the Owner. Assume responsibility for the discharge of water from the Site.
- E. Remove the temporary construction and restore the Site in a manner acceptable to the Construction Manager and to match surrounding material at the conclusion of the Work.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide materials that comply with Laws and Regulations.

PART 3 - EXECUTION

3.01 CONSTRUCTING, MAINTAINING, AND REMOVING TEMPORARY CONTROLS

- A. Construct temporary controls in accordance with Laws and Regulations.
- B. Maintain controls in accordance with regulatory requirements where applicable or in accordance with the requirements of the Contract Documents.
- C. Remove temporary control when no longer required, but before the Project is complete. Correct any damage or pollution that occurs as the result of removing controls while they are still required.

END OF SECTION

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01 57 23 TEMPORARY STORMWATER POLLUTION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

- A. Furnish labor, materials, equipment, and incidentals necessary to provide stormwater pollution prevention for the duration of the construction period including furnishing, installing, and maintaining erosion and sediment control structures and procedures and properly removing the features when no longer required.
- B. Develop, implement, and maintain a stormwater pollution prevention plan (SWPPP) in compliance with local, state, and federal Laws and Regulations. Provide preventive measures to keep sediment and other pollutants from the construction activity from entering any stormwater system, including open channels.
- C. Comply with the Texas Commission on Environmental Quality General Permit, TXR150000, (General Permit) for storm water discharges from construction activities under the Texas Pollutant Discharge Elimination System (TPDES) program.
- D. File all required legal notices and obtain required permits prior to beginning any construction activity.
- E. This Section provides guidelines and Best Management Practices information for the Contractor to use in adhering to all local, state, and federal environmental Laws and Regulations with respect to stormwater pollution prevention during construction activities.

1.02 DOCUMENTATION

- A. Documentation must be provided in accordance with Section 01 33 00 "Document Management."
- B. Submit copies of required notices and reports to the Construction Manager as Product Data in accordance with Section 01 33 03 "Product Data." Retain copies of these documents at the Site for review and inspection by the OPT or regulatory agencies at all times.
- C. Submit copies of required notices to local, state, and federal authorities and any other entity as required by the General Permit and applicable Laws and Regulations.
- D. Post a copy of required notices at the Site in a location where it is readily available for viewing by the general public and local, state, and federal authorities prior to starting construction activities and maintain the posting until completion of the construction activities.
- E. Maintain copies of a schedule of major construction activities, inspection reports, and revision documentation with the SWPPP required under the General Permit.
- F. Provide schedules in accordance with Paragraph 3.05.

1.03 QUALITY ASSURANCE

- A. Comply with applicable requirements of all governing authorities having jurisdiction. The Specifications and the Drawings are not intended to be prescriptive but rather to convey

the intent to provide complete slope protection, erosion control, and stormwater pollution prevention for both the Owner's property and adjacent properties.

- B. Perform Work to comply with “Best Practices” as established by the local agency of jurisdiction.
- C. Contractor must develop and implement a SWPPP in accordance with the General Permit prior to the beginning of construction activity.
- D. Contractor assumes sole responsibility for implementing, updating, and modifying the General Permit per Laws and Regulations for the SWPPP and Best Management Practices.
- E. Stormwater pollution prevention measures must be established prior to the beginning of construction and maintained during the entire length of construction until final stabilization has been achieved for the area protected.
- F. All land-disturbing activities must be planned and conducted to minimize the area to be exposed at any one time as well as time of exposure, off-site erosion, sedimentation, and adverse water quality impacts.
- G. Surface water runoff originating upgrade of an exposed area must be managed to minimize erosion and sediment loss during the period of exposure.
- H. Install measures to control both the velocity and rate of release so as to minimize erosion and sedimentation of the receiving water body (i.e. , ditch, channel, stream) in accordance with regulatory requirements and as directed by the OPT.
- I. Periodically clean out and dispose of all sediment and other pollutants as necessary to maintain adequate treatment capacity of each pollution control feature. Clean out and properly dispose of all sediment and other stormwater pollutants at the time of completion of the Work.

1.04 JOB CONDITIONS, CODES AND ORDINANCES

- A. Comply with the local codes and ordinances. If local codes and ordinances require more stringent or additional stormwater pollution prevention measures during construction beyond those required by state and federal Laws and Regulations, the Contractor must provide such measures at no additional cost.

1.05 STANDARDS

- A. The applicable provisions of the following standards apply as if written here in their entirety:
 1. ASTM International (ASTM):

ASTM D4632	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles, 90 pounds
ASTM D4833	Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products, 60 pounds
ASTM D3786	Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, 280 psi
ASTM D4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile, U.S. Sieve No. 70 (max) to No. 100 (min)

ASTM D4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All materials used for stormwater pollution prevention must meet the minimum design and specification requirements identified below for commonly used sediment loss prevention referenced from the North Central Texas Council Of Governments (NCTCOG) integrated Storm Water Management (iSWM) Design Manual for Construction. The Contractor must use appropriate control devices to protect against stormwater pollution from construction site activities.
- B. Erosion control blankets (ECBs) to hold seed and soil in place until vegetation is established on disturbed areas are subject to the following design criteria:
 - 1. The type and class of erosion control mat must be specified as appropriate for the slope of the area to be protected, the flow rate (sheet flow on cut/fill slopes) or velocity (concentrated flow in swales) of stormwater runoff in contact with the ECB, and the anticipated length of service.
 - 2. Erosion control blankets must meet the applicable Texas Department of Transportation (TxDOT) Minimum Performance Standards for TxDOT as provided in its Erosion Control Report and/or be listed on the most current annual Approved Products List for TxDOT applicable to TxDOT Item 169 Soil Retention Blanket and its Special Provisions.
- C. Silt fences for perimeter controls located downstream of disturbed areas are subject to the following design criteria:
 - 1. If 50 percent or less soil by weight passes the U.S. Standard sieve No. 200, select the apparent opening size (A.O.S.) to retain 85 percent of the soil.
 - 2. If 85 percent or more of soil by weight passes the U.S. Standard sieve No. 200, silt fences must not be used unless the soil mass is evaluated and deemed suitable by a soil scientist or geotechnical engineer concerning the erodibility of the soil mass, dispersive characteristics, and the potential grain-size characteristics of the material that is likely to be eroded.
 - 3. Silt fence fabric must meet the following minimum criteria:
 - a. Tensile Strength, ASTM D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles, 90 pounds.
 - b. Puncture Rating, ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products, 60 pounds.
 - c. Mullen Burst Rating, ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, 280 psi.

- d. Apparent Opening Size, ASTM D4751 Test Method for Determining Apparent Opening Size of a Geotextile, U.S. Sieve No. 70 (max) to No. 100 (min).
 - e. Ultraviolet Resistance, ASTM D4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus. Minimum 70 percent.
4. Filter stone for an overflow structure must be 1-1/2-inch washed stone containing no fine material. Angular shaped stone is preferable to rounded shaped stone.
 5. Fence posts must be galvanized steel or equivalent and may be T-section or L-section, 1.3 pounds per linear foot minimum, and 4 feet in length minimum. Wood posts may be used depending on anticipated length of service and provided they are 4 feet in length minimum and have a nominal cross-section of 2 inches by 4 inches for pine or 2 inches by 2 inches for hardwoods.
 6. Silt fence must be supported by galvanized steel wire fence fabric as follows:
 - a. 4-inch by 4-inch mesh size, W1.4/1.4, minimum 14-gauge wire fence fabric;
 - b. Hog wire, 12-gauge wire, small openings installed at bottom of silt fence;
 - c. Standard 2-inch by 2-inch chain link fence fabric; or
 - d. Other welded or woven steel fabrics consisting of equal or smaller spacing as that listed herein and appropriate gauge wire to provide support.
- D. Inlet protection used in new developments that include new inlets or roads with new curb inlets or during repairs to existing roadways are subject to the following design criteria:
1. Filter fabric protection must be designed and maintained in a manner similar to a silt fence.
 2. Where applicable, filter fabric, posts, and wire backing must meet the material requirements specified in Paragraph 2.01.C.
 3. Filter gravel must be 3/4-inch washed stone containing no fines. Angular shaped stone is preferable to rounded shapes.
 4. Concrete blocks must be standard 8-inch by 8-inch by 16-inch concrete masonry units.
 5. When organic filter tubes are used, the designer must specify the type of material to be used (or excluded) on a particular site:
 - a. Straw filter material must be Certified Weed Free Forage. The straw must be in good condition, air-dried, and not rotten or moldy.
 - b. Compost must conform to the requirements for Erosion Control Compost in TxDOT Special Specification 1001 Compost (2004). Compost may provide some oil and grease removal; however, the large percentage of fines in compost will result in less filtering and more ponding of stormwater.
 - c. Wood chips must be 100 percent untreated chips and free of inorganic debris, such as plastic, glass, metal, etc. Wood chip size must not be smaller than 1 inch and must not exceed 3 inches in diameter. Shavings must not be more than 5 percent of the total mass.

6. Bags used to secure inlet protection devices on pavement must be filled with aggregate, filter stone, or crushed rock that is less likely than sand to be washed into an inlet if the bag is broken. Filled bags must be 24 to 30 inches long, 16 to 18 inches wide, and 6 to 8 inches thick. Bags must be polypropylene, polyethylene, or polyamide woven fabric with a minimum unit weight of 4 ounces per square yard and meet the following criteria:
 - a. Greater than 300 psi Mullen Burst Strength using ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method.
 - b. Greater than 70 percent UV Stability using ASTM D4355 Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus.

- E. Stone outlet sediment traps (bermed or excavated) used in situations where flows are concentrated in a drainage swale or channel are subject to the following design criteria:
 1. The embankment must be placed on geotextile fabric meeting the following minimum criteria:
 - a. Tensile Strength, ASTM D4632 Text Method for Grab Breaking Load and Elongation of Geotextiles, 250 pounds.
 - b. Puncture Rating, ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products, 135 pounds.
 - c. Mullen Burst Rating, ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, 420 psi.
 - d. Apparent Opening Size, ASTM D4751 Test Method for Determining Apparent Opening Size of a Geotextile, U.S. Sieve No. 20 (max).
 2. Fill placed to constrict the swale for construction of the excavated stone outlet sediment trap and fill placed for the berm in the bermed stone outlet sediment trap must consist of clay material, minimum Plasticity Index of 30, using ASTM D4318 Standard Test for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 3. The embankment must be comprised of well graded stone riprap with a size range of 6 to 12 inches in diameter.

- F. Sediment basins used as treatment devices for sites with disturbed areas of 10 acres and larger that are part of a common drainage area are subject to the following design criteria:
 1. The embankment must be constructed with clay soil, minimum Plasticity Index of 30 using ASTM D4318 Standard Test for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 2. Texas Administrative Code Title 30, Chapter 299 (30 TAC 299), Dams and Reservoirs, contains specific requirements for dams that:
 - a. Have a height greater than or equal to 25 feet and a maximum storage capacity greater than or equal to 15 acre-feet;
 - b. Have a height greater than 6 feet and a maximum storage capacity greater than or equal to 50 acre feet;

- c. Are a high- or significant-hazard dam as defined in Chapter 299, regardless of height or maximum storage capacity; or
 - d. Are used as a pumped storage or terminal storage facility.
- 3. If the size of the detention basin meets or exceeds the above applicability, the design must be in accordance with state criteria, and the final construction Drawings and Specifications must be submitted to the TCEQ for review and approval.
- G. Check dams used for long drainage swales or ditches to reduce erosive velocities are subject to the following design criteria:
 - 1. Use geotextile filter fabric under check dams exceeding 12 inches in height. The fabric must meet the material specified for the Stone Outlet Sediment Trap discussed above.
 - 2. Loose, unconfined soil, wood chips, compost, and other material that can float or be transported by runoff must not be used to construct check dams.
 - 3. Sand bags must not be used for check dams, due to their propensity to break and release sand that is transported by the concentrated flow in the drainage swale or ditch.
 - 4. Rock Check Dams:
 - a. Stone must be well graded with stone size ranging from 3 to 6 inches in diameter for a check dam height of 24 inches or less.
 - b. The stone size range for check dams greater than 24 inches is 4 to 8 inches in diameter.
 - 5. Rock Bag Check Dams Bags:
 - a. Fill material should be pea gravel, filter stone or aggregate that is clean and free of deleterious material.
 - b. Bag material must comply with the requirements of Inlet Protection above.
 - 6. Sack Gabion Check Dams:
 - a. Sack gabions must be wrapped in galvanized steel, woven wire mesh. The wire must be 20 gauge with 1-inch diameter, hexagonal openings.
 - b. Stone must be well graded with a minimum size range from 3 to 6 inches in diameter.
 - 7. Organic Filter Tube Check Dams:
 - a. Filter material used within tubes to construct check dams must be limited to coir, straw, aspen fiber and other organic material with high cellulose content.
 - b. The material should be slow to decay or leach nutrients in standing water and comply with the requirements for Inlet Protection above.
- H. Stabilized construction exits used for sites in which significant truck traffic occurs on a daily basis are subject to the following design criteria:
 - 1. The construction exit material must be a minimum thickness of 6 inches. The stone or recycled concrete used must be 3 to 5 inches in size with little or no fines.

2. The geotextile fabric must meet the following minimum criteria:
 - a. Tensile Strength, ASTM D4632 Test Method for Grab Breaking Load and Elongation of Geotextiles, 300 pounds.
 - b. Puncture Strength, ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products, 120 pounds.
 - c. Mullen Burst Rating, ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method, 600 psi.
 - d. Apparent Opening Size, ASTM D4751 Test Method for Determining Apparent Opening Size of a Geotextile, U.S. Sieve No. 40 (max).
- I. Alternative pollution prevention measures selected by the Contractor must be identified from one or more of the following reference sources, as appropriate for the region of the construction activity:
 1. City of Austin Environmental Criteria Manual.
 2. North Central Texas Council of Governments (NCTCOG) integrated Stormwater Management (iSWM) Design Manual for Construction.
 3. Harris County/Harris County Flood Control District/City of Houston Stormwater Management Handbook for Construction Activities.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Prepare a SWPPP in accordance with applicable permit requirements for construction activity. Develop the SWPPP in conformance with the General Permit and any applicable local requirements.
- B. Prepare and implement the SWPPP prior to the beginning of construction activity in accordance with local, state, and federal Laws and Regulations.
- C. OPT may require Contractor to install stormwater pollution prevention devices and/or practices during construction in addition to those required under the approved SWPPP. Contractor must remain solely responsible for complying with all local, state, and federal Laws and Regulations.

3.02 INSTALLATION

- A. Erosion control blankets to hold seed and soil in place until vegetation is established on disturbed areas are subject to the following installation criteria:
 1. Prior to the installation of any erosion control matting, all rocks, dirt clods, stumps, roots, trash, and any other obstructions that would prevent the mat from lying in direct contact with the soil must be removed.
 2. Anchor trenching must be located along the entire perimeter of the installation area, except for small areas with less than 2 percent slope.
 3. Installation and anchoring must conform to the recommendations shown within the manufacturer's published literature for the erosion control blanket.

4. Anchors (staples) must be a minimum of 6 inches in length and 1 inch wide. They must be made of 11-gauge wire, or equivalent, unless the ECB is intended to remain in place with final stabilization and biodegrade.
 5. Particular attention must be paid to joints and overlapping material. Overlap along the sides and at the ends of ECBs should be per the manufacturer's recommendations for site conditions and the type of ECB being installed. At a minimum, the end of each roll of ECB must overlap the next roll by 3 feet and the sides of rolls must overlap 4 inches.
 6. After installation, check blankets for uniform contact with the soil, security of the lap joints, and flushness of the staples with the ground.
- B. Silt fences for perimeter controls located downstream of disturbed areas are subject to the following installation criteria:
1. Construct fences along a line of constant elevation (along a contour line if possible).
 2. Maximum drainage area must be 0.25 acres per 100 linear feet of silt fence.
 3. Maximum flow to any 20-foot section of silt fence must be 1 cfs.
 4. Maximum distance of flow to silt fence must be 200 feet or less. If the slope exceeds 10 percent, the flow distance must be less than 50 feet.
 5. Maximum slope adjacent to the fence must be 2:1.
 6. Stone overflow structures or other outlet control devices must be installed at all low points along the fence or spaced at approximately 300 feet if there is no apparent low point.
 7. A 6-inch wide trench is to be cut 6 inches deep at the toe of the fence to allow the fabric to be laid below the surface and backfilled with compacted earth or gravel to prevent bypass of runoff under the fence. Fabric must overlap at abutting ends a minimum of 3 feet and must be joined such that no leakage or bypass occurs. If soil conditions prevent a minimum toe-in depth of 6 inches or installation of support post to depth of 12 inches, silt fences must not be used.
 8. Sufficient room for the operation of sediment removal equipment must be provided between the silt fence and other obstructions in order to properly maintain the fence.
 9. The last 10 feet (or more) at the ends of a line of silt fence must be turned upslope to prevent bypass of stormwater. Additional upslope runs of silt fence may be needed every 200 to 400 linear feet, depending on the traverse slope along the line of silt fence.
- C. Inlet protection for new developments that include new inlets or roads with new curb inlets or during repairs to existing roadways are subject to the following installation criteria:
1. Maintain barricades, signs, and safety features around the Work in accordance with all provisions of the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD), when installing inlet protection on publicly traveled streets or in developed areas. Ensure that inlet protection is properly designed, installed, and maintained to avoid flooding of the roadway or adjacent properties and structures.
 2. Maximum depth of flow must be 8 inches or less.
 3. A 2-inch overflow gap or weir is required on all curb inlet protection devices.

4. Positive drainage is critical in the design of inlet protection. If overflow is not provided for at the inlet, excess flows must be routed through established swales, streets, or other watercourses to minimize damage due to flooding.
5. Filter Fabric Protection:
 - a. Filter fabric protection is appropriate where the drainage area is less than 1 acre and the basin slope is less than 5 percent.
 - b. Filter fabric, posts, and wire mesh must meet the material requirements specified in Paragraph 2.01.C.
 - c. A 6-inch wide trench is to be cut 6 inches deep at the toe of the fence to allow the fabric to be laid below the surface and backfilled with compacted earth or gravel. This entrenchment prevents any bypass of runoff under the fence.
 - d. Stone overflow structures must be installed where flow to the inlet is concentrated and more than 1 cfs according to the criteria in Paragraph 2.01.
6. Block and Gravel Protection (Curb and Drop Inlets):
 - a. Concrete blocks are to be placed on their sides in a single row around the perimeter of the inlet, with ends abutting.
 - b. Openings in the blocks should face outward, not upward. 1/2-inch by 1/2-inch wire mesh must then be placed over the outside face of the blocks covering the holes.
 - c. Filter stone must then be piled against the wire mesh to the top of the blocks with the base of the stone being a minimum of 18 inches from the blocks.
 - d. Alternatively, where loose stone is a concern (streets, etc.), the filter stone may be placed in appropriately sized geotextile fabric bags.
7. Excavated Impoundment Protection:
 - a. Excavated impoundment protection is only applicable to drop inlets.
 - b. It should not be applied to Y inlets because it will undermine the concrete pad surrounding the inlet opening. Nor can it be used for inlets on pavement.
 - c. With this protection method, it is necessary to install weep holes to allow the impoundment to drain completely.
 - d. The impoundment must be sized such that the volume of excavation is equal to or exceeds the runoff volume from the temporary control design storm (2-year, 24-hour) for the inlet's drainage area.
 - e. The trap must have a minimum depth of 1 foot and a maximum depth of 2 feet as measured from the top of the inlet and must have side slopes of 2:1 or flatter.
8. Organic Filter Tube Protection (Curb and Drop Inlets):
 - a. Organic filter tubes may be used on paved or unpaved surfaces. On paved surfaces, tubes must be secured in place by rock bags. On unpaved surfaces, the tubes must be embedded in the ground a minimum of 3 inches and staked at 4-foot spacing.

- b. Designer must provide calculations and specify the diameter of tube to be used based on the inlet's drainage area and the flow rate of runoff to the inlet.
 - c. The minimum allowable diameter is 12 inches.
 - d. For curb protection, the diameter of the tube must be at least 2 inches less than the height of the inlet opening. The tube should not be allowed to block the entire opening, since it will clog.
 - e. The tube must be placed on 4-inch by 4-inch or 2-inch by 4-inch wire mesh to prevent the tube from sagging into the inlet. The tube should be long enough to extend a minimum of 12 inches past the curb opening on each side of the inlet.
- D. Stone outlet sediment traps (excavated or bermed) for situations where flows are concentrated in a drainage swale or channel are subject to the following installation criteria:
1. The maximum drainage area contributing to the trap must be less than 10 acres for the excavated trap, and 5 acres or less for the bermed trap. For larger drainage areas a sediment basin must be used.
 2. The minimum storage volume must be the volume of runoff from the temporary control design storm (2-year, 24-hour) for the sediment trap's drainage area.
 3. The surface area of the design storage must be 1 percent of the area draining to the device.
 4. The maximum embankment height must be 6 feet as measured from the toe of the slope on the downstream side.
 5. Minimum width of the embankment at the top must be 2 feet.
 6. Embankment slope must be 1:5:1 or flatter.
 7. The embankment must have a depressed area to serve as the outlet with a minimum width of 4 feet.
 8. A 6-inch minimum thickness layer of 1-1/2-inch filter stone must be placed on the upstream face of the embankment when stormwater runoff contains fine silt and clay particles.
 9. The embankment must consist of stone riprap or a combination of compacted fill with stone riprap. The stone may be enclosed in wire mesh or a gabion basket and anchored to the channel bottom to prevent washing away.
 10. Fill must be placed in 8-inch loose lifts (maximum) and compacted to 95 percent Standard Proctor Density at optimum moisture content using ASTM D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
 11. Geotextile fabric, covered with a layer of stone, must extend past the base of the embankment on the downstream side a minimum of 2 feet.
 12. The outlet must be designed to have a minimum freeboard of 6 inches at design flow.

- E. Stabilized construction exits for sites in which significant truck traffic occurs on a daily basis are subject to the following installation criteria:
1. Limit site access to one route during construction, if possible; two routes for linear and larger projects.
 2. Prevent traffic from avoiding or shortcutting the full length of the construction exit by installing barriers. Barriers may consist of silt fence, construction safety fencing, or similar barriers.
 3. Design the access point(s) to be at the upslope side of the construction site. Do not place construction access at the lowest point on the construction site.
 4. Stabilized Construction Exits are to be constructed such that drainage across the entrance is directed to a controlled, stabilized outlet on-site with provisions for storage, proper filtration, and removal of wash water.
 5. The exit must be sloped away from the paved surface so that stormwater is not allowed to leave the Site onto roadways.
 6. Minimum width of exit must be 15 feet.
 7. Vehicles must not be permitted to track or drop sediment onto paved roads, streets, or parking lots. When necessary, vehicles must be cleaned to remove sediment prior to exit onto paved areas. When washing is required, it must be done on a constructed wheel wash facility that drains into an approved sediment trap or sediment basin or other sedimentation/filtration device.
 8. Minimum dimensions for the exit must be as follows:

Tract Area	Min. Width of Exit	Min. Length of Exit
<1 Acre	15 feet	20 feet
≥ 1 acre but <5 Acres	25 feet	50 feet
≥5 Acres	30 feet	50 feet

- F. Install pollution control devices in a manner consistent with their designed intent.

3.03 MAINTENANCE

- A. Maintain pollution prevention control structures and procedures in full working order at all times during construction. This must include any necessary repair or replacement of items which have become damaged or ineffective. Remove sediment and other pollutants which accumulate in pollution control devices as necessary to maintain the intended design efficiency for the pollution prevention measure.
- B. Dispose properly of trash, debris, and other pollutants.
- C. Place sediment material in approved earth spoil areas or return the sediment material to the area from which it eroded.
- D. Maintain pollution prevention structures and procedures until construction is complete for the area protected and until the Site achieves final stabilization. Unless more stringently defined by local, state, or federal requirements, final stabilization is defined as achieving 70 percent of background vegetative cover or placement of permanent cover, such as concrete or asphalt.

- E. Upon completion of construction and achievement of final stabilization, properly remove the temporary pollutant control structures and complete the area as indicated. Pollution control devices made of organic materials designed to degrade naturally in place will not require removal, unless specifically required by the OPT.
- F. Erosion control blankets must be inspected regularly (at least as often as required by the General Permit) for bare spots caused by weather related events. Missing or loosened blankets must be replaced or re-anchored. Also check for excess sediment deposited from runoff. Remove sediment and/or replace blanket as necessary. In addition, determine the source of excess sediment and implement appropriate Best Management Practices to control the erosion.
- G. Silt fences must be inspected regularly (at least as often as required by the General Permit) for buildup of excess sediment, undercutting, sags, and other failures. Sediment should be removed when it reaches approximately one-half the height of the fence. In addition, determine the source of excess sediment and implement appropriate Best Management Practices to control the erosion. If the fabric becomes damaged or clogged, it must be repaired or replaced as necessary.
- H. Inlet protection must be inspected regularly (at least as often as required by the General Permit). Floatable debris and other trash caught by the inlet protection should be removed after each storm event. Sediment should also be removed from curb inlet protection after each storm event because of the limited storage area associated with curb inlets. Sediment collected at inlet protection should be removed before it reaches half the height of the protection device. Sediment should be removed from inlets with excavated impoundment protection before the volume of the excavation is reduced by 50 percent. In addition, the weep holes should be checked and kept clear of blockage. Concrete blocks, 2-inch by 4-inch boards, stakes, and other materials used to construct inlet protection should be checked for damaged and repaired or replaced if damaged. When filter fabric or organic filter tubes are used, they should be cleaned or replaced when the material becomes clogged. For systems using filter stone, when the filter stone becomes clogged with sediment, the stones must be pulled away from the inlet and cleaned or replaced. Because of the potential for inlet protection to divert runoff or cause localized flooding, remove inlet protection as soon as the drainage area contributing runoff to the inlet is stabilized. Ensure that all inlet protection devices are removed at the end of the construction.
- I. The stone outlet sediment trap should be inspected regularly (at least as often as required by the General Permit) to check for clogging of the void spaces between stones. If the filter stone appears to be clogged, such that the basin will not completely drain, then the filter stone will require maintenance. If the filter stone is not completely clogged it may be raked with a garden rake to allow the water to release from the basin. If filter stone is completely clogged with mud and sediment, then the filter stone will have to be removed and replaced. Failure to keep the filter stone material properly maintained will lead to clogging of the stone riprap embankment. When this occurs, the entire stone rip-rap structure will need to be replaced. If the aggregate appears to be silted in such that efficiency is diminished, the stone should be replaced. Trash and debris should be removed from the trap after each storm event to prevent it from plugging the rock. Deposited sediment must be removed before the storage capacity is decreased by one-third, or sediment has reached a depth of 1 foot, whichever is less. The removed sediment must be stockpiled or redistributed in areas that are protected with erosion and sediment controls.

- J. Sediment basins should be inspected regularly (at least as often as required by the General Permit) to check for damage and to ensure that obstructions are not diminishing the effectiveness of the structure. Sediment must be removed and the basin must be re-graded to its original dimensions when the sediment storage capacity of the impoundment has been reduced by 20 percent. The removed sediment may be stockpiled or redistributed on-site in areas that are protected by erosion and sediment controls. Inspect temporary stabilization of the embankment and graded basin and the velocity dissipaters at the outlet and spillway for signs of erosion. Repair any eroded areas that are found. Install additional erosion controls if erosion is frequently evident.
- K. Check dams should be inspected regularly (at least as often as required by the General Permit). Silt must be removed when it reaches approximately one-third the height of the dam or 12 inches, whichever is less. Inspectors should monitor the edges of the dam where it meets the sides of the drainage ditch, swale, or channel for evidence of erosion due to bypass or high flows. Eroded areas must be repaired. If erosion continues to be a problem, modifications to the check dam or additional controls are needed. Care must be used when taking out rock check dams in order to remove as much rock as possible. Loose rock can create an extreme hazard during mowing operations once the area has been stabilized.
- L. Stabilized construction exits should be inspected regularly (at least as often as required by the General Permit). The stabilized construction exit must be maintained in a condition that prevents tracking or flow of sediment onto paved surfaces. Periodic re-grading and top dressing with additional stone must be done to keep the efficiency of the exit from diminishing. The rock must be re-graded when ruts appear. Additional rock must be added when soil is showing through the rock surface. Additional controls are needed if inspections reveal a properly installed and maintained exit, but tracking of soil outside the construction area is still evident. Additional controls may be daily sweeping of all soil spilled, dropped, or tracked onto public rights-of-way or the installation of a wheel cleaning system.

3.04 FIELD QUALITY CONTROL

- A. In the event of conflict between the specified requirements and stormwater pollution control laws, rules, or regulations or other local, state, or federal agencies, the more restrictive laws, rules, or regulations will apply.

3.05 SCHEDULES

- A. Prior to start of construction, submit schedules to the OPT for accomplishment of temporary and permanent erosion control work in connection with required clearing and grubbing, grading, construction, and paving. Include a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials in the submittal.

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01 60 00 PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide products for this Project that comply with the requirements of this Section. Specific requirements of the detailed equipment specifications govern in the case of a conflict with the requirements of this Section.
- B. Comply with applicable specifications and standards.

1.02 DOCUMENTATION

- A. Provide documents in accordance with the Contract Documents.

1.03 QUALITY ASSURANCE

- A. Design Criteria:
 - 1. Provide products designed for structural stability and operational capability.
 - 2. Provide members designed to withstand all loads imposed by installation, erection, and operation of the product without deformation, failure, or adversely affecting the operational requirements of the product. Size and strength of materials for structural members are specified as minimums only.
 - 3. Design mechanical and electrical components for all loads, currents, stresses, and wear imposed by startup and normal operations of the equipment without deformation, failure, or adversely affecting the operation of the unit. Mechanical and electrical components specified for equipment are specified as the minimum acceptable for the equipment.
- B. Coordination:
 - 1. Provide coordination of the entire Project, including verification that structures, piping, and equipment components to be furnished and installed for this Project are compatible.
 - 2. Determine that the equipment furnished for this Project is compatible with the requirements of the Contract Documents and with the equipment and materials furnished by others.
 - 3. Provide electrical components for equipment that comply with all provisions of the Contract Documents.
 - 4. Apply protective coatings and paints to equipment in the shop that are fully compatible with the final coatings to be field applied in accordance with the Contract Documents.
- C. Adapting Substitute Products:
 - 1. The Drawings and Specifications are prepared for the specified products. Make modifications to incorporate the products into the Project if a substitution is requested

for a product is and approved in accordance with Section 01 26 00 "Change Management."

2. Do not provide a product with a physical size that exceeds the available space. Consideration may be given to the acceptance of these products or equipment if the Contractor assumes all costs necessary to incorporate the item and the OPT approves such revisions.
3. Coordinate electrical requirements for the products to be installed in the Project, including revisions in electrical equipment components wiring and other elements necessary to incorporate the component.

1.04 STANDARDS

- A. The applicable industry standards referenced in the Specifications apply as if written here in their entirety.
- B. Provide equipment manufactured using structural and miscellaneous fabricated steel conforming to the standards of the American Institute of Steel Construction, except where indicated otherwise.

1.05 WARRANTIES AND GUARANTEES

- A. Correct Defective Work under the provisions of the General Conditions.
- B. Provide warranties and guarantees for periods as defined in the Contract Documents. Individual Sections of the Specifications may have more stringent warranty requirements than stated in the General Conditions. The most stringent warranty will apply in the event of conflicts within the Contract Documents.
- C. The Contract Documents may require special warranties that guarantee performance at a specified capacity, power consumption, efficiency, or other operating parameter. Correct defects that prevent products from meeting the specified performance parameters. The requirements of the special warranty that guarantee performance will be satisfied when the specified performance parameters have been met for a period of 1 calendar year of operation, unless Owner elects to accept Defective Work under the provisions of the General Conditions.
- D. The Contract Documents may require special warranties for periods extending beyond the one-year correction period specified in the General Conditions. The full warranty provisions and requirements for correction of Defective Work stated in the General Conditions apply throughout the extended warranty period.
- E. Provide a warranty bond to provide the same protection as the Contractor's performance bond for extended special warranties. The warranty bond will become effective on the day the performance bond expires which is 1 year after the date of final payment per the General Conditions. The warranty bond will remain in effect until the extended warranty period has expired.
- F. In the event that products are repaired, modified, or replaced under the warranty bond, then the warranty period will continue on the date of completion of these repairs for a period of 6 months or until the end of the original warranty period, whichever is later. In no

event will the warranty period extend more than 6 months beyond the end of the original warranty period.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Provide products according to normally accepted engineering and shop practices, except where a higher standard of quality is required by the Contract Documents.
- B. Manufacture like parts of duplicate units to standard sizes and gages that are interchangeable.
- C. Two or more items of the same kind are to be identical and made by the same Supplier.
- D. Provide products suitable for the intended service.
- E. Adhere to the equipment capacities, sizes, and dimensions indicated in the Contract Documents.
- F. Do not use products for any purpose other than that for which they were designed.
- G. Provide new products. Do not provide equipment that has been in service at any time prior to delivery except for testing in accordance with the Contract Documents.
- H. Provide materials suitable for service conditions.
- I. Provide iron castings that are tough, close grained gray iron free from blowholes, flaws, or excessive shrinkage and that conform to ASTM A48.
- J. Design structural members for shock or vibratory loads.
- K. Provide steel that is at least 1/4 inch thick for all elements that will be submerged or subject to splashing all or part of the time during normal operation of the equipment. Chamfer or grind all edges to eliminate sharp exposed edges.

2.02 ELECTRIC MOTORS

- A. Provide equipment with motors that comply with the following requirements unless the detailed equipment specifications have different requirements:
 - 1. Provide motors designed in compliance with NEMA, ANSI, IEEE, and AFBMA standards and the NEC for the specific duty imposed by the driven equipment that are appropriate for the application per these same standards.
 - 2. Provide motors designed for frequent starting duty equivalent to the duty service required by the driven equipment where frequent starting occurs.
 - 3. Provide motors rated for continuous duty at 40 deg. C ambient unless recognized and defined by the standards and codes for intermittent duty as a standard industry practice. Provide motors for which motor temperature rise above 40 deg. C ambient does not exceed the NEMA limit when operating continuously at nameplate horsepower.
 - 4. Provide motors designed to start with an appropriate starter or variable speed drive.

5. Provide motors designed for motor bearing life based upon the actual operating load conditions imposed by the driven equipment.
 6. Provide motors sized for the altitude of the location where the equipment is to be installed.
 7. Provide motors that meet the following service factor requirements:
 - a. Maximum load of 87 percent of the nameplate horsepower for motors with a 1.0 service factor; and
 - b. Maximum load of 100 percent of the nameplate horsepower for motors with a 1.15 service factor.
 8. Provide motors that comply with the latest applicable provisions of NEMA MG1 and are manufactured using the following process when the detailed specifications call for encapsulated motor windings:
 - a. Seal the stator assembly by vacuum pressure impregnation (VPI) with epoxy resin after stator assembly;
 - b. Provide two VPI treatments for stator, with each treatment consisting of a dip followed by an oven bake; and
 - c. Provide a final (third) coating of a durable epoxy varnish suitable for protection against dust, moisture, and chemical degradation after the final cure for the stator assembly.
 9. Provide motors with a clamp type grounding terminals inside the motor conduit box.
 10. Provide oversized conduit boxes for motors with external conduit boxes.
 11. Provide motors with maximum starting current that meets NEMA MG1, Class H.
 12. Provide motors with efficiencies that comply with NEMA MG1 for high efficiency motors.
 13. Provide motors with minimum insulation Type F.
 14. Provide motors that are random wound with copper coils.
 15. Provide motors rated for the appropriate classification when motors are installed in a hazardous location.
- B. Provide the manufacturer's standard motor on integrally constructed motor driven equipment such as appliances, hand tools, etc. if redesign of the complete unit would be required to provide a motor with the specified features.
- C. Provide motors within the horsepower ranges indicated below that are rated and constructed as follows unless otherwise required by the detailed equipment specifications.
1. Below 1/2 hp:
 - a. 115 volts, 60 Hertz, single phase;
 - b. Dripproof in clean and dry locations; TEPF in all other locations;
 - c. Permanently lubricated sealed bearings; and

- d. Built in manual reset thermal protector or furnished with integrally mounted stainless steel enclosed manual motor overload switch.
 - 2. 1/2 to 1 hp:
 - a. 230/460 volts, 60 Hertz, 3 phase;
 - b. Dripproof in clean and dry locations, TEFC in all other locations; and
 - c. Permanently lubricated sealed bearings.
 - 3. 1-1/2 hp and above:
 - a. 230/460 or 208 volts, 60 Hertz, 3 phase;
 - b. Dripproof in clean and dry locations, TEFC in all other locations;
 - c. Oil or grease lubricated anti friction or oil lubricated sleeve bearings; and
 - d. Vertical motors must have 15-year average life thrust bearings.
- D. Provide space heaters operating on 120-volt single-phase service for motors with horsepower ratings of 15 hp or greater.

2.03 EQUIPMENT APPURTENANCES

- A. Provide a safety guard covering all sides on belt or chain drives, fan blades, couplings, and other moving or rotating parts:
 - 1. Fabricate safety guards from 16 US gauge or heavier galvanized or aluminum clad sheet steel or 1/2-inch mesh galvanized expanded metal;
 - 2. Design guards for easy installation and removal;
 - 3. Provide galvanized supports and accessories for each guard;
 - 4. Provide stainless steel bolts and hardware; and
 - 5. Provide safety guards designed to prevent the entrance of rain and dripping water in outdoor locations.

2.04 ANCHOR BOLTS

- A. Provide suitable anchor bolts for each product.
- B. Provide anchor bolts with templates or setting drawings in time to permit casting the anchor bolts in the concrete when concrete is placed.
- C. Provide two nuts for each bolt.
- D. Provide anchor bolts for products mounted on baseplates that are long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete. Bolts must be long enough to provide full nut engagement and leave three threads exposed. Housekeeping pads are not structural concrete.
- E. Provide stainless steel anchor bolts, nuts, and washers.

2.05 SPECIAL TOOLS AND ACCESSORIES

- A. Furnish tools, instruments, lifting and handling devices, and accessories necessary for proper maintenance and adjustment that are available only from the manufacturer or are not commonly available.

2.06 EQUIPMENT IDENTIFICATION PLAQUES

- A. Provide a plaque for each piece of equipment in accordance with Section 40 05 53 "Identification for Process Piping and Equipment."

2.07 LUBRICATION SYSTEMS FOR EQUIPMENT

- A. Provide equipment lubricated by systems which:
 - 1. Require attention no more frequently than weekly during continuous operation.
 - 2. Do not require attention during startup or shut down.
 - 3. Do not waste lubricants.
- B. Provide lubricants to fill lubricant reservoirs and to replace lubricant consumed during testing, startup, and operation prior to acceptance of equipment by the Owner.

2.08 INSULATION OF PIPING

- A. Insulate all piping on or related to equipment as required to prevent freezing under any condition. Insulate piping per the manufacturer's written instruction.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install equipment including equipment pre-selected or furnished by the Owner. Assume responsibility for proper installation, startup, and making the necessary adjustments so that the equipment is placed in proper operating condition per Section 01 75 00 "Starting and Adjusting."

3.02 LUBRICATION

- A. Lubricate all products provided or installed for this Project, including products furnished by the Owner, per the manufacturer's written recommendations until the product is accepted by the Owner.

END OF SECTION

01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Comply with requirements of the General Conditions and specified administrative procedures in closing out the Contract.

1.02 DOCUMENTATION

- A. Submit affidavits and releases on forms provided by the Construction Manager.

1.03 SUBSTANTIAL COMPLETION

- A. The following requirements must be met for the Project or a designated portion of the Work to be Substantially Complete per the General Conditions:
 - 1. Work must be fully functional and able to operate in accordance with the Contract Documents without special or extraordinary efforts on the part of the Owner.
 - 2. Performance Acceptance Testing (PAT) must be complete and indicated compliance with the requirements of the Contract Documents.
 - 3. Operation and maintenance manuals must be approved and operator training conducted to allow the Owner to assume responsibility for operations.
- B. Conduct inspections with superintendent, Subcontractors, and Suppliers for the Work or a designated portion of the Work prior to calling for a Substantial Completion inspection by the OPT. Create a list of deficiencies in the Work that must be completed for the Project to qualify for Substantial Completion. Review the list with the Construction Manager or the designated member of the OPT. The Construction Manager or the designated member of the OPT may assist the Contractor with this effort; however, it is the Contractor's responsibility to create and manage this list of deficiencies until corrections are made.
- C. Correct the identified deficiencies prior to calling for a Substantial Completion inspection.
- D. Notify the Construction Manager that the Work or a designated portion of the Work is Substantially Complete per the General Conditions. Include a list of the items remaining to be completed or corrected before the Project will be considered for Final Completion.
- E. OPT will visit the Site to observe the Work within a reasonable time after notification is received to determine the status of the Project.
- F. Construction Manager will notify the Contractor that the Work is either Substantially Complete or that additional Work must be performed before the Project will be considered Substantially Complete.
 - 1. Construction Manager will notify the Contractor of items that must be completed before the Project will be considered Substantially Complete.
 - 2. Correct the noted deficiencies in the Work.
 - 3. Notify the Construction Manager when the items of Work in the Construction Manager's notice have been completed.

4. OPT will revisit the Site and repeat the process.
5. Construction Manager will issue a Certificate of Substantial Completion to the Contractor when the OPT considers the Project to be Substantially Complete. The certificate will include a tentative list of items to be corrected before Final Payment will be recommended.
6. Review the list and notify the Construction Manager of any objections to items on the list within 10 days after receiving the Certificate of Substantial Completion.

1.04 TRANSFER OF UTILITIES

- A. Transfer utilities to the Owner when the Certificate of Substantial Completion has been issued.
- B. Submit final meter readings for utilities and similar data as of the date the Owner occupied the Work.

1.05 CLOSEOUT REQUIREMENTS

- A. Provide the following before Final Completion:
 1. Record Documents per Section 01 31 13 "Project Administration";
 2. Keys and keying schedule;
 3. Warranties, bonds, and service agreements;
 4. Equipment Installation Reports;
 5. Shop Drawings, Product Data, operation and maintenance manuals, and other documentation required by the Contract Documents;
 6. Specified spare parts and special tools;
 7. Certificates of occupancy, operating certificates, or other similar releases required to allow the Owner unrestricted use of the Work and access to services and utilities;
 8. Evidence of continuing insurance and bond coverage as required by the Contract Documents; and
 9. Final videos and photographs per Section 01 33 06 "Graphic Documentation."

1.06 WARRANTIES, BONDS, AND SERVICES AGREEMENTS

- A. Provide warranties, bonds, and service agreements required by Section 01 33 00 "Document Management" or by the individual Sections of the Specifications.
- B. The date for the start of warranties, bonds, and service agreements is established per the General Conditions.
- C. Compile warranties, bonds, and service agreements and review these documents for compliance with the Contract Documents.
 1. Each document is to be signed by the respective Supplier or Subcontractor.
 2. Each document is to include:
 - a. The product or Work item description;

- b. The firm name, with the name of the principal, address, and telephone number;
 - c. Scope of warranty, bond, or services agreement;
 - d. Date, duration, and expiration date for each warranty bond and service agreement;
 - e. Procedures to be followed in the event of a failure; and
 - f. Specific instances that might invalidate the warranty or bond.
- D. Submit digital copies of the documents to the Construction Manager for review.
 - E. Submit warranties, bonds, and services agreements within 10 days after equipment or components placed in service.

1.07 FINAL COMPLETION

- A. Conduct inspections with Superintendent, Subcontractors, and Suppliers prior to calling for a Final Completion inspection by the OPT. Create a list of deficiencies in the Work that must be completed for the Project to qualify for the Final Completion inspection. Review the list with the Construction Manager or the designated member of the OPT. The Construction Manager or the designated member of the OPT may assist the Contractor with this effort; however, it is the Contractor's responsibility to create and manage this list of deficiencies until corrections are made.
- B. Identify, list, and correct deficiencies prior to calling for a Final Completion inspection. The Project at the call for Final Completion represents the Contractor's interpretation of a project completed in conformance with the Contract Documents and reflects the Contractor's representation of a quality project meeting the Owner's expectations.
- C. Notify the Construction Manager when:
 - 1. Work has been completed and complies with the Contract Documents;
 - 2. Equipment and systems have been tested per the Contract Documents and are fully operational;
 - 3. Final operation and maintenance manuals have been provided to the Owner and all operator training has been completed;
 - 4. Specified spare parts and special tools have been provided;
 - 5. Work is complete and ready for final inspection;
 - 6. Final documentation for all outstanding Modifications and Claims (other than those listed on the Certificate of Final Completion) have been processed and are ready for incorporation into the final Application for Payment; and
 - 7. Closeout requirements in Paragraph 1.05 have been completed.
- D. OPT will visit the Site to determine if the Project is complete and ready for final payment within a reasonable time after the notice is received.
- E. Construction Manager will notify the Contractor that the Project is complete or will notify the Contractor that Work is Defective.

- F. Take immediate steps to correct Defective Work. Notify the Construction Manager when Defective Work has corrected. OPT will visit the Site to determine if the Project is complete and the Work is acceptable. Construction Manager will issue a Certificate of Final Completion to the Contractor when the Project is complete or will notify the Contractor that Work is Defective.
- G. Submit the request for final payment with closeout documentation described in Paragraph 1.06 if notified that the Project is complete and the Work is acceptable.

1.08 REINSPECTION FEES

- A. Owner may impose a set-off against the Application for Payment in accordance with the General Conditions to compensate the OPT for additional visits to the Project if additional Work is required.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

01 74 23 FINAL CLEANING

PART 1 - GENERAL

1.01 SUMMARY

- A. Perform a thorough cleaning of the Site, buildings, or other structures prior to Owner occupancy of the buildings, and prior to Final Completion. Leave the Project clean and ready for occupancy.

1.02 DOCUMENTATION

- A. Provide data for maintenance per Section 01 33 04 "Operation and Maintenance Data."

1.03 QUALITY CONTROL

- A. Use experienced workmen or professional cleaners for final cleaning.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Furnish the labor and products needed for cleaning and finishing as recommended by the manufacturer of the surface material being cleaned.
- B. Use cleaning products only on the surfaces recommended by the Supplier.
- C. Use only those cleaning products which will not create hazards to health or property and which will not damage surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

- A. Thoroughly clean the entire Site and make ready for occupancy.
 - 1. Remove construction debris, boxes, and trash from the Site.
 - 2. Remove construction storage sheds and field offices.
 - 3. Restore grade to match surrounding condition and remove excess dirt.
 - 4. Sweep all drives and parking lots clean of dirt and debris. Use water trucks or hose down paved site to like new appearance.
- B. Clean floors and inspect for damage.
 - 1. Remove oil, grease, paint drippings, and other contaminants from floors, then mop repeatedly until thoroughly clean. Replace damaged flooring.
 - 2. Clean resilient flooring with an approved cleaner and provide one coat of liquid floor polish as recommended by the flooring manufacturer. Polish to a buffed appearance with powered floor buffer.
 - 3. Vacuum all carpets with powered floor sweeper to remove dirt and dust. Remove glue or other substances from nap of carpet.

- C. Clean and polish inside and outside glass surfaces. Wash with window cleaner and water, apply a coat of high quality glass polish, and wipe clean. Do not scratch or otherwise mar glass surfaces.
- D. Clean wall surfaces to remove dirt or scuff marks. Remove excess adhesive along top edges of wall base. Remove adhesive from surfaces of vinyl wall coverings.
- E. Align ceiling tile to fit properly in grid and replace cracked or damaged tile. Remove smear marks and other dirt from tile and clean surface of grid system.
- F. Spot paint nicks and other damage. Repaint the wall from inside corner to inside corner if spot-painting does not blend into the existing color and texture of the surrounding surfaces. Touch up damaged surfaces on factory finished equipment using special paint furnished by the manufacturer.
- G. Clean plumbing fixtures, valves, and trim. Clean toilet seats and covers. Remove labels and adhesive from fixtures. Remove floor drains and clean baskets or buckets. Polish strainers and exposed chrome or brass.
- H. Remove dirt, oil, grease, dust, and other contaminants from floors, equipment, and apparatus in mechanical and electrical rooms.
- I. Clean and polish ceramic tile floors and wall surfaces to remove mildew or other stains. Tuck point defective joints.
- J. Inspect exterior painted surfaces. Spot paint any damaged surfaces.
- K. Clean permanent filters and replace disposable filters on heating, ventilating, and air conditioning systems. Clean ducts, blowers, and coils if units were operated without filters during construction.
- L. Clean roof areas of debris; flush roof drainage systems with water until clear.
- M. Broom clean exterior paved surfaces and rake clean other surfaces of the grounds.
- N. Clean and polish all electrical equipment and exposed conduits. Remove paint overspray. Provide a blemish free appearance on all exposed equipment and conduits.

END OF SECTION

01 75 00 STARTING AND ADJUSTING

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide step-by-step procedures for starting provided systems, including equipment, pumps, and processes.
- B. Provide pre-startup inspections by equipment manufacturers.
- C. Place each system in service and operate the system to prove performance and to provide for initial correction of defects in workmanship, calibration, and operation.
- D. Provide for initial maintenance and operation.
- E. Include costs for starting and adjusting provided by manufacturer's representative in the Cost of Work for the equipment package.
- F. Owner will provide chemicals, if any, required for continued operations.

1.02 STANDARDS

- A. Comply with the specified standards associated with the testing or startup of equipment.

1.03 DOCUMENTATION

- A. Provide the following documents in accordance with Section 01 33 00 "Document Management":
 - 1. A Plan of Action for testing, checking, and starting equipment as Product Data per Section 01 31 13 "Project Administration."
 - 2. Equipment Installation Reports on the form provided by the Construction Manager certifying that the equipment and related appurtenances have been thoroughly examined and approved for startup and operation.
 - 3. Operation and maintenance manuals per Section 01 33 04 "Operation and Maintenance Data." Preliminary operation and maintenance data must be approved before installation, testing, and initial operation of equipment or providing training required by Section 01 79 00 "Training of Operation and Maintenance Personnel."

1.04 SPECIAL JOB CONDITIONS

- A. Do not start or test any equipment until the complete unit has been installed and thoroughly checked.
- B. Provide the services of a qualified representative of the manufacturer to attend the tests and startup procedures as required by this Section.
- C. Do not start or test any equipment until the preliminary operation and maintenance manual per Section 01 33 04 "Operation and Maintenance Data" has been approved.

PART 2 - PRODUCTS

2.01 TESTING INSTRUMENTATION

- A. Provide new instrumentation and testing devices needed to conduct tests for maintenance and operation as recommended in the operation and maintenance manuals. This equipment is to become the property of the Owner and transferred in good working order as a spare part at Substantial Completion. This equipment is to be calibrated and ready for use during the startup procedure and for training provided in accordance with Section 01 79 00 "Training of Operation and Maintenance Personnel."

PART 3 - EXECUTION

3.01 SERVICES OF MANUFACTURER'S REPRESENTATIVES

- A. Provide the services of experienced and technically competent representatives of the manufacturer for inspections, tests, supervision of installation, training, and assistance with placing equipment in operation.
- B. Perform installation, adjustment, and testing of the equipment under the direct supervision of the manufacturer's representative where specified. Certify that the equipment and related appurtenances have been thoroughly examined and approved for startup and operation in the Equipment Installation Reports.
- C. Provide on-site services as necessary for proper and trouble free operation of the equipment.

3.02 INSPECTION AND STARTUP

- A. Inspect equipment prior to placing any equipment or system into operation. Make adjustments as necessary for proper operation. Do not start or test any apparatus until the complete unit has been installed and thoroughly checked.
 - 1. Check for adequate and proper lubrication.
 - 2. Determine that parts or components are free from undue stress from structural members, piping, or anchorage.
 - 3. Adjust equipment for proper balance and operations.
 - 4. Determine that vibrations are within acceptable limits.
 - 5. Determine that equipment operates properly under full load conditions.
 - 6. Determine that the equipment is in true alignment.
 - 7. Ensure that the proper procedure is employed in startup of systems.

3.03 STARTING REQUIREMENTS

- A. Refer to the individual Specification Sections for specific startup procedures or other requirements.

3.04 INITIAL OPERATION

- A. Start, test, and place equipment and systems into operation for 30 days to allow the OPT to observe the operation and overall performance of the equipment and to determine that controls function as intended.
- B. Operate equipment which is used on a limited or part-time basis in the presence of the OPT for a period long enough to demonstrate that controls function as specified.
- C. Perform acceptance test as specified in individual Specification Sections. Demonstrate that equipment and systems meet the specified performance criteria.
- D. Equipment and systems may be considered as substantially complete at the end of this initial operation period if the equipment is placed in continuous beneficial use by the Owner, unless specifically stated otherwise in the individual equipment Specifications.

3.05 INITIAL MAINTENANCE

- A. Maintain equipment in accordance with the operation and maintenance manuals until Project is substantially complete and provisions have been made by the Owner for accepting responsibility for equipment operation in accordance with the General Conditions.
- B. Service equipment in accordance with the operation and maintenance manuals immediately before releasing the equipment to the Owner.

END OF SECTION

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01 79 00 TRAINING OF OPERATION AND MAINTENANCE PERSONNEL

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide services of Supplier's operation and maintenance training specialists to instruct Owner's personnel in recommended operation and maintenance procedures for equipment furnished. Details for training may be established in the specifications for that equipment.
- B. Provide a combination of classroom and hands on training.
- C. Training may be conducted at Contractor's or Supplier's facilities provided Contractor pays for travel, lodging, and per diem costs of the Owner.
- D. Record training sessions on video and submit to the Owner on DVD disk in MPEG-4 format for Owner's later use in instructing Owner's personnel. Include this recording as part of the final operation and maintenance manual. Provide legal releases or pay additional fees required to allow training by the manufacturer to be recorded.
- E. Include the cost for training and startup in the Cost of the Work for each equipment package.

1.02 DOCUMENTATION

- A. Provide documentation in accordance with Section 01 33 00 "Document Management" and include:
 - 1. Equipment Installation Reports in accordance with Section 01 75 00 "Starting and Adjusting" on forms provided by the Construction Manager;
 - 2. A lesson plan for training in accordance with Paragraph 3.01.C;
 - 3. Credentials of Supplier's proposed operation and maintenance instructors demonstrating compliance with requirements of Paragraph 1.04; and
 - 4. Operation and maintenance manuals per Section 01 33 04 "Operation and Maintenance Data." Preliminary operation and maintenance data must be approved before installation, testing, and initial operation of equipment or providing training required by the Section.

1.03 SCHEDULING OF TRAINING

- A. Coordinate training services with startup and initial operation of equipment on days and times Owner is available.
- B. Training may be required outside of normal business hours to accommodate schedules of operation and maintenance personnel.
- C. Provide training of Owner's personnel after acceptable preliminary operation and maintenance manuals have been approved.
- D. Coordinate training with equipment startup and testing and availability of Owner's personnel.

- E. Provide a proposed training schedule for review and acceptance by OPT showing all training required in the Contract Documents. Demonstrate compliance with specified training requirements relative to number of hours of training, number of training sessions, and scheduling.
- F. Submit initial training schedule at least 60 days before scheduled start of first training session. Submit final training schedule, incorporating revisions in accordance with OPT's comments, no later than 30 days prior to starting the first training session.
- G. Owner reserves the right to modify personnel availability for training in accordance with process or emergency needs.
- H. Schedule for training is to be approved by Owner.
 1. Schedule training and startup operations for no more than one piece of equipment or system at a time.
 2. Owner may require re-scheduling of training if operations personnel are not available for training on a scheduled date.
 3. Provide a minimum of 2 weeks' notice if training must be rescheduled.
 4. Training is to be limited to 24 hours per week.
 5. Time required for training is to be included in the development of the Project schedule.
- I. Schedule and coordinate training for equipment or systems which depend upon other equipment or systems for proper operation so that trainees can be made familiar with the operation and maintenance of the entire operating system.

1.04 SERVICES OF SUPPLIER'S REPRESENTATIVE

- A. Supplier's instructors must be factory-trained by the equipment manufacturer.
- B. Instructors must have knowledge of the theory of operation and practical experience with the equipment or system.
- C. Instructors must be proficient and experienced in conducting training of the type required and must have successfully conducted similar training courses.
- D. Qualifications of instructors are subject to acceptance by OPT. Provide services of replacement instructor with acceptable qualifications if OPT does not accept qualifications of proposed instructor. Include each instructor's résumé and specific details of instructor's operating, maintenance, and training experience relative to the specific equipment for which instructor will provide training to demonstrate their qualifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 OPERATOR TRAINING

- A. Provide classroom and hands-on training of the care and operation of the equipment to the Owner's personnel.

- B. Provide training in adequate detail to ensure that the trainees who complete the program will be qualified and capable of operating and maintaining the equipment, products, and systems provided.
- C. Provide a training plan that indicates the schedule and sequence of the training programs. The training plan is to include for each course:
 - 1. Number of hours for the course;
 - 2. Agenda and narrative description, including the defined objectives for each lesson;
 - 3. Draft copy of training handbooks;
 - 4. A descriptive listing of suggested reference publications;
 - 5. Audio-visual equipment required for training; and
 - 6. Type and number of tools or test equipment required for each training session.
- D. Provide and use training aids to complement the instruction and enhance learning.
 - 1. Provide training handbooks for use in both the classroom and the hands-on phases of training for each course.
 - 2. Instructional materials must include references to the operation and maintenance manuals and identify and explain the use of the manual.
 - 3. Provide a copy of all audio/visual training materials used in the presentations to the Owner.
- E. Operations training is to include:
 - 1. Orientation to provide an overview of system/subsystem configuration and operation;
 - 2. Terminology, nomenclature, and display symbols;
 - 3. Operations theory;
 - 4. Equipment appearance, functions, concepts, and operation;
 - 5. Operating modes, practices, and procedures under normal, diminished, and emergency conditions;
 - 6. Startup and shutdown procedures;
 - 7. Safety precautions;
 - 8. On-the-job operating experience for monitoring functions, supervisory, or command activities. Include functions and activities associated with diminished operating modes, failure recognition, and responses to system/subsystem and recovery procedures; and
 - 9. Content and use of operation and maintenance manuals and related reference materials.
- F. Provide training for performing on-site routine, preventive, and remedial maintenance of the equipment or system. Maintenance training is to include:
 - 1. Orientation to provide an overview of system/subsystem concept, configuration, and operation;
 - 2. Operations theory and interfaces;

3. Instructions necessary to ensure a basic theoretical and practical understanding of equipment appearance, layout, and functions;
 4. Safety precautions;
 5. Use of standard and special tools and test equipment;
 6. Adjustment, calibration, and use of related test equipment;
 7. Detailed preventive maintenance activities;
 8. Troubleshooting, diagnostics, and testing;
 9. Equipment assembly and disassembly;
 10. Repair and parts replacement;
 11. Parts ordering practices and storage;
 12. Failure and recovery procedures;
 13. Cabling and/or interface connectors;
 14. Content and use of operation and maintenance manuals and related reference materials;
 15. Procedures for warranty repairs;
 16. Lubrication; and
 17. Procedures, practices, documentation, and materials required to commence system maintenance.
- G. Provide training for the equipment listed in the table below. The table indicates the minimum acceptable training time. Provide additional hours of training if required to meet the training objectives described in this Section.

Specification Section	Equipment/System Description	Min. Hours
26 24 19	Motor Control Center	4
26 32 13	Diesel Generator	4

END OF SECTION

03 11 00 CONCRETE FORMING

1.00 GENERAL

1.01 WORK INCLUDED

- A. Furnish material and labor to form, tie, brace and support wet concrete, reinforcing steel and embedded items until the concrete has developed sufficient strength to remove forms.

1.02 QUALITY ASSURANCE

- A. Design Criteria: Forms shall be designed for the pressure exerted by a liquid weighing 150 pounds per cubic foot. The rate of placing the concrete, the temperature of the concrete, and all other pertinent factors shall be taken into consideration when determining the depth of the equivalent liquid. An additional design live load of 50 pounds per square foot shall be used on horizontal surfaces.
- B. Alignment Control:
 - 1. True alignment of walls and other vertical surfaces having straight lines or rectangular shapes shall be controlled and checked by the following procedures:
 - a. Forming shall be arranged with provisions for adjusting the horizontal alignment of a form, after the form has been filled with concrete to grade, using wedges, turn buckles, or other adjustment methods. Establish a transit line or other reference so that adjustments can be made to an established line while the concrete in the top of the form is still plastic.
 - b. Adjusting facilities shall be at intervals which permit adjustments to a straight line. Concrete shall not be placed until adequate adjusting facilities are in place.
- C. Tolerances: Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
 - 1. Record Data.
 - a. Manufacturers' literature for specified products.

1.04 STANDARDS

- A. The applicable provisions of the following standards shall apply as if written here in their entirety:
 - 1. American Concrete Institute (ACI) Specifications:

ACI 117	Specifications for Tolerances for Concrete Construction and Materials
ACI 301	Specifications for Structural Concrete
ACI 318	Building Code Requirements for Structural Concrete

2. American Institute of Steel Construction (AISC) Publication:
 - a. AISC Manual of Steel Construction.
3. American Iron and Steel Institute (AISI) Publication:
 - a. AISI Cold Formed Steel Design Manual.
4. American Plywood Association (APA) Standards:
 - a. APA Design/Construction Guide: Concrete Forming.

1.05 DELIVERY AND STORAGE

- A. Lumber for forms shall be stacked neatly on platforms raised above ground.

1.06 JOB CONDITIONS

- A. The Contractor shall notify the Engineer upon completion of various portions of the work required for placing concrete so that compliance with the plans and specifications may be monitored. The Engineer will authorize the Contractor to proceed with the placement after this has been completed and corrections, if required, have been made.
- B. In hot weather, both sides of the face forms may be required to be treated with oil to prevent warping and to secure tight joints.

2.00 PRODUCTS

2.01 MATERIALS

- A. Lumber: Properly seasoned and of good quality; free from loose or unsound knots, knot holes, twists, shakes, decay, splits, and other imperfections which would affect its strength or impair the finished surface of the concrete.
 1. Refer to Section 03 30 00 "Cast-In-Place Concrete" for finish requirements.
- B. Fiber Board Form Lining: Hardboard finished smooth on one side; minimum thickness of 3/16 inch thoroughly wet with water at least 12 hours before using.
- C. Plywood Form Lining: Conforming to APA HDO; exterior exposure waterproof adhesive, 3/8 inch thick.
- D. Form Oil: Light, clear oil; shall not discolor or injuriously affect the concrete surface, subsequent coatings, or delay or impair curing operations.

2.02 FABRICATIONS

- A. Lumber: Lumber for facing or sheathing shall be surfaced on at least one side and two edges, and sized to uniform thickness. Lumber of nominal 1-inch thickness or plywood of 3/4-inch thickness shall be permitted for general use on structures, if backed by a sufficient number of studs and wales.
- B. Special Form Lumber:
 1. Molding for chamfer strips or other uses shall be made of redwood, cypress, or pine materials of a grade that will not split when nailed, and which can be maintained to a

true line without warping. The form shall be mill cut and dressed on all faces. Fillet forms at sharp corners, both inside and outside and at edges, with triangular chamfer strips at all non-contiguous edges exposed to view. Thoroughly oil chamfer strips before installation on forms.

2. Construct forms for railings and ornamental work to standards equivalent to first class mill work.
 3. All moldings, panel work, and bevel strips shall be straight and true with neatly mitered joints, and designed so that the finished work shall be true, sharp and clean cut.
- C. Forms:
1. Forms shall be built mortar tight and of material sufficient in strength to prevent bulging between supports.
 2. Reused forms or form lumber shall be maintained clean and in good condition as to accuracy, shape, strength, rigidity, tightness, and smoothness of surface.
 3. All forms shall be so constructed as to permit removal without damage to the concrete. Exercise special care in framing forms for copings, offsets, railing and ornamental work, so that there will be no damage to the concrete when the forms are removed.
- D. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- E. Metal Forms:
1. The specifications for "Forms" regarding design, mortar tightness, filleted corners, beveled projections, bracing, alignment, removal, re use, oiling, and wetting shall apply equally to metal forms.
 2. The metal used for forms shall be of such thickness that the forms will remain true to shape. Bolt and rivet heads on the facing sides shall be countersunk. Clamps, pins, or other connecting devices shall be designed to hold the forms rigidly together and to allow removal without injury to the concrete.
 3. Metal forms which do not present a smooth surface or line up properly shall not be used. Exercise special care to keep metal free from rust, grease, or other foreign material that discolors the concrete.
- F. Form Linings:
1. Timber forms for exposed concrete surfaces which are to be given a rubbed finish shall be face-lined with an approved type of form lining material.
 2. If plywood is used for form lining, it shall be made with waterproof adhesive and have a minimum thickness of 3/4 inch. It shall preferably be oiled at the mill and then re-oiled or lacquered on the job before using.
 3. If fiber board is used, apply water to the screen side on the board. Stack the boards screen side to screen side. Use the smooth hard face as the contact surface of the form. Such surfaces may be formed with 3/4-inch thick plywood made with waterproof adhesive if backed with adequate studs and wales. The greatest strength of the outer

plies should be at right angles to the studding. In this case, form lining will not be required.

4. Carefully align edges and faces of adjacent panels and fill the joints between panels with patching plaster or cold water putty to prevent leakage. Lightly sand with No. 0 sandpaper to make the joints smooth.
 5. Forms which are reused shall have all unused form tie holes filled and smoothed as specified above.
- G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- H. Form Ties:
1. Metal form ties shall be used to hold forms in place and to provide easy metal removal. The use of wire for ties shall not be permitted.
 2. Leave no metal or other material within 1-1/2 inches of the surface, when removing form tie assemblies which are used inside the forms to hold the forms in correct alignment. The assembly shall provide cone-shaped depressions in the concrete surface at least 1 inch in diameter and 1-1/2 inches deep to allow filling and patching. Such devices, when removed, shall leave a smooth depression in the concrete surface without undue injury to the surface from chipping or spalling.
 3. Burning off rods, bolts, or ties shall not be permitted.
 4. Metal ties shall be held in place by devices attached to wales. Each device shall be capable of developing the strength of the tie.
 5. Metal and wooden spreaders which are separate from the forms shall be wired to top of form and shall be entirely removed as the concrete is placed.
 6. In the construction of basement or water bearing walls, the portion of a single rod tie that is to remain in the concrete shall be provided with a tightly fitted washer at midpoint to control seepage. Multi-rod ties do not require washers. The use of form ties which are tapered or encased in paper or other material to allow the removal of complete tie, and which leave a hole through the concrete structure, shall not be permitted.
- I. Falsework:
1. Falsework shall be designed and constructed so that no excessive settlement or deformation occurs. Falsework shall provide necessary rigidity.
 2. Timber used in falsework centering shall be sound, in good condition and free from defects which impair its strength.
 3. Steel members shall be of adequate strength and shape for the intended purpose.
 4. Timber piling used in falsework may be of any wood species which satisfactorily withstands driving and which adequately supports the superimposed load.

5. When sills or timber grillages are used to support falsework columns, unless founded on solid rock, shale or other hard materials, place them in excavated pits. Backfill to prevent the softening of the supporting material from form drip or from rains that may occur during the construction process. Sills or grillages shall be of ample size to support the superimposed load without settlement.
6. Falsework not founded on a satisfactory spread footing shall be supported on piling, which shall be driven to a bearing capacity to support the superimposed load without settlement.

3.00 EXECUTION

3.01 PREPARATION

- A. Before placing concrete, ensure that embedded items are correctly, firmly and securely fastened into place. Embedded items shall be thoroughly clean and free of oil and other foreign material. Anchor bolts shall be set to the correct location, alignment and elevation by the use of suitable anchor bolt templates.

3.02 INSTALLATION

- A. Pre-Placement:
 1. During the elapsed time between building the forms and placing the concrete, maintain the forms to eliminate warping and shrinking.
 2. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 - a. For concrete surfaces exposed to view: Class A, 1/8 inch.
 - b. For concrete surfaces to receive a rubbed finish: Class A, 1/8 inch.
 - c. For concrete surfaces to receive plaster, stucco or wainscoting: Class B, 1/4 inch.
 - d. For concrete surfaces not exposed to view: Class D, 1 inch.
 3. Construct forms tight enough to prevent loss of concrete mortar.
 4. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
 5. Do not use rust-stained steel form-facing material.
 6. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
 7. Treat the facing of forms with suitable form oil before concrete is placed. Apply oil before the reinforcement is placed. Wet form surfaces which will come in contact with the concrete immediately before the concrete is placed.

8. At the time of placing concrete, the forms shall be clean and entirely free from all chips, dirt, sawdust, and other extraneous matter at the time. Forms for slab, beam and girder construction shall not have tie wire cuttings, nails or any other matter which would mar the appearance of the finished construction. Clean forms and keep them free of foreign matter during concrete placement.
- B. Where aluminum anchors, aluminum shapes, or aluminum electrical conduits are embedded in concrete, paint aluminum contact surfaces with zinc rich primer. Allow the paint to thoroughly dry before placing the aluminum in contact with the concrete.
- C. Placement:
1. Set and maintain forms to the lines designated, until the concrete is sufficiently hardened to permit form removal. If, at any stage of the work, the forms show signs of bulging or sagging, immediately remove that portion of the concrete causing this condition. If necessary, reset the forms and securely brace against further movement.
 2. Provide adequate cleanout openings where access to the bottom of the forms is not otherwise readily attainable.
 3. Chamfer exterior corners and edges of permanently exposed concrete.
 4. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
 5. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement. Carefully and accurately place and support reinforcement in concrete structures.
- D. Removal: Remove forms so that the underlying concrete surface is not marred or damaged in any way. Forms shall not be removed until the concrete has attained sufficient strength to safely carry the dead load, but in no case less than the number of curing days set forth in the following table:

Forms	Curing Days
Forms for concrete of minor structural load carrying importance	1 day
Forms for walls, columns, sides of drilled shafts, massive structural components and other members not resisting a bending moment during curing	1 day
Forms and falsework under slabs, beams and girders where deflections due to dead load moment may exist (for spans < or = 10 feet)	7 days
Forms and falsework under slabs, beams and girders where deflections due to dead load moment may exist (for spans > 10 feet and < or = 20 feet)	14 days
Forms and falsework under slabs, beams and girders where deflections due to dead load moment may exist (for spans > 20 feet)	21 days

- E. Reuse:
1. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

2. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Owner's Representative.
- F. Shores and Reshores:

END OF SECTION

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03 21 00 REINFORCING STEEL

1.00 GENERAL

1.01 WORK INCLUDED

- A. Furnish labor and reinforcing materials required to cut, bend, tie, splice, place and support the reinforcement in the material grades, sizes, quantities and locations specified.

1.02 QUALITY ASSURANCE

- A. Tolerances:
 - 1. Reinforcing shall be placed where specified, with the following maximum tolerances, plus or minus:
 - a. Concrete Cover: 1/4 inch.
 - b. Reinforcing Bar Spacing: 1/4 inch in 12 inches.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
 - 1. Shop Drawings:
 - a. Reinforcing bar layout drawing with bar lists clearly marked and referenced to the Drawings. Include:
 - 1). Material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcing.
 - 2). Additional reinforcing required for openings through concrete structures.
 - 2. Record Data: Manufacturers' literature for specified products.
 - 3. Certified Test Reports:
 - a. Certification of steel quality, size, grade and manufacturer's origin.

1.04 STANDARDS

- A. The applicable provisions of the following standards shall apply as if written here in their entirety:
 - 1. ASTM International (ASTM) Standards:

ASTM A1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

- 2. American Concrete Institute (ACI) Publications:

ACI 301	Specification for Structural Concrete
ACI SP-66	ACI Detailing Manual

ACI 318	Building Code Requirements for Structural Concrete
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3. Concrete Reinforcing Steel Institute (CRSI) Publications:

CRSI	Manual of Standard Practice
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1.05 DELIVERY AND STORAGE

- A. Store reinforcement above the surface of the ground upon platform skids or other supports. Protect from mechanical and chemical injury and surface deterioration caused by exposure to conditions producing rust. When placed in the Work, reinforcement shall be free from dirt, scale, dust, paint, oil and other foreign material. Tag and store reinforcement for ease of correlation with Shop Drawings.

1.06 JOB CONDITIONS

- A. Proposed deviations from reinforcing indicated on the Drawings or Specifications shall be approved in writing by the Engineer prior to fabrication.
- B. Lap lengths shall be of the length shown on the Drawings or noted in lap and embedment table, and shall be in compliance with ACI 318.
- C. Specified cover for reinforcing shall be maintained throughout construction. Bars shall be cut to lengths necessary to allow for proper clearances. Cover of concrete shall be measured from face of forms to outside face of reinforcement.
- D. Stirrups shall be hooked.

2.00 PRODUCTS

2.01 MATERIALS

- A. Steel Reinforcing Bars: Billet-Steel bars for concrete reinforcement conforming to ASTM A615; Grade 60, deformed, with minimum yield strength of 60,000 psi. Steel reinforcing bars shall be produced in the United States of America.
- B. Welded Wire Reinforcement: Cold-drawn steel wire conforming to ASTM A1064; flat sheets fabricated in accordance with ASTM A1064.
- C. Joint Dowel Bars: Plain-steel bars, ASTM A615/A615M, Grade 60. Cut bars true to length with ends square and free of burrs.
- D. Supports (Chairs): Bar supports shall be of the proper type for the intended use.
 - 1. Exposed Surface: CRSI Class 1 – Maximum Protection – uniform high density polyethylene (plastic) or fiberglass reinforced plastic (FRP). Plastic protected wire bar supports are not allowed.
 - 2. Unexposed Surface: CRSI Class 3 – No Protection.
- E. Spacers: Precast mortar blocks with a 28-day compressive strength that is greater than the specified concrete strength in which the blocks are being placed. Additionally:
 - 1. Cure a minimum of 4 days.

2. Blocks shall be in the form of a frustum positioned such that its size increases away from the formed surface. The surface placed adjacent to the forms shall not exceed 2-1/2 x 2-1/2 inches or 3 inches in diameter.
 3. Blocks shall be accurately cast to the thickness required and the surface to be placed adjacent to the forms shall be a true plane free of surface imperfections.
 4. Wires ties for securing reinforcement shall be embedded in the block.
- F. Mechanical Splices:
1. Mechanical splices shall develop at least 125 percent of the reinforcement yield strength.
 2. Cadweld splices as manufactured by Erico Products, Inc.

3.00 EXECUTION

3.01 FABRICATION

- A. Reinforcing bars shall be bent cold by machine to shapes indicated on the Drawings; true to shapes indicated; irregularities in bending shall be cause for rejection. Unless otherwise noted, all hook and bend details and tolerances shall conform to the requirements of ACI SP-66 and ACI 318.
1. Fabricate reinforcement to provide lapped connections, bends and transitions in reinforcement as required for continuity of the typical reinforcement specified on the Drawings.
 2. Unless otherwise detailed, intersecting wall and/or beam reinforcement shall extend to the far face and terminate in a standard hook. Reinforcement at the outside face of corners shall be continuous or provide lap splices at each side of the corner.

3.02 PREPARATION

- A. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- B. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcement.

3.03 INSTALLATION

- A. General: Place the reinforcement carefully and accurately in the concrete structures. Rigidly tie and support the reinforcement. Welding of any type of reinforcement shall not be permitted.
- B. Splices:
1. Splice reinforcement only as indicated on the Drawings or as approved by the Engineer prior to fabrication. Splices shall preferably occur at points of minimum stress.
 2. Lap Splice: Lengths shall be as indicated on the Drawings. Rigidly wire the bars at all splices. Overlap sheets of wire fabric sufficiently to maintain a uniform strength and securely fasten.

3. Mechanical Splice: Cadweld splices or approved equal, installed in accordance with the manufacturer's instructions and recommendations. The splice device shall develop at least 125 percent of the specified yield strength of the reinforcement.

C. Placement:

1. Place reinforcement, as indicated on the Drawings with the specified tolerances. Hold securely in place during the placing of the concrete. The minimum clear distance between bars shall be per ACI 318 unless noted otherwise. Always pass vertical stirrups around the main tension members and securely attach thereto. Wire reinforcing together at a sufficient number of intersections to produce a sound, sturdy mat or cage of reinforcement that will maintain the reinforcement in correct positions when the concrete is placed.
2. Hold the reinforcing steel in concrete slabs firmly in place with wire supports or "chairs." Sizing and spacing of the chairs shall be sufficient to properly support the steel, and shall be in accordance with CRSI Publications "Manual of Standard Practice in."
3. Space the reinforcing steel in concrete walls the proper distance from the face of the forms, as indicated on the Drawings:
 - a. For wall surfaces exposed to view, use chairs.
 - b. For wall surfaces not exposed to view, use chairs or precast mortar blocks.
4. Where reinforcing conflicts with location of anchor bolts, inserts, etc., submit prompt notifications so that revisions can be made before concrete is placed. No cutting of reinforcing shall be permitted without the prior approval of the Engineer.
5. Welded wire shall be fabricated flat sheets, in longest practical lengths. Lap joints one mesh. Do not locate end laps over beams of continuous structures or midway between supporting beams. Offset end laps of adjacent widths to prevent continuous lap. Fasten ends and sides of welded wire fabric at 48 inches O.C. with tie wire.
6. Reinforcing shall extend through construction joints.
7. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.04 FIELD QUALITY CONTROL

- A. Concrete shall not be placed until the Engineer has observed the final placing of the reinforcing steel, and has given permission to place concrete.

END OF SECTION

03 30 00 CAST-IN-PLACE CONCRETE

1.00 GENERAL

1.01 SUMMARY

- A. Furnish labor, materials, mixing and transporting equipment and incidentals necessary to proportion, mix, transport, place, consolidate, finish, and cure concrete in the structure.

1.02 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and silica fume; subject to compliance with requirements.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:

- 1. Shop Drawings:

- a. Mix Design: For each mix design, provide documentation using field test data or trial mixture data in accordance with ACI 301, which includes average strength documentation using either field strength test data or trial mixtures.
- b. Submit a schedule to the Owner's representative which shows the sequence of concrete placements.
- c. Procedures for placement through water if required.
- d. If joints are not detailed on the Drawings, construction joint details and locations shall be submitted to the Engineer for approval.
 - 1). Repair procedures if required due to failed test or retest.

- 2. Certified Test Reports:

- a. Materials used in the mix design and which will be used during production of concrete for the Project.
- b. Water: Verification that all potable mix water and curing water sources do not exceed the non-potable water limits listed in ASTM C1602 Table 2.
 - 1). Test mix water chloride content as indicated in ASTM C1602 Table 2.
- c. Aggregate, conforming to ASTM C33, including the test reports for soundness and abrasion resistance.
- d. Aggregate:
 - 1). Verification that aggregate is not "potentially reactive" per ASTM C1260.
 - 2). Or a cement chemical analysis indicating that the total alkali content is acceptable per Paragraph 2.02.A.
 - 3). Test all aggregate sources for chlorides in accordance with ASTM C1524.

- e. 7-day and 28-day compressive strength tests results.
 - f. If the sum total of chlorides in mix water and aggregates exceeds 80 percent of the specified limit for hardened concrete, then prior to use of concrete, test mix design to verify acceptable chloride ion concentrations in accordance with ASTM C1218.
3. Record Data:
- a. Manufacturer's literature on specified materials.
 - b. Documentation indicating conformance with ASTM C94 requirements.
 - 1). Concrete delivery tickets in accordance ASTM C94.
 - c. Documentation of supplier's National Ready Mixed Concrete Association certification.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications:
 - 1. A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.
 - 2. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- C. Testing Agency Qualifications:
 - 1. An independent testing agency, acceptable to authorities having jurisdiction and the Engineer, qualified according to ASTM C1077 and ASTM E329 to conduct the testing indicated.
 - 2. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- E. Pre-Submittal Conference:
 - 1. Conduct conference at the Site to comply with requirements in Section 01 31 00 "Project Management and Coordination."

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cement in bulk or bags which are plainly marked with the brand and manufacturer's name. Immediately upon receipt, store cement in a dry, weather-tight, and properly ventilated structure which excludes moisture. Storage facilities shall permit easy access for inspection and identification. Cement not stored in accordance with the requirements shall not be used.

- B. Sufficient cement shall be in storage to complete placement of concrete started. In order that cement may not become unduly aged after delivery, maintain records of delivery dates. Use cement which has been stored at the Site for 60 days or more before using cement of lesser age. No cement shall be used which is lumped, caked, stored more than 90 days, or whose temperature exceeds 170 F.

1.06 STANDARDS

- A. Mixing, sampling, placing, curing and testing of concrete, and the materials used shall be in compliance with the latest revisions of the following standards, unless otherwise noted in the Contract Documents. The Contractor shall maintain one copy of each of the applicable standards at the construction field office.

1. ASTM International (ASTM) Standards:

ASTM Standards	
ASTM C31	Standard Practice for of Making and Curing Concrete Test Specimens in the Field
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C94	Standard Specification of Ready Mixed Concrete
ASTM C109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
ASTM C125	Standard Terminology Relating to Concrete and Concrete Aggregates
ASTM C138	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143	Standard Test Method for Slump of Hydraulic Cement Concrete
ASTM C150	Standard Specification for Portland Cement
ASTM C171	Standard Specification for Sheet Materials for Curing Concrete
ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C191	Standard Test Method for Time of Setting of Hydraulic Cement by Vicat Needle
ASTM C192	Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C290	Standard Specification for Elastomeric Joint Sealants
ASTM C309	Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete

ASTM Standards	
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C579	Standard Test Methods for Compressive Strength of Chemical Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
ASTM C580	Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes
ASTM C595	Standard Specification for Blended Hydraulic Cements
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C827	Standard Test Method for Change in Height at Early Stages of Cylindrical Specimens of Cementitious Mixtures
ASTM C845	Standard Specification for Expansive Hydraulic Cement
ASTM C881	Standard Specification for Epoxy Resin Base Bonding Systems for Concrete
ASTM C1116	Standard Specification for Fiber-Reinforced Concrete
ASTM C1218	Standard Test Method for Water-Soluble Chloride in Mortar and Concrete
ASTM C1240	Standard Specification for Silica Fume used in Cementitious Mixtures
ASTM C1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D2240	Standard Test Method for Rubber Property Durometer Hardness
ASTM E96	Standard Test Methods for Water Vapor Transmission of Materials

2. American Concrete Institute (ACI) Standards:

ACI Standards	
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavy-weight, and Mass Concrete
ACI 301	Specification for Structural Concrete
ACI 305.1	Specification for Hot Weather Concreting
ACI 306.1	Standard Specification for Cold Weather Concreting
ACI 308.1	Specification for Curing Concrete

ACI Standards	
ACI 318	Building Code Requirements for Structural Concrete

3. Concrete Plant Manufacturers Bureau (CPMB) Standards:
 - a. Concrete Plant Standards.

2.00 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Products: Subject to compliance with requirements, provide one of the products specified.
 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 CONCRETE MATERIALS

- A. Cementitious Material; General: If the fine and/or coarse aggregates test “Potentially Reactive”, in accordance with ASTM C1260, then a low alkali cementitious material shall be used. A low alkali cementitious material shall be such that, the Sodium Oxide Equivalent ($N_{a_2O_{eq}}$) shall not exceed 0.6 percent of the total cementitious material content.
- B. Cement; Type:
 1. Type I or I/II Portland cement, conforming to ASTM C150; used for all concrete, unless noted otherwise.
- C. Supplementary Cementitious Materials (SCM):
 1. Fly Ash/Pozzolans: Conforming to ASTM C618, Class C or F fly ash; used in all classes of concrete. If fly ash is not available then provide a straight cement mix.
- D. Coarse Aggregate:
 1. Crushed stone or gravel conforming to ASTM C33, in the gradation size specified.
 - a. Class: Moderate weathering region, but not less than 3M.
 - b. Aggregate shall have a coefficient of thermal expansion (CoTE) of 4.5 microstrain per degree Fahrenheit.

2. For gradation size number 467, a maximum aggregate size of 1-1/2 inches is:

Sieve Size	Percent Retained	Percent Passing
2"	0	100
1-1/2"	0-5	95-100
3/4"	30-65	35-70
3/8"	70-90	10-30
No. 4	95-100	0-5

3. For gradation size number 57, the maximum aggregate size of 1 inch is:

Sieve Size	Percent Retained	Percent Passing
1-1/2"	0	100
1"	0-5	95-100
1/2"	40-75	25-60
No. 4	90-100	0-10
No. 8	95-100	0-5

4. For gradation size number 67, the maximum aggregate size of 3/4 inch is:

Sieve Size	Percent Retained	Percent Passing
1"	0	100
3/4"	0-10	90-100
3/8"	45-80	20-55
No. 4	90-100	10-10
No. 8	90-100	0-5

5. For gradation size number 8, the maximum aggregate size of 3/8 inch is:

Sieve Size	Percent Retained	Percent Passing
1"	0	100
3/8"	0-15	85-100
No. 4	70-90	10-30
No. 8	90-100	0-10
No. 16	95-100	0-5

E. Fine Aggregate:

1. Washed and screened natural sands or sands manufactured by crushing stones; conforming to ASTM C33. The gradation in ASTM C33 for air entrained concrete is:

Sieve Size	Percent Retained	Percent Passing
3/8"	0	100

Sieve Size	Percent Retained	Percent Passing
#4	0-5	95-100
#8	0-20	80-100
#16	15-50	50-85
#30	40-75	25-60
#50	70-90	10-30

2. Fine aggregate shall have not more than 45 percent retained between any two consecutive sieves. Its fineness modulus, as defined in ASTM C125, shall be not less than 2.3 nor more than 3.1.

F. Water: Potable and complying with ASTM C1602 and ASTM C1602 Table 2.

2.03 ADMIXTURES

- A. Measure and dose admixtures in accordance with manufacturer's recommendations.
- B. Air Entraining Admixture: Conforming to ASTM C260.
- C. Water Reducing Admixtures: Conforming to ASTM C494; Types A or D.
- D. Set Retarding Admixtures: Conforming to ASTM C494; Types B and D.
- E. Water Reducing Admixtures, High Range (HRWR): High Range Water Reducer shall comply with ASTM C494, Type F or G. HRWR shall be added to the concrete mix at the concrete batch plant. HRWR may not be added at placement site except to redose a batch and only after approval of the HRWR manufacturer. The high range water reducing admixture shall be able to maintain the plasticity range without significant loss of slump or rise in concrete temperature for 2 hours. Other admixtures may only be used with the HRWR if approved by the HRWR manufacturer. A representative of the HRWR manufacturer shall be present during any large placement, placement of slabs, or during times of unusual circumstance which may require changes to the product formulation.
 1. Manufacturers:
 - a. GCP Applied Technologies.
 - b. Master Builders Solutions US LLC.
 - c. Sika Corporation.

2.04 WATERSTOPS

- A. Non-Expanding Strip Waterstops (Hydrophilic): Non-Self-expanding strip waterstops shall be used only where specifically indicated. Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophilic material for adhesive bonding to concrete.
 1. Products:
 - a. Sika Lockstop; Sika Corporation – U.S., or approved equal

2.05 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape for sealing lap joints, penetrations, and as required for securing terminations.
1. Available Products:
 - a. Fortifiber Corporation; Moistop Ultra A.
 - b. Raven Industries Inc.; Vapor Block 15.
 - c. Reef Industries, Inc.; Griffolyn Type-105.
 - d. Stego Wrap (15-mil) Vapor Barrier; STEGO INDUSTRIES LLC.
 - e. Huskey Yellow Guard, 15-mil Vapor Barrier; Poly-America, L.P.

2.06 FLOOR AND SLAB TREATMENTS

- A. Floor Hardener: Hardening agent for exposed concrete floors shall be dry-shake surface hardener. The standard application rate for this product shall be in accordance with the manufacturer's recommendations.
1. MasterTop 200; Master Builders Solutions US LLC.
 2. Approved equal.
- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
1. MasterTop 120 SR; Master Builder Solutions US LLC.
 2. Approved equal.
- C. Epoxy Broadcast Overlay System: Moisture tolerant, traffic bearing, skid resistant, seamless, protective, overlay system for application by the broadcast method.
1. Binder: 100 percent solids epoxy resin.
 - a. MasterSeal 350; Master Builders Solutions US LLC.
 - b. Approved equal.
 2. Aggregate: Proprietary mixture or aluminum oxide, or silicon carbide, or roofing granules, or silica sand or trap rock passing the #50 sieve and retained on the #60 sieve.
 - a. MasterSeal 940 DR; Master Builders Solutions US LLC.
 - b. Approved equal.

2.07 CURING MATERIALS

- A. Sheet Curing Material: Conforming to ASTM C171.
1. Waterproof paper.
 2. Polyethylene film.

3. White burlap - polyethylene film.
- B. Membrane Curing Compounds: Membrane curing compound conforming to ASTM C309; applied according to the manufacturer's recommendations. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, 18 to 22 percent solids.
1. Products:
 - a. Diamond Clear VOX; Euclid Chemical Co.
 - b. Lambco Glazecote 30; Lambert Corporation.
 - c. Dress & Seal; Laticrete International, Inc.
 - d. Vocomp-20; W.R. Meadows, Inc.
 - e. Cure & Seal 250E; Nox-Crete Products Group, Kinsman Corporation.
 - f. Starseal 0800; Vexcon Chemicals, Inc.
 - g. Approved equal.
- C. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C1315, Type 1, Class A.
1. Products:
 - a. Polyseal WB-15; ChemMasters.
 - b. UV Safe Seal; Lambert Corporation.
 - c. Lumiseal Plus; Laticrete International, Inc.
 - d. MasterKure CC 1315 WB; Master Builders Solutions US LLC.
 - e. Vocomp-30; W.R. Meadows, Inc.
 - f. Vexcon Starseal 1315; Vexcon Chemicals, Inc.
 - g. Approved equal.
- D. Finishing Aid: Spraying material designed to form a monomolecular film on fresh concrete that reduces the rate of evaporation of surface moisture prior to finishing. This material is not a curing compound. Concrete must be cured as specified.
1. MasterKure ER 50; Master Builders Solutions US LLC.
 2. Approved equal.

2.08 RELATED MATERIALS

- A. Expansion and Isolation Joint Filler:
1. Water retaining structures: ASTM D1752, Type I or II.
 2. Non-water retaining structures: ASTM D1751; or ASTM D1752, Type I or II.
 3. Thickness as indicated on the Drawings.
- B. Expansion and Isolation Joint Sealant:
1. Water retaining structures: ASTM C920, Type M, Grade P or NS as applicable, Class 50, Use I (ASTM C127, Class 2), UV resistance.

2. Non-water retaining structures: ASTM C920, Type S or M, Grade P or NS as applicable, Class 50, Use T, UV resistance.
 3. Backing material for sealant shall be a rod of diameter and composition recommended by the sealant manufacturer.
- C. Bonding Agent: Water-based epoxy modified, with integral corrosion inhibitor. Install according to the manufacturer's recommendations.
1. Sika Armatec 110 EpoCem; Sika Corporation.
 2. MasterEmaco P 124; Master Builders Solutions US LLC.
 3. Approved equal.
- D. Non-Shrink Grout:
1. General: Non-shrink grout for grouting of pump, motor, and equipment baseplates or bedplates, column baseplates, other miscellaneous baseplates, piping block outs and other uses of grout. Grout shall meet the following requirements, as verified by independent laboratory tests:
 - a. No shrinkage from the time of placement, or expansion after set, under ASTM C827 and CRD C621 83 (Corps of Engineers). When non-shrink grouts are tested under CRD C621 83, the grout shall be tested in a fluid state. A fluid state shall be defined as flowing through a flow cone at a rate of 20 seconds, plus or minus 5 seconds.
 - b. An initial set time of not less than 45 minutes under ASTM C191.
 2. Non-Shrink Non-Metallic Grout: Pre-mixed, non-staining, non-shrink grout; minimum 28-day compressive strength of 5000 psi.
 - a. Do not use for vibrating equipment.
 - b. Products:
 - 1). MasterFlow 100; Master Builders Solutions US LLC.
 - 2). Five Star Grout; Five Star Products, Inc.
 - 3). SikaGrout 212; Sika Corporation.
 3. Non-Shrink Epoxy Structural Grouts: Furnished in two components from the factory and mixed on the Site; conforming to ASTM C579, ASTM C580, and ASTM C827; chemical resistant, water resistant and a minimum 7-day compressive strength of 12,000 psi.
 - a. Use for vibrating equipment.
 - b. Products:
 - 1). Sikadur 42, Grout-Pak; Sika Corporation.
 - 2). Five Star HP Epoxy Grout; Five Star Products, Inc.
 - 3). MasterFlow 648; Master Builders Solutions US LLC.
- E. Normal Shrinkage Grout: 1 part Portland cement, Type I or I/II, to 3 parts of clean, first quality sand; proportioning on a volumetric basis; used for non-structural applications for grouting areas as shown on the Drawings which do not require non-shrink grout.

- F. Foundation Waterproofing: Foundation coating shall be used only on the exterior of concrete walls not exposed to view where indicated on the Drawings.
 - 1. MasterSeal 581 (Thoroseal); Master Builders Solutions US LLC.
 - 2. TREMproof 250GC; Tremco Commercial Sealants and Waterproofing.
 - 3. Approved equal.
- G. Zinc Rich Primer: Aluminum surfaces which contact or are embedded in concrete shall be coated with zinc rich primer. Primer shall be:
 - 1. Tneme-Zinc; Tnemec Company, Inc.
 - 2. MasterProtect P 8100AP; Master Builders Solutions US LLC.
 - 3. Approved equal.
- H. Reglets: Fabricate reglets of not less than 0.0217-inch thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- I. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336-inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.09 REPAIR MATERIALS

- A. Structural Concrete Repair Material: Low-shrink, non-slump, non-metallic, quick setting patching mortar; as approved by the manufacturer for each application and applied accordance with the manufacturer's recommendations.
 - 1. Products:
 - a. Five Star Structural Concrete; Five Star Products, Inc.
 - b. SikaTop 123; Sika Corporation.
 - c. SikaTop 122; Sika Corporation.
 - d. MasterEmaco N 425; Master Builders Solutions US LLC.
 - e. Approved equal.

2.10 CONCRETE MIXTURES

- A. Design Criteria:
 - 1. Provide a mix design for each concrete application indicated. This may necessitate multiple mix designs for each class of concrete depending on HRWR, entrained air, and other requirements.
 - 2. All Concrete shall be normal weight concrete composed of Portland cement, fine aggregate, coarse aggregate, admixtures, and water, as specified.
 - 3. ACI 211.1 shall be the basis for selecting the proportions for concrete made with aggregates of normal and high density and of workability suitable for usual cast in place structures.

4. The workability of any mix shall be as required for the specific placing conditions and the method of placement. The concrete shall have the ability to be worked readily into corners and around reinforcing steel without the segregation of materials or the collection of free water on the surface. Compliance with specified slump limitations shall not necessarily designate a satisfactory mix.
5. In no case shall the amount of coarse material produce harshness in placing or honeycombing in the structure, when forms are removed. The maximum amount of coarse aggregate (dry loose volume) per cubic foot of finished concrete shall not exceed 0.82 cubic feet.
6. In calculating water-cement ratio: The water content shall include the amount of water batched or to be added later, plus the free water in the aggregate, and minus the water content at SSD conditions.
7. No allowance shall be made for the evaporation of water after batching. If additional water is required to obtain the desired slump, a compensating amount of cement shall also be added. In no case shall the maximum water cement ratio exceed the specified maximum or that of the approved mix design.
8. Air Entrainment: Provide the percent air entrainment in each concrete mix design as recommended by ACI 318:
 - a. Exposure Class: F1, unless otherwise specified/restricted:
 - 1). Do not provide air-entrainment in drilled shafts unless placed underwater.
 - 2). Do not provide air-entrainment and entrapped air shall not exceed 3 percent for the following applications:
 - a). Interior slabs.
 - b). Slabs on composite metal decks.
9. Maximum water-soluble chloride ion content in concrete, by percent weight of concrete, shall not exceed ACI 318 Exposure Class C1.
10. When job conditions dictate, water-reducing and set-controlling admixtures may be used. Only specified admixtures shall be used. Admixtures shall be batched at the batch plant.
11. High Range Water Reducer (HRWR): Provide HRWR in mix designs for the following specified applications:
 - a. Drilled shafts, footings, walls, columns, and beams.
 - b. Interior of building curbs which are not cast monolithically with slabs.
 - c. Exception: Do not provide HRWR in slabs and pavement (a water reducer is permitted provided performance requirements are met).
12. If fly ash is to be used in place of cement, no more than 25 percent of the cement may be replaced.
13. Concrete shall be capable of developing two-thirds of the required 28-day compressive strength in 7 days.

14. Shrinkage Limits: All concrete used in the following structures shall have a shrinkage limit of 0.04 percent at 28 days in accordance with ASTM C157:

- a. Generator Building

B. Concrete Classifications:

Class	Min. 28-Day Compressive Strength (psi)	Max. Size Aggregate (inches)	Max. Water: Cementitious Materials Ratio	Slump +/- 1 (inches)	Min. Sacks of Cement Per Cubic Yard **
A	4000	1.5 Size No. 467	0.45	3 (8*)	5.75
B	3000	1.5 Size No. 467	0.47	3	5.75
C	4000	1.0 Size No. 57	0.45	4 (8*)	5.75
D	5000	0.75 Size No. 67	0.47	4	6.00
E	1500	1.5 Size No. 467	0.70	4	4.00
F	4000	0.375 Size No. 8	0.47	3	6.50

* Slump shown is with HRWR
 ** Provide one additional sack of cement per cubic yard if concrete must be deposited in standing water.

C. Concrete Usage:

Class	Usage
Class A Use	Footings and slabs, and other unless noted otherwise
Class B Use	Pavement, gutters, sidewalks
Class C Use	Walls, columns, beams, drilled shafts
Class D Use	Precast concrete and precast panels
Class E Use	Cradling, blocking, mud slab, lean concrete backfill
Class F Use	Stair pans and landings, interior building curbs

D. Required Average Compressive Strength:

1. All concrete is required to have an average compressive strength greater than the specified strength. The required average compressive strength shall be established according to the requirements of ACI 301.
2. Standard Deviation: Calculate a standard deviation and establish the required average compressive strength (f_{cr}') in accordance with ACI 301. If field test records are not available, select the required average strength from ACI 301.

- E. Documentation of Required Average Compressive Strength:
1. Documentation indicating the proposed concrete proportions will produce an average compressive strength equal to or greater than f_{cr}' . Documentation shall consist of field strength records or trial mixture.
 2. Field Strength Test Records: Document field strength test records according to ACI 301, which is partially restated here:
 - a. If field test data are available and represent a single group of at least 10 consecutive strength tests for one mixture, using the same materials, under the same conditions, and encompassing a period of not less than 45 days, verify that the average of the field test results equals or exceeds f_{cr}' .
 - b. If the field test data represent two groups of strength tests for two mixtures, plot the average strength of each group versus the water-cementitious materials ratio of the corresponding mixture proportions and interpolate between them to establish the required mixture proportions for f_{cr}' .
 3. Trial Mixtures:
 - a. Establish trial mixture proportions according to ACI 301, which is partially restated here:
 - 1). Make at least three trial mixtures complying with performance and design requirements. Each trial mixture shall have a different cementitious material content. Select water-cementitious materials ratios that will produce a range of compressive strengths encompassing f_{cr}' .
 - 2). Submit a plot of a curve showing the relationship between water-cementitious materials ratio and compressive strength.
 - 3). Establish mixture proportions so that the maximum water-cementitious materials ratio is not exceeded when the slump is at the maximum specified.
 - b. Trial mixtures shall be designed, sampled, and tested by an independent testing laboratory, retained and paid by the Contractor and approved by the Owner.
 - c. Provide 7-day and 28-day strengths test results.
 4. Revisions to concrete mixtures:
 - a. When less than 15 compressive strength tests results for a given class of concrete are available from the current Project:
 - 1). If any of the following criteria are met, take immediate steps to increase average compressive strength of the concrete.
 - a). A 7-day compressive strength test result multiplied by 1.5 falls below the required 28-day compressive strength.
 - b). A 28-day compressive strength test result is deemed not satisfactory.
 - b. When at least 15 compressive strength test results for a given class of concrete become available from the current Project:
 - 1). Calculate the actual average compressive strength, standard deviation and required average compressive strength using the previous 15 consecutive

strength tests. Submit results in graphical form with each 28-day test result for that class of concrete.

- 2). If any of the following criteria are met, take immediate steps to increase average compressive strength of the concrete.
 - a). A 7-day compressive strength test result multiplied by the average job-to-date ratio of 7-day to 28-day compressive strength falls below the required 28-day compressive strength.
 - b). A 28-day compressive strength test result is deemed not satisfactory.
 - c). The average compressive strength falls below the required average compressive strength.
- c. When revisions to the mix design are required, notify the Engineer in writing of the corrective actions taken.

2.11 OFF-SITE BATCH PLANT

- A. Batch plants shall be an established concrete batching facility meeting the requirements of the Concrete Plant Standards of the Concrete Plant Manufacturers Bureau.

2.12 CONCRETE MIXING

- A. Mixers may be stationary, truck, or paving mixers of approved design. They shall be capable of combining the materials into a uniform mixture and of discharging without mixture segregation. Stationary and paving mixers shall be provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. The mixers or mixing plant shall include a device for automatically counting the total number of batches of concrete mixed. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer on the name plate.
- B. The mixing time for stationary mixers shall be based upon the mixer's ability to produce uniform concrete throughout the batch and from batch to batch. For guidance purposes, the manufacturer's recommendations, or 1 minute for 1 cubic yard plus 1/4 minute for each additional cubic yard may be used. Final mixing time shall be based on mixer performance. Mixers shall not be charged in excess of the capacity specified by the manufacturer.
- C. When a stationary mixer is used for partial mixing of the concrete (shrink mixed), the stationary mixing time may be reduced to the minimum necessary to intermingle the ingredients (about 30 seconds).
- D. When a truck mixer is used, either for complete mixing (transit-mixed) or to finish the partial mixing in a stationary mixer and in the absence of uniformity test data, each batch of concrete shall be mixed not less than 70 nor more than 100 revolutions of the drum, at the rate of rotation designated by the manufacturer of the equipment as mixing speed. If the batch is at least 1/2 cubic yard less than the rated capacity, in the absence of uniformity test data, the number of revolutions at mixing speed may be reduced to no less than 50. Additional mixing shall be performed at the speed designated by the manufacturer of the equipment as agitating speed. When necessary for proper control of the concrete, mixing of transit-mixed concrete shall not be permitted until the truck mixer is at the Site of the concrete placement. Truck mixers shall be equipped with accurate revolution counters.

- E. Paving mixers may be either single compartment drum or multiple compartment drum type. A sled or box of suitable size shall be attached to the mixer under the bucket to catch any concrete spillage that may occur when the mixer is discharging concrete into the bucket. Multiple compartment drum paving mixers shall be properly synchronized. The mixing time shall be determined by time required to transfer the concrete between compartments of the drum.
- F. Vehicles used in transporting materials from the batching plant to the paving mixers shall have bodies or compartments of adequate capacity to carry the materials and to deliver each batch, separated and intact, to the mixer. Cement shall be transported from the batching plant to the mixers in separate compartments which are equipped with windproof and rain proof covers.

3.00 EXECUTION

3.01 PREPARATION

- A. Notify the Owner's representative upon completion of various portions of the work required for placing concrete, so that inspection may be made as early as possible. Keep the Owner's representative informed of the anticipated concrete placing schedules.
- B. All items, including lines and grades, forms, waterstops, reinforcing, inserts, piping, electrical, plumbing and the Contractor's concreting materials and equipment shall be in compliance with the Contract Documents before proceeding.
- C. Do not place any concrete until formwork and the placing reinforcement in that unit is complete. Place no concrete before the completion of all adjacent operations which might prove detrimental to the concrete.
- D. Brilliantly light the Site so that all operations are plainly visible when concrete mixing, placing, and finishing, continues after daylight. Whenever possible, concrete finishing shall be completed in daylight hours.
- E. When placing concrete, the forms shall be clean and entirely free from all chips, dirt, sawdust and other extraneous matter. Forms for slab, beam and girder construction shall not have tie wire cuttings, nails, or any other matter which would mar the appearance of the finished construction. Clean forms and keep them free of any foreign matter during concrete placing.
- F. The concrete shall be mixed in quantities required for immediate use. Any concrete which is not in place within the time limits specified shall not be used. Concrete shall not be re-tempered.
- G. Concrete shall not be placed if impending weather conditions would impair the quality of the finished Work.
- H. Unless otherwise provided, the following requirements shall govern the time sequence on which construction operations shall be carried.
 - 1. Forms for walls or columns shall not be erected on concrete footings until the concrete in the footing has cured for at least 2 curing days. Concrete may be placed in a wall or column as soon as the forms and reinforcing steel placements are approved.

2. Steel beams or forms and falsework for superstructures shall not be erected on ground-supported concrete substructures until the substructure concrete has cured for at least 4 curing days.
3. Falsework required for superstructures shall not be erected until the substructure has cured for 4 curing days, and shall not be removed until allowed for by Section 03 11 00 "Concrete Forming."

3.02 EMBEDDED ITEMS

- A. Where aluminum anchors, aluminum shapes, or aluminum electrical conduits are embedded in concrete, paint aluminum contact surfaces with zinc rich primer. Allow the paint to thoroughly dry before placing the aluminum in contact with the concrete.
- B. Paint steel or other ferrous metal to be mounted on or placed in contact with dry/cured concrete, and coat in accordance with Section 09 96 00.01 "High-Performance Coatings" prior to installation.
- C. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 1. Install anchor bolts, accurately located, to elevations required.
 2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 3. Install dovetail anchor slots in concrete structures as indicated.

3.03 VAPOR RETARDERS

- A. Place, protect, and repair vapor-retarder sheets according to ASTM E1643 and manufacturer's written instructions. At a minimum, provide the following:
 1. Lap sheets not less than 6 inches at all joints. Use pressure-sensitive tape at all laps. Lap reinforcement directly over film before placing concrete, taking precautions to prevent punctures.
 2. Carefully cut film around pipes and wiring outlets. Install reinforcing sheets and apply pressure sensitive tape around penetrations as recommended by the manufacturer.
 3. Terminate vapor barrier as indicated on the Drawings.
- B. Granular fill below vapor retarder sheet shall be smoothed and free of protrusions that might damage or rupture the sheet.
- C. Completely cover subgrade with the vapor retarder sheet as indicated on the Drawings.

3.04 JOINTS

- A. Expansion Joints and Devices:
 1. Workmanship: Exercise careful workmanship in joint construction to separate the concrete sections by an open joint or by the joint materials, and make the joints true to the outline indicated.

2. Expansion Joints: Construct expansion joints and devices to provide expansion and contraction. Construct joints which are to be left open or filled with poured joint material with forms which are adaptable for loosening or early removal. In order to avoid jamming by the expansion action of the concrete and the consequent likelihood of injuring adjacent concrete, remove or loosen these forms as soon as possible after the concrete has initially set. Make provisions for loosening the forms to permit free concrete expansion without requiring full removal.
 3. Armored Joints: Carefully construct armored joints to avoid defective anchorage of the steel and porous or honeycombed concrete adjacent to same. Anchor pre-molded materials to the concrete on one side of the joint with approved adhesive. Anchor so that the material does not fall out of the joint.
- B. Construction Joints:
1. Construction joints are formed by placing plastic concrete in direct contact with concrete which has attained its initial set. When concrete is specified as monolithic, the term shall be interpreted as the manner and sequence of concrete placement so that construction joints do not occur.
 2. Additional horizontal and vertical construction joints, when submitted and approved by the Engineer, may have an impact on reinforcing details. Revise reinforcing details to reflect additional joints.
 3. Unless otherwise provided, construction joints shall be square and normal to the forms. Provide bulkheads in the forms for all joints except horizontal joints.
 4. Clean horizontal construction joints for receiving the succeeding lift using air water cutting. The surface shall be exposed sound, clean aggregate with a 1/4 inch amplitude. After cutting, wash the surface until there is no trace of cloudiness in the wash water.
 5. In areas where air water cutting cannot be satisfactorily accomplished, or in areas where it is undesirable to disturb the surface of the concrete before it has hardened, prepare the surface for receiving the next lift by wet sand blasting to immediately remove all laitance and unsound concrete prior to placing of the next lift. Thoroughly wash the surface of the concrete after sand blasting to remove all loose material.
 6. Provide construction joints with concrete keyways, reinforcing steel dowels, and waterstops where indicated on the Drawings. The method of forming keys in keyed joints shall permit the easy removal of forms without chipping, breaking, or damaging the concrete.
 7. Construction joint layout unless otherwise indicated on the Drawings:
 - a. Maximum horizontal spacing of construction joints shall be 45 feet.
 - b. Maximum vertical spacing of construction joints shall be 15 feet.
- C. Control Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-

fourth of concrete thickness, spaced as indicated on the Drawings or at not more than 15 feet on center, and as follows:

1. **Tooled Joints:** Form control joints after initial floating by tooling/grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 2. **Sawed Joints:** Form control joints with early entry dry-cut power saws within 2 hours of finishing operations. Cut 1/8-inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. **Dowel Joints:** Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- E. **Hardened Concrete:** Where new concrete or grout is to be placed in contact with existing or recently hardened concrete, texture the existing or recently hardened surface by chipping or other means so that an irregular surface having a height variance of not less than 1/4 inch is created. The existing or recently hardened concrete shall then be coated with a bonding agent and new concrete or grout placed.

3.05 WATERSTOPS

- A. **Non-Self-Expanding Strip Waterstops:**
1. Install in construction joints and at other locations indicated, according to manufacturer's written instructions, bonding or mechanically fastening and firmly pressing into place.
 - a. Waterstop shall be bonded to the substrate using a continuous bead of swelling sealant or adhesive as recommended by the manufacturer.
 - 1). ADEKA Ultra Seal P-201.
 - 2). Sika Lockstop or approved equal.
 2. Install in longest lengths practicable.
 3. Protect from moisture, oil, dirt, and sunlight prior to the placement of concrete. Coordinate with manufacturer for additional requirements.

3.06 CONCRETE PLACEMENT

- A. **Cold Weather:**
1. If air temperature has fallen to, or is expected to fall below 40 F during the protection period (a minimum of 48 hours but not less than that required by ACI 306.1), then cold weather concreting shall be performed in accordance with ACI 306.1.
 2. In cases where the temperature drops below 40 F after the concreting operations have been started, sufficient canvas and framework or other type of housing shall be furnished to enclose and protect the structure, in accordance with the requirements of ACI 306.1. Sufficient heating apparatus to provide heat shall be supplied, and heating

source and protection from combustion gas shall be in accordance with ACI 306.1. The concrete shall be protected when placed under all weather conditions. Should concrete placed under such conditions prove unsatisfactory, remove and replace the concrete at no cost to the Owner.

3. When the air temperature is above 30 F:
 - a. The minimum concrete temperature at the time of mixing shall be 60 F unless other requirements of ACI 306.1 are met, which may allow for a lower mix temperature.
 - b. The minimum concrete temperature at the time of placement and during the protection period shall be 55 F unless other requirements of ACI 306.1 are met, which may allow for a lower temperature.
4. The means used to heat a concrete mix shall be in accordance with ACI 306.1.
5. Salts, chemicals, or other foreign materials shall not be mixed with the concrete to preventing freezing. Calcium chloride is not permitted.

B. Hot Weather:

1. Hot weather is defined as any combination of high air temperature, low relative humidity, and wind velocity that impairs the quality of the concrete. Hot weather concreting shall be in accordance with ACI 305.1. Concrete shall be placed in the forms without the addition of any more water than that required by the design (slump). No excess water shall be added on the concrete surface for finishing. Control of initial set of the concrete and extending the time for finishing operations may be accomplished with the use of approved water reducing and set retarding admixture, as specified.
2. Maximum time intervals between the addition of mixing water and/or cement to the batch, and the placing of concrete in the forms shall not exceed the following (excluding HRWR admixture use):

Concrete Temperature	Maximum Time from Water Batch to Placement
Non-Agitated Concrete	
Up to 80 F	30 Minutes
Over 80 F	15 Minutes
Agitated Concrete	
Up to 75 F	90 Minutes
75 F to 89 F	60 Minutes

- a. The use of an approved set-retarding admixture will permit the extension of the above time maximums by 30 minutes, for agitated concrete only.
- b. The use of an approved high range water reducing (HRWR) or hydration-controlling admixture will allow placement time extensions as determined by the manufacturer.
3. The maximum temperature of fresh concrete at time of discharge shall not exceed 95 F. The temperatures of the mixing water shall be reduced by the use of chilled water or ice.

4. The maximum temperature of fresh concrete with high range water reducing admixture shall not exceed 100 F at time of discharge.
 5. Under extreme heat, wind, or humidity conditions, concreting operations may be suspended if the quality of the concrete being placed is not acceptable.
- C. Handling and Transporting:
1. Delivery tickets shall be required for each batch and shall be in accordance with ASTM C94. Each delivery ticket must show plainly the amount of water, in gallons that can be added to the mixer truck at the Site without exceeding the maximum water cement ratio approved for that mix design. Amount of water added must be in proportion to contents of truck.
 2. Arrange and use chutes, troughs, or pipes as aids in placing concrete so that the ingredients of the concrete are not segregated. They shall be steel or steel lined. When steep slopes are necessary, equip the chutes with baffles or make in short lengths that reverse the direction of movement. Extend open troughs and chutes, if necessary, inside the forms or through holes left in the forms. Terminate the ends of these chutes in vertical downspouts.
 3. Keep chutes, troughs, and pipes clean and free from coatings of hardened concrete by thoroughly flushing with water before and after placement. Discharge water used for flushing away from the concrete in place.
 4. Use pumping equipment that has sufficient capacity so that:
 - a. Discharge of pump concrete does not result in segregation.
 - b. Modification of accepted concrete mixture is not required.
 5. Carting or wheeling concrete batches on completed concrete floor slab shall not be permitted until the slab has aged at least 4 curing days. Unless pneumatic tired carts are used, wheel the carts on timber planking so that the loads and impact are distributed over the slab. Curing operations shall not be interrupted for the purpose of wheeling concrete over finished slabs.
- D. Depositing:
1. The method and manner of placing shall prevent segregation or separation of the aggregate or the displacement of the reinforcement. Use drop chutes or tremies as necessary.
 2. Free Fall: Concrete shall not be allowed to free fall more than 10 feet when HRWR admixture is used or 5 feet without the use of HRWR. Free falling concrete shall avoid striking reinforcing during placement. Placement of concrete for heights exceeding the free fall limit shall be placed using a tremie.
 - a. Augured Cast-in-Place Shafts: Refer to Section 31 63 29 "Drilled Concrete Piers and Shafts."
 - b. Concrete shall not be allowed to free fall through water. Place as indicated below.
 3. Prevent the splattering of forms and reinforcing bars if the splattered concrete will dry or harden before incorporation into the mass.

4. Fill each part of the forms by directly depositing concrete as near its final position as possible. Work the concrete under and around the reinforcement bars. Depositing large quantities at one point in the forms, then running or working it along the forms shall not be permitted.
 - a. Place required sections in one continuous operation to avoid additional cold joints. Each layer shall be fluid and concrete shall not have taken initial set when a new layer is placed upon it. Not more than 1 hour shall elapse between the placing of successive concrete layers in any portion of the structures included in continuous placement.
 5. Place in continuous horizontal layers with a depth of from 1 to 3 feet. If excessive bleeding causes water to form on the surface of the concrete in tall forms, revise mix design to reduce the bleeding.
 6. In tall walls, place the concrete to a point about 1 foot below the top of the wall and allow to settle for 1 hour. Resume and complete concreting before set occurs.
 7. For slopes greater than 2 percent, start concrete placement at low end and proceed upslope.
 8. After the concrete has taken initial set, the forms shall not be jarred. No force or load shall be placed upon projecting reinforcement.
- E. Consolidating:
1. Compact each layer of concrete and flush the mortar to the surface of the forms by continuous-working mechanical vibrators. Apply the vibrator to the concrete immediately after deposit. Move vibrator throughout the layer of the newly placed concrete, several inches into the plastic layer below. Thoroughly work the concrete around the reinforcement, embedded fixtures and into the corners and angles of the forms until it is well-compacted.
 2. Mechanical vibrators shall not be operated so that they penetrate or disturb previously placed layers which are partially set or hardened. They shall not be used to aid the flow of concrete laterally. The vibration shall be of sufficient duration to completely compact and embed reinforcement and fixtures, but not to an extent causing segregation.
 3. Keep vibrators constantly moving in the concrete and apply vertically at points uniformly spaced, not farther apart than the radius over which the vibrator is visibly effective. The vibrator shall not be held in one location longer than required to produce a liquified appearance on the surface.
 4. When submerged in concrete, internal vibrators shall maintain a frequency of not less than 6000 impulses per minute for heads with diameters greater than 5 inches and 10,000 impulses for smaller vibrator heads. The vibration intensity (amplitude) shall be sufficient to produce satisfactory consolidation.
 - a. Vibrator head shall be sufficiently small to allow placement between reinforcing steel.
 - b. Provide at least one standby vibrator.
 - c. Check vibrators intended for regular service or standby service prior to concreting operations.

F. Placement in Water:

1. Deposit concrete in water only when dry conditions cannot be obtained. The forms, cofferdams, or caissons shall be sufficiently tight to prevent any water flowing through the space where concrete is to be deposited. Pumping of water shall not be permitted while the concrete is being placed, nor until it has set for at least 36 hours.
2. Carefully place the concrete using a tremie, closed bottom dumping bucket, or another approved method which does not permit the concrete to fall through the water without protection. The concrete shall not be disturbed after being deposited. Regulate depositing to maintain horizontal surfaces.
3. When a tremie is used, it shall consist of a tube constructed in sections having water-tight connections. The means of supporting the tremie shall permit the movement of the discharge end over the entire top surface of the work, and shall allow the tremie to be rapidly lowered to retard the flow. The number of times it is necessary to shift the location of the tremie shall be held to a minimum for any continuous placement of concrete. During the placing of concrete, keep the tremie tube full to the bottom of the hopper. When a batch is dumped into the hopper, slightly raise the tremie, but not out of the concrete at the bottom, until the batch discharges to the level of the bottom of the hopper. Stop the flow by lowering the tremie. Continue placing operations until the work is completed.
4. When concrete is placed by means of the bottom dump bucket, the bucket shall have a capacity of not less than 1/2 cubic yard. Lower the bucket gradually and carefully until it rests upon the concrete already placed. Raise it very slowly during the discharge travel to maintain still water at the point of discharge and to avoid agitating the mixture.
5. Use a sump or other approved method to channel displaced fluid and concrete away from the shaft excavation. Recover slurry and dispose of it as approved. Do not discharge displaced fluids into or in close proximity to streams or other bodies of water.

G. Placement in Slabs:

1. Allow concrete in columns, walls and deep beams or girders to stand for at least 1 hour to permit full settlement from consolidation, before concrete is placed for slabs they are to support. Haunches are considered as part of the slab and shall be placed integrally with them.
2. When monolithic slabs are placed in strips, the widths of the strips, unless otherwise specified or indicated, shall insure that concrete in any one strip is not allowed to lie in place for more than 1 hour before the adjacent strips are placed.
3. Immediately before placing concrete, thoroughly dampen the subgrade to receive concrete to prevent moisture absorption from the concrete.
4. As soon as concrete placing is complete for a slab section of sufficient width to permit finishing operations, level the concrete, strike off, tamp and screed. The screed shall be of a design adaptable to the use intended, shall have provision for vertical adjustment and shall be sufficiently rigid to hold true to shape during use.
5. The initial strike off shall leave the concrete surface at an elevation slightly above grade so that, when consolidation and finishing operations are completed, the surface of the slab is at grade elevation.

6. Continue tamping and screeding operations until the concrete is properly consolidated and free of surface voids. Bring the surface to a smooth, true alignment using longitudinal screeding, floating, belting, and/or other methods.
 7. When used, templates shall be of a design which permits early removal so satisfactory finishing at and adjacent to the template is achieved.
 8. While the concrete is still plastic, straighten the surface as required to achieve specified flatness requirements. Remove high spots and fill depressions with fresh concrete and re-float. Continue to check during the final finishing operation, until the surface is true to grade and free of depressions, high spots, voids, or rough spots.
 9. Where floor drains are shown in slabs and sloping the slab is not indicated, slope slab to drain on a grade of 1/16 inch per foot. The thickness of slab at floor drain shall be the thickness of slab as indicated on the Drawings.
- H. Placement in Foundations: Place concrete in deep foundations so that segregation of the aggregates or displacement of the reinforcement is avoided. Provide suitable chutes or vertical pipes. When footings can be placed in dry foundation pits without the use of cofferdams or caissons, forms may be omitted and the entire excavation filled with concrete to the elevation of the top of footing. The placing of concrete bases above mud slab is permitted after the forms are free from water and the seal course cleaned. Execute necessary pumping or bailing during concreting from a suitable sump located outside the forms.
- I. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on the Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.

3.07 FINISHING FORMED SURFACES

- A. Forms for walls, columns, and sides of beams and girders shall be removed as specified in Section 03 11 00 "Concrete Forming." Patch, repair, finish, and clean concrete after form removal. Finish concrete not more than 7 days after form removal. Cure concrete as finishing progresses.
- B. Air voids, for all types of finishes, are defects and shall be removed by rubbing or patching.
- C. Finish Schedule:

Type of Finish	Location
No Finish	Surfaces which are not visible from the inside or outside of the completed structure, are more than 12" below finish grade, and where a coating/membrane/drainage board will not be installed
Rough Finish	<u>Describe each location</u>
Smooth Finish	Surfaces exposed to view, areas below to a point 12" below grade, and where a coating/membrane/drainage board will be installed.

Type of Finish	Location
Smooth Rubbed Finish	<u>Describe each location (typically where aesthetics are a concern)</u>

- D. No Finish: Patch tie holes. Repair defects larger than 1-1/2 inches in diameter or 1/2 inch in deep. Remove projections larger than 1 inch.
- E. Smooth Finish: The form facing material shall produce a smooth, uniform texture on the concrete. Patch tie holes. Repair defects larger than 3/4 inch wide or 1/2 inch deep. Remove projections flush with the adjacent surface.
- F. Smooth Rubbed Finish:
 - 1. Surfaces to receive a rubbed finish shall meet smooth finish requirements in addition to those indicated here.
 - 2. Rub surfaces with fluted carborundum stone rubbing at the proper time in the concrete aging process after forms are removed. Rubbing shall remove form marks and surface imperfections, and produce a smooth uniform finish appearance and texture.
 - a. Wet surfaces requiring surface finish and rub surface with a carborundum brick or an abrasive of equal quality. Bring the surface to a paste, to remove all form marks and projections, and to produce a smooth dense surface without pits or irregularities.
 - b. Carefully spread or uniformly brush the material ground to a paste over the surface and allow to take a reset. The use of cement or plaster to form a surface shall not be permitted.

3.08 FINISHING FLOORS AND SLABS

- A. General: Screed, restraigten, and finish concrete surfaces. Do not wet concrete surfaces.
- B. Finish slabs, platforms, and steps monolithically and apply as indicated on the Drawings and the following schedule of finishes:

Type of Finish	Location
Rough Finish	Tank floors that receive grout topping and slabs which receive additional concrete toppings.
Float Finish	Top of walls, vault top slabs not subject to pedestrian foot traffic.
Trowel Finish	Interior slab surfaces exposed to view or to be covered with resilient flooring, carpet, and ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.
Broom Finish	Exterior concrete platforms, steps, and ramps.

- 1. Rough Finish: Provide a rough surface by screeding only without further finish.
- 2. Float Finish: Finish surfaces using a float to a true, even plane with no coarse aggregate visible. In the initial floating, while the concrete is plastic, use sufficient pressure on the float to bring excess moisture to the surface for removal. Apply a final "light float" finish to the surface as the concrete hardens. The surface shall have a uniform granular texture and shall meet the straightness requirements.

3. Trowel Finish:
 - a. After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - b. Finish and measure surface so gap at any point between concrete surface and an unlevelled freestanding 10-foot long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed the following:
 - 1). 1/8 inch.
4. Broom Finish: Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with the Engineer before application.
- C. Give sidewalks a brush finish, unless noted otherwise. Score sidewalks at a spacing equal to the width of the walk and edge on each side using a tool with a radius of approximately 1/4 inch.
- D. Finishing in Hot, Dry Weather: During periods of high temperature and/or low humidity, take extreme care in finishing the slabs to eliminate initial shrinkage cracks. Following the initial set of concrete, but while the concrete is still "green" continue to finish as required to remove shrinkage cracks which may occur. In hot, dry weather, keep a cement finisher on the job following normal finishing operations for a sufficient length of time to insure the removal of initial shrinkage cracks.

3.09 MISCELLANEOUS CONCRETE ITEMS

- A. Normal Shrinkage Grouting:
 1. Prior to grout application, thoroughly clean the surface of all foreign matter. Roughen concrete surface to CSP 4 and wet as required for a saturate surface dry condition (SSD). Set forms in place; tight and securely anchored to prevent the loss of grout.
 2. The necessary materials and tools shall be on hand before starting grouting operations.
 3. After preparing surface and immediately prior to grouting, provide scrub coat of grout material. Do not allow scrub coat to dry prior to placing grout.
 4. After mixing, quickly and continuously place the grout to avoid overworking, segregation and breaking down of the initial set. Mix and place the grout where indicated on the Drawings. Cure grout using wet curing method for concrete. Grout shall receive a trowel finish, unless otherwise noted.
- B. Non-Shrink Grout:
 1. Obtain field technical assistance from the grout manufacturer, as required, to ensure that grout mixing and installation comply with the manufacturer's recommendations and procedures.
 2. Roughen concrete surface as required by the manufacturer, but not less than CSP 4. Saturate the surface to achieve an SSD condition. Baseplates shall be free of oil, grease, laitance and other foreign substances.

- a. Epoxy Grout: Surface shall be dry as recommended by the manufacturer.
3. Place grout according to the manufacturer's directions so that spaces and cavities below the bottom of the baseplates are completely filled. Provide forms where structural components of the baseplates do not confine the grout. Trowel finish the non-shrink grout where the edge of the grout is exposed to view and after the grout has reached its initial set. Cut off the exposed edges of the grout at a 45-degree angle to the baseplate, bedplate, member, or piece of equipment.
4. Wet cure a minimum of 3 days, but not less than that recommended by the manufacturer.
 - a. Epoxy Grout: Dry curing is acceptable if recommended by the manufacturer.
5. Use epoxy non-shrink grout under all machinery, pumps, equipment, and where chemicals are present that would abate cementitious non-shrink grouts.
- C. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.10 CONCRETE CURING AND PROTECTION

- A. General: Begin curing of concrete immediately after completion of finishing activities for unformed concrete and immediately after removal of forms from formed concrete. Apply curing method without staining, marring, or damaging concrete surfaces. Where pedestrian traffic is unavoidable, provide suitable walkways to protect the curing material and the concrete surface from damage. Unless a particular curing method is specified, select the appropriate curing method from the curing options indicated.
- B. Length of Curing Period:
 1. Curing Day: A day on which the ambient temperature is above 50 deg. F for at least 18 hours.
 2. Curing Period: 7 consecutive curing days.
 3. Extended Curing Period: When curing day requirements are not met, then extend the curing period by one day for each day not in compliance. Extend curing up a maximum total of 14 consecutive days.
- C. Wet Curing with Absorbent Material:
 1. Cover concrete surfaces with absorbent material and hold it in contact with concrete surface. Provide a minimum 8-inch lap of adjacent material section edges.
 2. Apply water to absorbent material and saturate. Maintain saturated condition for curing period – do not allow absorbent material to dry.
 3. Do not use wet curing if curing water will be subject to freezing during the curing period.
- D. Sheet Curing: Cover concrete surfaces with sheets and hold in contact with concrete surface. Apply in accordance with manufacturer recommendations, which includes placement, patching holes, and tape joints per manufacturer recommendations.

- E. Membrane Curing:
 - 1. Cover the surface of the concrete with a continuous, uniform film. Application shall be in accordance with manufacturer recommendations. Prevent overspray as necessary to meet project requirements.
 - 2. Do not allow foot traffic on surface in accordance with manufacturer recommendations.
 - 3. Repair film if damaged within the curing period.
 - 4. Unless preapproved, do not use membrane curing on surfaces that:
 - a. Receive concrete topping, terrazzo, paint, floor hardener, or other finish.
 - b. Are specified to have a rubbed finish.
- F. Protection: During and after curing period, protect concrete surfaces from damage, marring, or staining by construction activities.

3.11 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- B. After the tie rods are broken back or removed, thoroughly clean the holes to remove grease and loose particles. Patch holes with structural concrete repair material or non-shrink grout. After the holes are completely filled, strike off flush excess mortar and finish the surface to render the filled hole inconspicuous.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. If the surface of the concrete is bulged, uneven, or shows honeycombing or form marks, which in the Engineer's opinion cannot be repaired satisfactorily, remove and replace the entire section.
 - 2. Patch honeycomb and minor defects in all concrete surfaces with structural concrete repair material. Cut back each defective area with a pneumatic chipping tool as deep as the defect extends, but in no case less than 1/2 inch. Prepare the existing concrete and apply repair material according to the manufacturer's recommendations. Finish the surface of the patches to match finish on surrounding concrete.
 - 3. Immediately after form removal, cut out honeycombs, rock pockets, and voids to expose solid concrete but not less than 1-inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with repair material before bonding agent has dried.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, pop outs, honeycombs, rock pockets, crazing and cracks in excess of 0.01-inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 5. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Engineer's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Engineer's approval.

3.12 FIELD QUALITY CONTROL

A. Testing:

1. General:

- a. Tests shall be required throughout the Work to monitor the quality of concrete. Samples shall be taken in accordance with ASTM C172.
- b. Engineer may waive these requirements on concrete placements of 10 cubic yards or less. However, evidence shall be furnished showing a design mix which meets the Specifications.
- c. Unless noted otherwise, testing of the materials, ready mix, transit mix, or central plant concrete will be by an independent testing agency. The independent testing agency will be approved by the Owner and paid by the Contractor. A summary of all tests performed will be available. No concrete shall be placed without a representative present at either the plant or at the Site.
- d. Unless the Owner's laboratory is on the Site, provide housing for the curing and storage of test specimens and equipment.

2. Slump Test: Slump tests, in accordance with ASTM C143, shall be used to indicate the workability and consistency of the concrete mix from batch to batch. Generally, a slump test shall be made at the start of operations each day, at regular intervals throughout a working day, and at any time when the appearance of the concrete suggests a change in uniformity.

3. Air Content Test: Tests for the concrete's air content shall be made in accordance with ASTM C231 or ASTM C173, at the point of delivery of concrete, prior to placing in forms. The test shall be made frequently to monitor a proper air content uniform from batch to batch.
4. Temperature Test: Test for the concrete's temperature in accordance with ASTM C1064 and as follows: the temperature of the concrete to be placed shall be taken with a thermometer immediately before placement, with the point of measurement being in the chute or bucket. Temperature test shall be performed for each truck. Record temperatures on batch ticket.
5. Compression Test:
 - a. Compression test specimens shall be 6-by-12-inch concrete cylinders made and cured in accordance with ASTM C31. If the maximum aggregate size is no larger than 1 inch, 4-by-8-inch concrete cylinders are acceptable. No fewer than two 6-by-12-inch or three 4-by-8-inch specimens shall be made for each test Sample. Samples shall be taken at a minimum of every 50 cubic yards of concrete for each class placed. At least one set of test specimens per day shall be made for each class of concrete used that day. Specimens shall be cured under laboratory conditions specified in ASTM C31. Additional concrete cylinders may be required for curing on the job under actual job curing conditions. These Samples could be required when:
 - 1). There is a possibility of the air temperature surrounding the concrete falling below 40 F, or rising above 90 F.
 - 2). The curing procedure may need to be improved and/or lengthened.
 - 3). It is necessary to determine when the structure may be put into service.
 - b. Compression strength tests shall be made on the laboratory-cured and job-cured concrete cylinders at 7 and 28 days, in accordance with ASTM C39. The value of each test result shall be the average compressive strength of all of the cylinders in the test Sample. All cylinders within a test Sample shall be taken at the same time from the same batch of concrete. For the 28-day cylinders, the strength level shall be satisfactory if the averages of all sets of three consecutive strength test results exceed the required design compressive strength, and no individual strength test result falls below the required compressive strength by more than 500 psi.
6. Chloride testing shall be in accordance with ASTM C1218.
7. Shrinkage testing shall be in accordance with ASTM C157.
8. Failure to Meet Requirements:
 - a. Should the 7-day strengths shown by the test specimens fall below the required values, additional curing shall be performed on those portions of the structures represented by the test specimens at the Contractor's expense. Test cores shall be obtained and tested in accordance with ASTM C42. If additional curing does not give the strength required, the Owner reserves the right to require strengthening, replacement of those substandard portions of the structure, or additional testing, at the Contractor's expense.

- b. Upon receipt of the Contractor's written request, substandard concrete work may be reexamined in place by nondestructive testing methods or core Samples, in accordance with ACI 301. The services of an independent testing laboratory shall be retained and all expenses paid without compensation from the Owner. Laboratory results shall be evaluated by the Engineer, who shall make the final decision on acceptability of the concrete in question. Core Sample holes shall be repaired.
 - c. Nondestructive Testing: : Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
 - d. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by Engineer.
- B. The Owner may withhold payment for any section of concrete which does not meet the requirements of the Specifications. Withheld payment shall be based upon the unit prices established for concrete and reinforcing steel. Payment shall be withheld until the unacceptable concrete has been refinished, removed and replaced or otherwise brought into conformance with the Specifications.
- C. PVC/TPER/PE Waterstops: Waterstops shall be observed by the Owner's representative prior to concrete placement. Unacceptable splicing defects include:
- 1. Misalignment of center bulb, ribs, and end bulbs greater than 1/16 inch.
 - 2. Bond failure at joint deeper than 1/16 inch.
 - 3. Misalignment which reduces waterstop cross-section more than 15 percent.
 - 4. Bubble or visible porosity in the weld.
 - 5. Visible signs of splice separation when a cooled splice is bent by hand at a sharp angle.
 - 6. Charred or burnt material.

END OF SECTION

Concrete Mix Design

Project Name: _____
 FNI Project Number: _____
 Project Location: _____
 Owner: _____
 General Contractor: _____
 Mix Number / Class: _____

A. Mix Design:

Cement = _____ lb/yd³
 Fly Ash = _____ lb/yd³
 Other Cementitious Material:
 _____ = _____ lb/yd³
 Fine Aggregate = _____ lb/yd³
 Coarse Aggregate = _____ lb/yd³
 Water = _____ lb/yd³
 Water Reducing Admixture = _____ oz/yd³
 High Range Water Reducer = _____ oz/yd³
 Air Entraining Admixture = _____ oz/yd³
 Other Admixture:
 _____ = _____ oz/yd³
 Slump = _____ inches
 Gross Weight = _____ lb/yd³
 Air Content = _____ percent
 Water/Cement Ratio = _____

B. Materials:

	Source	ASTM	Type	Remarks
Cement				
Fly Ash				
Other Cementitious Material: _____				
Fine Aggregate				
Coarse Aggregate				
Water				
Water Reducer				
High Range Water Reducer				
Air Entraining				

	Source	ASTM	Type	Remarks
Other Admixture: _____				

C. Determination of Average Strength Required (f_{cr}'):

1. Test Records Available:

A. Summary of Test Records (Provide Supporting Documentation):

Test Group No.	No. of Consecutive Tests	Specified Strength (psi)	Standard Deviation (psi)
Average Standard Deviation:			

B. Standard Deviation Modification Factor (ACI 30 1, Table 4.2.3.3.a): ____.

C. Standard Deviation Used: ____.

D. Average Compressive Strength Required: ____.

2. Test Records Not Available:

A. Average Compressive Strength Required (ACI 30 1, Table 4.2.3.3.b, if required): ____.

D. Documentation of Required Average Compressive Strength (Check One):

1. Field Strength:

a. Field Strength Test Records (ACI 30 1, Table 4.2.3.3.a): ____ . *Complete Attachment A.

2. Trial Mixtures:

a. Trial Mixtures (ACI 301, Table 4.2.3.3.b, if required): ____ . *Complete Attachment B.

I, _____ certify that the above information is correct and all gradations, cement certifications, and test results are located at our place of business for review by the Engineer.

Name: _____

Date: _____

Title: _____

Company: _____

Address: _____

Attachment A

Documentation of Required Average Strength – Field Strength Records

(ACI 301, 4.2.3.4.a)

A. Summary of Test Records (Provide Supporting Documentation):

Test Record No.	No. of Tests in Record	Duration of Record (days)	Water-Cementitious Materials Ratio	Average Strength (psi)

B. Interpolation used? _____.

1. Provide an interpolation calculation or plot of strength versus proportions.

C. Submit the following data for each mix:

1. Brand, type, and amount of cement.
2. Brand, type, and amount of each admixture.
3. Source of each material used.
4. Amount of water.
5. Proportions of each aggregate material per cubic yard.
6. Gross weight per cubic yard.
7. Measured slump.
8. Measured air content.
9. Results of consecutive strength tests.

END OF ATTACHEMENT A

Attachment B

Documentation of Required Average Strength – Trial Mixtures

(ACI 301, 4.2.3.4.b)

A. Summary of Test Record(s):

Trial Mix No.	7-Day Tests		28-Day Tests		Water-Cementitious Materials Ratio	Slump (in)	Air Content (percent)	Temperature (F)
	No. of Test Cylinders	Strength (psi)	No. of Test Cylinders	Strength (psi)				

B. Maximum water-cementitious materials ratio _____.

1. Provide an interpolation calculation or plot of strength versus water-cementitious materials ratio.

C. Submit the following data for each mix:

1. Brand, type, and amount of cement.
2. Brand, type, and amount of each admixture.
3. Amount of water used in trial mixes.
4. Proportions of each aggregate material per cubic yard.
5. Gross weight per cubic yard.
6. Measured slump.
7. Measured air content.
8. Compressive strength developed at 7 days and 28 days, from not less than three test cylinders cast for each 7-day and 28-day test.

END OF ATTACHMENT B

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03 41 00 PLANT PRECAST STRUCTURAL CONCRETE

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes plant-precast structural concrete units, including the following:
 - 1. Hollow-core slab units.
- B. Related Sections include the following:

1.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide precast structural concrete units and connections capable of withstanding design loads within limits and under conditions indicated.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixes: For each concrete mix.
- C. Shop Drawings: Detail fabrication and installation of precast structural concrete units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, openings, and types of reinforcement, including special reinforcement.
 - 1. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, inserts, connections, and joints, including accessories.
 - 2. Indicate locations and details of anchorage devices to be embedded in other construction.
 - 3. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation.
- D. Welding Certificates: Copies of certificates for welding procedures and personnel.
- E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- F. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Concrete materials.
 - 2. Reinforcing materials and prestressing tendons.
 - 3. Admixtures.

4. Bearing pads.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed precast structural concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in manufacturing precast structural concrete units similar to those indicated for this Project and with a record of successful in-service performance.
 1. Assumes responsibility for engineering precast structural concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 2. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of precast structural concrete that are similar to those indicated for this Project in material, design, and extent.
 3. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group C, Category C2.
 4. Has sufficient production capacity to produce required units without delaying the Work.
- C. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1077 and ASTM E329 to conduct the testing indicated, as documented according to ASTM E548.
- D. Design Standards: Comply with ACI 318 (ACI 318M) and the design recommendations of PCI MNL 120, "PCI Design Handbook--Precast and Prestressed Concrete."
- E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and camber and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products."
- F. Product Options: Drawings indicate size, profiles, and dimensional requirements of precast concrete units and are based on the specific types of units indicated. Other fabricators' precast concrete units complying with requirements may be considered.
- G. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.4, "Structural Welding Code--Reinforcing Steel."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver precast structural concrete units to Project Site in such quantities and at such times to ensure continuity of installation. Store units at Project Site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.
- B. Lift and support units only at designated lifting and supporting points as shown on Shop Drawings.

1.07 SEQUENCING

- A. Furnish anchorage items to be embedded in other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

2.00 PRODUCTS

2.01 FABRICATORS

- A. Available Fabricators: Subject to compliance with requirements, fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Gate Precast

2.02 MOLD MATERIALS

- A. Molds: Provide molds and, where required, form-facing materials of metal, plastic, wood, or another material that is nonreactive with concrete and dimensionally stable to produce continuous and true precast concrete surfaces within fabrication tolerances and suitable for required finishes.

2.03 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Deformed-Steel Wire: ASTM A1064.
- D. Plain-Steel Welded Wire Fabric: ASTM A1064, fabricated from as-drawn steel wire into flat sheets.
- E. Supports: Manufacturer's bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place according to CRSI's "Manual of Standard Practice," PCI MNL 116, and as follows:

2.04 PRESTRESSING TENDONS

- A. Prestressing Strand: ASTM A416/A416M, Grade 250 or 270 (Grade 1725 or 1860), uncoated, seven-wire, low-relaxation strand.

2.05 CONCRETE MATERIALS

- A. Portland Cement; Provide one of the following
 - 1. ASTM C150, Type II or Type I/II, of same type, brand, and source.
 - 2. ASTM C595, Type IL blended hydraulic cement.
- B. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C33, with coarse aggregates complying with Class 4M.
- C. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.

- D. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
- E. Water-Reducing Admixture: ASTM C494, Type A.
- F. Retarding Admixture: ASTM C494, Type B.
- G. Water-Reducing and Retarding Admixture: ASTM C494, Type D.
- H. High-Range, Water-Reducing Admixture: ASTM C494, Type F.
- I. High-Range, Water-Reducing and Retarding Admixture: ASTM C494, Type G.
- J. Plasticizing Admixture: ASTM C1017.
- K. Fly Ash Admixture: ASTM C618, Class C or F.

2.06 BEARING PADS

- A. Provide bearing pads for precast structural concrete units as follows:
 - 1. High-Density Plastic: Multimonomer, nonleaching, plastic strip. Korolath or approved equal.

2.07 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C150, Type I, and clean, natural sand, ASTM C144. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

2.08 CONCRETE MIXES

- A. Prepare design mixes for each type of concrete required.
 - 1. Limit use of fly ash and silica fume to not exceed, in aggregate, 25 percent of Portland cement by weight.
- B. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.
- C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318 (ACI 318M).
- D. Normal-Weight Concrete: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.40.
- E. Other Admixtures: Use water-reducing, high-range water-reducing, water-reducing and accelerating, or water-reducing and retarding admixtures according to manufacturer's written instructions.
- F. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.09 FABRICATION

- A. Formwork: Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances.
 - 1. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial-formula, form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's written instructions.
 - 2. Unless forms for precast, prestressed concrete units are stripped before detensioning, design forms so stresses are not induced in precast concrete units because of deformation or movement of concrete during detensioning.
- B. Built-in Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect position of main reinforcement or concrete placement. Do not relocate bearing plates in units unless approved by Architect.
- C. Cast-in openings larger than 10 inches (250 mm) in diameter or 10 inches (250 mm) square according to Shop Drawings. Smaller holes may be field cut by trades requiring them, as approved by Architect.
- D. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
 - 2. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete-placement operations. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, and hangers, as required.
 - 3. Place reinforcement to obtain at least the minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
 - 4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.
 - 1. Delay detensioning until concrete has reached at least 70 percent of its compressive strength as established by test cylinders cured under the same conditions as concrete.
 - 2. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.

3. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
- F. Mix concrete according to PCI MNL 116 and requirements in this Section. After concrete batching, no additional water may be added.
 - G. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 116 for measuring, mixing, transporting, and placing concrete.
 - H. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 116.
 - I. Comply with ACI 306.1 procedures for cold-weather concrete placement.
 - J. Comply with ACI 305.1 recommendations for hot-weather concrete placement.
 - K. Identify pickup points of precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint casting date on each precast concrete unit on a surface that will not show in finished structure.
 - L. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.
 - M. Product Tolerances: Fabricate precast structural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 product tolerances.
 - N. Finish formed surfaces of precast structural concrete as indicated for each type of unit, and as follows:
 1. Top Surface; Rough/Broom Finish: Surfaces to remain in contact with topping slab shall be broomed with fiber-bristle broom. Coordinate required final finish with the Engineer before application.
 2. All other surfaces; Standard Finish: Normal plant-run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls will be tolerated. Major or unsightly imperfections, honeycombs, or structural defects are not permitted.
 - 3.
 - O. Screed finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections.

2.10 HOLLOW-CORE SLAB UNITS

- A. Type: Precast, prestressed concrete units with open, hollow cores running the full length of the slab units.
- B. Furnish units free of voids and honeycombs.
- C. Provide standard finish to precast concrete units.

- D. Reinforce units to resist transportation and erection stresses.
- E. Include cast-in weld plates where required.
- F. Coordinate with other trades for installation of cast-in items.
- G. Provide solid, monolithic, precast concrete slab units forming an integral part of hollow-core slab unit system. Design and fabricate solid units to dimensions and details indicated for hollow-core slab units.

2.11 SOURCE QUALITY CONTROL

- A. Owner will employ an independent testing agency to evaluate precast structural concrete fabricator's quality-control and testing methods.
 - 1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide Samples of materials and concrete mixes as may be requested for additional testing and evaluation.
- B. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 116 requirements.
- C. Strength of precast concrete units will be considered deficient if units fail to comply with PCI MNL 116 requirements, including the following:
 - 1. Units fail to comply with compressive-strength test requirements.
 - 2. Reinforcement and prestressed tendons of units do not comply with fabrication requirements.
 - 3. Concrete curing and protection of units against extremes in temperature fail to comply with requirements.
 - 4. Units are damaged during handling and erecting.
- D. Testing: If there is evidence that the strength of precast concrete units may be deficient or may not comply with PCI MNL 116 requirements, Owner will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C42.
 - 1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Architect.
 - 2. Cores will be tested, after immersion in water, in a wet condition per ACI 301 if units will be wet under service conditions.
 - 3. Cores will be tested in an air-dry condition per ACI 301 if units will be dry under service conditions.
 - 4. Strength of concrete for each series of three cores will be considered satisfactory if the average compressive strength is equal to at least 85 percent of the 28-day design compressive strength and no single core is less than 75 percent of the 28-day design compressive strength.

5. Test results will be made in writing on the same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports will include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of precast concrete unit or units represented by core tests; design compressive strength; type of break; compressive strength at break, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mix that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.
- F. Dimensional Tolerances: Units with dimensions smaller or larger than required and not complying with tolerance limits may be subject to additional testing.
 1. Precast concrete units with dimensions larger than required will be rejected if the appearance or function of the structure is adversely affected or if larger dimensions interfere with other construction. Repair or remove and replace rejected units, as required, to comply with construction conditions.
- G. Defective Work: Precast concrete units that do not comply with requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that comply with requirements.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Bearing Pads: Install bearing pads as precast concrete units are being erected. Set pads on true, level, and uniform bearing surfaces and maintain in correct position until precast concrete units are placed.
- B. Install precast structural concrete. Shore and brace precast concrete units to maintain location, stability, and alignment until permanent connections are installed.
- C. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.
 1. Protect precast concrete units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.

- D. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units unless approved by Architect.
- E. Erection Tolerances: Install precast concrete units level, plumb, square, and true, without exceeding the recommended erection tolerances in PCI MNL 127, "Recommended Practice for Erection of Precast Concrete."
- F. Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at keyways, connections, and joints as follows:
 - 1. Provide forms or other approved method to retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.
 - 2. Submit bonding agent for approval, Sika Armatec-110, or approved equal.

3.03 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections.
- B. Field welds and connections using high-strength bolts will be subject to tests and inspections.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace Work that does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

3.04 CLEANING

- A. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.
 - 1. Wash and rinse according to precast concrete fabricator's written recommendations. Protect other Work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes.

END OF SECTION

05 52 13 PIPE AND TUBE RAILINGS

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Aluminum pipe and tube railings.

1.03 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project Site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.04 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of mechanically connected railings.
 - 2. Railing brackets.
 - 3. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
 - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 - 2. Fittings and brackets.
 - 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - a. Show method of connecting members at intersections.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.

- B. Welding certificates.
- C. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- E. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.
- F. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.07 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

2.00 PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Infill of Guards:
 - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C, material surfaces)

2.03 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide flange-mounted railing base flange by easyfit.com, part # EF12G-40.

2.04 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.
- B. Extruded Bar and Tubing: ASTM B221 (ASTM B221M), Alloy 6063-T5/T52.
- C. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, Alloy 6063-T6.
 - 1. Provide 1 ½" diameter Standard Weight (Schedule 40) pipe.
- D. Drawn Seamless Tubing: ASTM B210 (ASTM B210M), Alloy 6063-T832.
- E. Plate and Sheet: ASTM B209 (ASTM B209M), Alloy 6061-T6.
- F. Die and Hand Forgings: ASTM B247 (ASTM B247M), Alloy 6061-T6.
- G. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.05 FASTENERS

- A. General: Provide the following:
 - 1. Aluminum Railings: Type 316 stainless-steel fasteners.
 - 2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
 - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941 (ASTM F1941M), Class Fe/Zn 5, unless otherwise indicated.

2.06 MISCELLANEOUS MATERIALS

- A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.07 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with either welded or nonwelded connections unless otherwise indicated.
- H. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- I. Form Changes in Direction as Follows:
 - 1. By bending or by inserting prefabricated elbow fittings.
- J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- K. Close exposed ends of railing members with prefabricated end fittings.
- L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
- M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

- N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
 - 1. For removable railing posts, provide flange-mounted railing base flange by easyfit.com, part # EF12G-40.
- O. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.08 ALUMINUM FINISHES

- A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Mill Finish: AA-M12, nonspecular as fabricated.

3.00 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.02 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

3.03 ANCHORING POSTS

- 1. Install removable railing sections, where indicated, in flange-mounted railing base.

3.04 ADJUSTING AND CLEANING

- A. Clean aluminum by washing thoroughly with clean water and soap and rinsing with clean water.

3.05 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

06 10 00 ROUGH CARPENTRY

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Wood blocking.
 - 2. Wood furring.
 - 3. Plywood panels.

1.03 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) size or greater but less than 5 inches nominal (114 mm actual) size in least dimension.
- C. Exposed Framing: Framing not concealed by other construction.
- D. Timber: Lumber of 5 inches nominal (114 mm actual) size or greater in least dimension.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project Site.

1.05 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

2.00 PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED LUMBER (NOT USED)

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

2.04 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Furring.
 - 4. Grounds.
- B. Dimension Lumber Items: Construction or No. 2
 - 1. Hem-fir (north); NLGA.
 - 2. Mixed southern pine or southern pine; SPIB.
 - 3. Spruce-pine-fir; NLGA.
 - 4. Hem-fir; WCLIB or WWPA.
 - 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 - 6. Western woods; WCLIB or WWPA.
 - 7. Northern species; NLGA.
- C. Concealed Boards: 15 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
 - 2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
 - 3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
 - 4. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.05 PLYWOOD PANELS

- A. Equipment Panels: Plywood, DOC PS 1, Exterior, A-C in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

2.06 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193] or ICC-ES AC308 as appropriate for the substrate.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
 - 2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2 (ASTM F738M and ASTM F836M, Grade A1 or A4).

3.00 EXECUTION

3.01 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere

with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

- G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.
- H. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.02 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.03 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

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07 52 16 STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING

1.00 GENERAL

1.01 SECTION INCLUDES

- A. SBS-modified bituminous membrane roofing. System components and accessories
- B. Base sheet.
- C. Specified Manufacturers and Contractors Warranties.

1.02 RELATED SECTIONS

- A. Division 06 Section "Rough Carpentry" for wood nailers, cants and blocking.
- B. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counter flashings.

1.03 REFERENCES

- A. Roofing Terminology: Refer to the following publications for definitions of roofing work related terms in this Section:
 - 1. ASTM D 1079 "Standard Terminology Relating to Roofing and Waterproofing."
 - 2. Glossary of NRCA's "The NRCA Roofing and Waterproofing Manual."
 - 3. Roof Consultants Institute "Glossary of Building Envelope Terms."
 - 4. FMG – Factory Mutual Approval guide
 - 5. UL – Underwriters Laboratories Building Materials Directory.
- B. Sheet Metal Terminology and Techniques: SMACNA "Architectural Sheet Metal Manual."
- C. Hot Roofing Asphalt: Roofing asphalt heated to temperature recommended by roofing manufacturer to flux modified roofing membrane, measured at the mop cart or mechanical spreader immediately before application.

1.04 DESIGN CRITERIA

- A. General: Installed roofing membrane system shall remain watertight; and resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Roofing materials shall be compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.
- C. Installer shall comply with current code requirements based on authority having jurisdiction.
- D. Wind Uplift Performance: Install roof system in a manor to resist minimum wind uplift pressure of 68 psf. For the field of the roof, 90 psf. in a 4-foot wide perimeter zones, and 107 psf in 4 feet by 4 feet perimeter zones and in accordance with approved test assembly requirements.

1. Field-of-Roof Uplift Pressure: 20.61lbf/sq. ft. (kN/sq. m).
 2. Perimeter Uplift Pressure: 34.58 lbf/sq. ft. (kN/sq. m).
 3. Corner Uplift Pressure: 52.04 lbf/sq. ft. (kN/sq. m).
 4. FMG Class 1-SH (severe hail exposure)
- E. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
1. Exterior Fire-Test Exposure: FM Class A and UL Class 1A-90, ASTM E 108, for application and roof slopes indicated.

1.05 SUBMITTALS

- A. Product Data: Manufacturer's data sheets for each product to be provided.
- B. Detail Shop Drawings: Provide roofing system plans, elevations, sections, details, and details of attachment to other Work, including:
1. Base sheet installation methods.
 2. Roofing membranes, cap sheet application.
 3. Base flashings and membrane terminations.
 4. Flat base and tapered insulation, including slopes.
 5. Crickets, saddles, and tapered edge strips, including slopes.
 6. Insulation fastening and adhesive patterns.
 7. Cover board fastening and adhesive patterns.
 8. Wood blocking installation.
 9. Metal edge trim, thru-wall flashing and counter flashing.
- C. Verification Samples: Provide for each product specified.
- D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- E. Product and Maintenance Data: Refer to manufacturer's latest published documents.
- F. Guarantees: Provide manufacturer's current guarantee specimen. 20 year NDL warranty, Roofing contractor 2 year labor and material warranty.
- G. Prior to beginning the work of this section, roofing sub-contractor shall provide a copy of the final System Assembly Letter issued by the manufacturer indicating that the products and system to be installed are compatible and shall be eligible to receive the specified manufacturer's guarantee/warranty when installed by a certified contractor in accordance with the Manufacturers application requirements, inspected and approved by manufacturer's Technical Representative.

- H. Prior to roofing system installation, roofing contractor shall provide a copy of the Guarantee/warranty Application Confirmation document issued by manufacturer indicating that the project has been reviewed for eligibility to receive the specified guarantee and registered.
 - 1. "INSERT FIRM NAME" shall be listed as the Specifier/Consultant of record in the appropriate fields on the Guarantee Application Confirmation.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive the specified manufacturer's guarantee. Minimum 3 years' experience with projects of similar scope and cost.
- B. Manufacturer Qualifications: Qualified manufacturer that has UL listing and FMG approval for roofing system identical to that used for this Project.
- C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 329.
- D. Test Reports:
 - 1. Contractor shall retain an independent testing agency to conduct roof deck fastener pullout tests at existing gypsum roof deck.
- E. Source Limitations: Obtain all components from the single source roofing manufacturer guaranteeing the roofing system. All products used in the system shall be labeled or approved by the roofing manufacturer issuing the guarantee.
 - 1. All roofing shall be described in this section and shall be provided and/or approved by roof system manufacturer.
 - 2. Obtain written approval from the roofing manufacturer for any materials not manufactured or provided by manufacturer stating that materials are acceptable and compatible with other materials and systems required.
- F. Make no deviations from the specifications or the approved shop drawings without the prior written approval of roof system manufacturer.
- G. Provide evidence of NRCA Certified Roofing Torch Applicator (CERTA) training for any installer of torch-applied modified bitumen membrane. Copies of certifications are required and shall be maintained on the jobsite for inspection at any time.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.08 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.

1.09 GUARANTEE

- A. Provide manufacturer's system guarantee equal to Johns Manville's Peak Advantage No Dollar Limit Roofing System Guarantee.
 - 1. Single-Source special guarantee includes base sheet roofing plies, base flashings, liquid applied flashing, roofing membrane accessories, granule surfaced roofing membrane, roof insulation, fasteners, adhesives, cover board, walkway products, expansion joints, edge metal products, and other components of roofing system approved by the manufacturer.
 - 2. Guarantee Period: Twenty (20) years from date of Substantial Completion.
 - 3. Contractor is required to list "INSERT FIRM NAME" as the Specifier/Consultant of record in the appropriate fields ("Specifier Account") when applying for the manufacturer's warranty.
- B. Installer's Guarantee: Submit roofing Installer's guarantee, signed by Installer, covering Work of this Section, including all components of roofing system, for the following guarantee period:
 - 1. Guarantee Period: Two (2) years from date of Substantial Completion.
- C. Existing Guarantees: Guarantees on existing building elements should not be affected by scope of work.
 - 1. Installer is responsible for coordinating with building owner's representative to verify compliance.

2.00 PRODUCTS

2.01 BASE PLY SHEET AND TOP PLY CAP-SHEET MATERIALS

- A. Roofing Membrane Base Ply Sheet: ASTM D 6163, Grade S, Type I, glass-fiber-reinforced, SBS-modified asphalt sheet; smooth surfaced; suitable for application method specified. Basis of Design: DynaBase.
- B. Roofing Membrane Top Ply Cap Sheet: ASTM D 6163, Grade G, Type I, glass-fiber-reinforced, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified.
- C. Solar Reflectance of 0.70 (minimum) and Initial Thermal Emittance of 0.75 (minimum). Basis of Design: DynaGlas FR CR G

2.02 FLASHING SHEET MATERIALS

- A. Backer Sheet: ASTM D 4601, Type II, asphalt-impregnated and coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides. Basis of Design: PermaPly 28.
- B. Flashing Sheet: ASTM D 6221, Grade G, Type I, composite polyester- and glass-fiber-reinforced, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified. Basis of Design: DynaFlex.
- C. Liquid Applied Flashing: A liquid and fabric reinforced flashing system created with a stitch bonded polyester scrim and a two-component, moisture cured, elastomeric, liquid applied flashing material, consisting of an asphalt extended urethane base material and an activator. Basis of Design: PermaFlash System.

2.03 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with built-up roofing.
- B. Roofing Asphalt: ASTM D 312-15, Type IV.
- C. Asphalt Primer: ASTM D 41. Basis of Design: Asphalt Primer
- D. Asphalt Roofing Cement: ASTM D 4586, type I, asbestos free, of consistency required by roofing system manufacturer for application. Basis of Design: Bestile Industrial Roof Cement
- E. Cold-Applied Adhesive: ASTM D3019, Type III, Grade 2. asphalt-based, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with membrane applications. Basis of Design: JM MBR Cold Application Adhesive
- F. Cold-Applied Adhesive: Roofing system manufacturer's asphalt-based, two-component, asbestos-free, cold-applied adhesive specially formulated for compatibility and use with membrane applications. Basis of Design: JM MBR Bonding Adhesive
- G. Cold-Applied Flashing Adhesive: Roofing system manufacturer's asphalt-based, two-component, asbestos-free, trowel-grade, cold-applied adhesive specially formulated for compatibility and use with flashing applications. Basis of Design: JM MBR Flashing Cement
- H. Cold-Applied Flashing Adhesive: Roofing system manufacturer's asphalt-based, two-component, asbestos-free, trowel-grade, cold-applied adhesive specially formulated for compatibility and use with flashing applications. Basis of Design: JM MBR Utility Cement
- I. Mastic Sealant: As required by Johns Manville.
- J. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roofing membrane components to substrate, tested by manufacturer for required pullout strength, and provided by the roofing system manufacturer. Basis of Design: Johns Manville UltraLok Impact Fasteners, Johns Manville OlyLok Locking impact nails.
- K. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, with anchors. Basis of Design: JM Termination Systems
- L. Roofing Granules: Ceramic-coated roofing granules matching specified cap sheet, provided by roofing system manufacturer. JM CR Roofing Granules

- M. Self-Adhered Primer: One-part penetrating primer solution to enhance the adhesion of self-adhering membranes. JM SA Primer Low VOC
- N. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.04 BASE-SHEET MATERIALS

- A. Base Sheet: ASTM D 4601, Type II non-perforated, asphalt-impregnated and -coated, glass-fiber sheet, dusted with fine mineral surfacing on both sides. Basis of Design: Johns Manville PermaPly 28
- B. Base-Sheet Fasteners: Tube, disk and locking staple design, factory-coated steel fasteners and Galvalume metal battens meeting corrosion-resistance provisions in FMG 4470, designed for fastening base-sheet to substrate, tested by manufacturer for required pullout strength, and provided by the roofing system manufacturer. Product: Johns Manville UltraLok Locking Impact Fastener

2.05 AUXILIARY ROOFING SYSTEM COMPONENTS

- A. Expansion Joints: Provide factory fabricated weatherproof, exterior covers for expansion joint openings consisting of flexible rubber membrane, supported by a closed cell foam to form flexible bellows, with two metal flanges, adhesively and mechanically combined to the bellows by a bifurcation process. Provide product from single-source roofing system supplier that is included in the No Dollar Limit guarantee. Basis of Design: Johns Manville Expand-O-Flash.
- B. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with the requirements affecting performance of roofing system.
 - 1. General:
 - a. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 - b. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 2. Sonovoid Concrete Roof Decks:
 - a. Grout along plank edges and over weld places; and in un-even areas, pour a leveling slab compound over the area to resolve un-evenness issues.
 - b. Grout and leveling compound: Thoro Crete SL, self-levelling resurfacing mortar for concrete floors, as manufactured by Thoro Concrete Repair Systems.

- c. Verify that concrete substrate is visibly dry and free of moisture.
- 3. Unacceptable panels should be brought to the attention of the General Contractor and Project Owner's Representative and shall be corrected prior to installation of roofing system.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean and remove from substrate sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation in accordance with roofing system manufacturer's written instructions.
- B. Prevent materials from entering and clogging roof drains penetrations and conductors and from spilling or migrating onto surfaces of other construction.
- C. If applicable, prime surface of concrete deck with asphalt primer at a rate recommended by roofing manufacturer and allow primer to dry.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 BASE-SHEET INSTALLATION – CONCRETE ROOF DECK

- A. Install one lapped base sheet course and mechanically fasten to concrete roof deck substrate per roofing system manufacturer's written instructions.
 - 1. Enhance fastening rate in perimeter and corner zones per code requirements, wind uplift system approvals or manufacturer's guarantee requirements, whichever is more stringent.
- B. Comply with roofing system manufacturer's written instructions for installing roof insulation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.04 ROOFING MEMBRANE INSTALLATION, GENERAL

- A. Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of the roofing manufacturer and requirements in this Section.
- B. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.
- C. Coordinate installing roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is imminent.
 - 1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation.
 - 2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
 - 3. Remove and discard temporary seals before beginning work on adjoining roofing.

- D. Asphalt Heating: Heat roofing asphalt to temperature recommended by roofing manufacturer to flux modified membrane. Do not exceed roofing asphalt manufacturer's recommended temperature limits during roofing asphalt heating. Discard roofing asphalt maintained at a temperature exceeding finished blowing temperature for more than 4 hours.
- E. Substrate-Joint Penetrations: Prevent roofing asphalt from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.05 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

- A. Install two modified bituminous roofing membrane sheets base ply and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, with the following installation method:
 - 1. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.
 - 2. Adhere modified bituminous roofing membrane cap sheet to substrate in a solid mopping of hot roofing asphalt applied at temperatures recommended by roofing system manufacturer.
- B. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
 - 1. Repair tears and voids in laps and lapped seams not completely sealed.
 - 2. Apply roofing granules to cover exuded bead at laps while bead is hot.
- C. Install roofing membrane sheets so side and end laps shed water.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.06 FLASHING AND STRIPPING INSTALLATION

- A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
 - 1. Prime substrates with asphalt primer if required by roofing system manufacturer.
 - 2. Backer Sheet Application: Mechanically fasten backer sheet to walls or parapets.
 - 3. Backer Sheet Application: Install backer sheet and adhere to substrate in a solid mopping of hot roofing asphalt.
 - 4. Backer Sheet Application: Install backer sheet and adhere to substrate in approved adhesive applied at rate required by roofing system manufacturer.
 - 5. Flashing Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt. Apply hot roofing asphalt to back of flashing sheet if recommended by roofing system manufacturer.

6. Flashing Sheet Application: Adhere flashing sheet to substrate in approved adhesive applied at rate required by roofing system manufacturer.
 7. Flashing Sheet Application: Adhere flashing sheet to substrate in approved asphalt roofing cement; apply cement at rate required by roofing system manufacturer.
- B. Extend base flashing up walls or parapets a minimum of 8 inches (200 mm) above roofing membrane and 4 inches (100 mm) onto field of roofing membrane.
 - C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
 1. Seal top termination of base flashing with a strip of glass-fiber fabric set in MBR Flashing cement.

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency approved by owner to perform roof tests and inspections and to prepare test reports.
- B. Inspections:
 1. During instillation on individual roof areas, provide for on-site inspection by a qualified technical representative of roof membrane manufacturer. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers written instructions. Issue a report of observations together with photographs to Contractor to submit to TMD and A/E.
 2. Upon completion of instillation, provide Substation Completion Inspection and Final Inspection of the roof system by Technical representative employed by the roofing Manufacturer specifically to inspect instillation for warranty purposes and compliance with Contract Documents and Manufacturer's Requirements.
 3. Notify Roof System Manufacture's Representative a minimum of 14 calendar days prior to the date of the Substantial Completion Inspection and Final Inspection.
- C. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements. Perform all corrections necessary for issuance of warranties.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.08 PROTECTION AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.
- D. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants and coatings.

- E. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.
- F. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.
- G. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original protection.

END OF SECTION

07 62 00 SHEET METAL FLASHING AND TRIM

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Formed roof-drainage sheet metal fabrications.
 - 2. Formed low-slope roof sheet metal fabrications.
- B. Related Sections include the following:
 - 1. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.03 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project Site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 3. Review requirements for insurance and certificates if applicable.
 - 4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.
- B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
 3. Include identification of material, thickness, weight, and finish for each item and location in Project.
 4. Include details for forming, including profiles, shapes, seams, and dimensions.
 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 6. Include details of termination points and assemblies.
 7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
 8. Include details of roof-penetration flashing.
 9. Include details of edge conditions, including eaves, rakes, crickets, and counterflashings as applicable.
 10. Include details of special conditions.
 11. Include details of connections to adjoining work.
 12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches (1:10).
- C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.
- D. Samples for Verification: For each type of exposed finish.
1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
 2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
 3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
 4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.07 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Build mockup of typical roof edge, eave, including gutter, fascia, fascia trim, approximately 10 feet (3.0 m) long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.09 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

2.00 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A653/A653M, G90 (Z275) coating designation; prepainted by coil-coating process to comply with ASTM A755/A755M.
 - 1. Surface: Smooth, flat.
 - 2. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3. Color: As selected by Architect from manufacturer's full range.
 - 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil (0.013 mm).

2.03 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

- b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
- 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D1187.
- F. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

2.04 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated.
 - 1. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 - 2. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
 - 3. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.05 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
- H. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.
- I. Do not use graphite pencils to mark metal surfaces.

2.06 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Counterflashing: Fabricate from the following material:
 1. Galvanized Steel: 0.0217 inch (0.55 mm) thick.
- B. Flashing Receivers: Fabricate from the following material:
 1. Galvanized Steel: 0.0217 inch (0.55 mm) thick.
- C. Splash Pans: Fabricate from the following material:
 1. Concrete on ground, 24" long, 16" wide, and weight 80 lbs.

2.07 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard

but with thickness not less than twice the gutter thickness. Fabricate gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.

1. Gutter Profile: Style B according to cited sheet metal standard.
2. Gutters with Girth up to 15 Inches (380 mm): Fabricate from the following materials:
 - a. Galvanized Steel: 0.022 inch (0.56 mm) thick.
- B. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from the same material as downspouts and anchors. Shop fabricate elbows.
 1. Hanger Style: Hangers to have fasteners designed to hold downspouts securely to walls.
 2. Fabricate from the following materials:
 - a. Galvanized Steel: 0.022 inch (0.56 mm) thick.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 1. Verify compliance with requirements for installation tolerances of substrates.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. General: Anchor sheet metal and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 2. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 3. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 4. Torch cutting of sheet metal flashing and trim is not permitted.

5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
 2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."
- G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.03 ROOF DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.
 2. Anchor and loosely lock back edge of gutter to continuous eave or apron flashing.
 3. Anchor gutter with straps spaced not more than 24 inches (600 mm) apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
- C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints.
1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c.
 2. Provide elbows at base of downspout to direct water away from building as indicated.

3.04 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.
- C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.
1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant or interlocking folded seam or blind rivets and sealant.
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
 2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.05 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.06 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

- B. Clean off excess sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

07 84 13 PENETRATION FIRESTOPPING

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.
- B. Related Requirements:
 - 1. Section 03 30 00 "Cast-In-Place Concrete" for wall and roof construction.

1.03 ALLOWANCES

- A. Penetration firestopping Work is part of an allowance.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project Site.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.07 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.08 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

- B. Install and cure penetration firestopping materials per manufacturer’s written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.09 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

2.00 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in “Penetration Firestopping Systems” Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
 - 1). UL in its “Fire Resistance Directory.”
 - 2). Intertek Group in its “Directory of Listed Building Products.”

2.02 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 - 1. Hilti – FS-One Intumescent Firestop Sealant
 - 2. 3M Fire Protection Products
 - 3. Nelson Fire Insulation and Stopping
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
 - 1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.

2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.
- E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
1. Permanent forming/damming/backing materials.
 2. Substrate primers.
 3. Collars.
 4. Steel sleeves.

2.03 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project Site to form a nonshrinking, homogeneous mortar.
- G. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- H. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.04 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.03 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).

3.05 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.06 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.07 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Where Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Listed Building Products" under "Firestop Systems."
 - 1. UL-Classified Systems: C-AJ-0091.
 - 2. F-Rating: 2 hours.
 - 3. T-Rating: 1 hour.
 - 4. W-Rating: No leakage of water at completion of water leakage testing.
 - 5. Type of Fill Materials: As required to achieve rating.
- C. Penetration Firestopping Systems for Metallic Pipes, Conduit, or Tubing FS-539 W:
 - 1. UL-Classified Systems: C-AJ-1551
 - 2. F-Rating: 2 hours.

3. T-Rating: 1 hour.
4. W-Rating: No leakage of water at completion of water leakage testing.
5. Type of Fill Materials: As required to achieve rating.

END OF SECTION

07 92 00 JOINT SEALANTS

1.00 GENERAL

1.01 SUMMARY

- A. This Section includes sealants for the following:
 - 1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces.
 - 2. Exterior joints in horizontal traffic surfaces.
 - 3. Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 4. Interior joints in horizontal traffic surfaces.

1.02 SUBMITTALS

- A. Product Data: For each joint sealant product indicated.
- B. Samples: For each joint sealant product indicated.
- C. Sealant compatibility and adhesion test reports.
- D. Preconstruction field-adhesion test reports.
- E. Product certificates.

1.03 QUALITY ASSURANCE

- A. Sealant Compatibility and Adhesion Testing: Use sealant manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
- B. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates using test method indicated in Part 3 "Field Quality Control" Article.
- C. Mockups: Before installing joint sealants, apply elastomeric sealants to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.04 WARRANTY

- A. Special Installer's Warranty: Written warranty in which Installer agrees to repair or replace elastomeric joint sealants that do not meet requirements specified in this Section or fail in adhesion within specified warranty period two years from date of Substantial Completion.

2.00 PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.

2.02 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected.

2.03 ELASTOMERIC JOINT SEALANTS

- A. Low-Modulus Nonacid-Curing Silicone Sealant, Type I:
 - 1. Products:
 - a. Dow Corning; 790.
 - b. GE Silicones; Silpruf
 - c. Pecora Corporation; 890.
 - d. Sonneborn Building Products Div., ChemRex Inc.; Omniseal.
 - 2. Type and Grade: S (single component) and NS (nonsag).
 - 3. Class: 25.
 - 4. Additional Movement Capability: Capable of 100 percent movement in extension and 50 percent movement in compression when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719.
 - 5. Exposure: Use NT (nontraffic).
 - 6. Substrates: Uses M, G, A, and, as applicable to joint substrates indicated, O.
 - 7. Nonstaining to porous substrates when testing per ASTM C 1248 for substrates indicated.
- B. Medium-Modulus Neutral-Curing Silicone Sealant, Type 2:
 - 1. Products:
 - a. Dow Corning; 791.
 - b. Tremco; Spectrem 2.
 - 2. Type and Grade: S (single component) and NS (nonsag).
 - 3. Class: 25.
 - 4. Exposure: Use NT (nontraffic).

5. Substrates: Uses M, G, A, and, as applicable to joint substrates indicated, O.
 6. Nonstaining to porous substrates when testing per ASTM C 1248 for substrates indicated.
- C. Mildew-Resistant Silicone Sealant, Type 3:
1. Products:
 - a. Dow Corning; 786 Mildew Resistant.
 - b. GE Silicones; Sanitary 1700.
 - c. Pecora Corporation; 898 Silicone Sanitary Sealant.
 - d. Tremco; Tremsil 600 White.
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 25.
 4. Exposure: Use NT (nontraffic).
 5. Substrates: Uses G, A, and, as applicable to joint substrates indicated, O.
- D. Multicomponent Nonsag Urethane Sealant, Type 4:
1. For joints not subject to traffic and requiring additional movement capability, provide the following:
 - a. Products:
 - 1). Pecora Corporation; Dynatrol II.
 - 2). Sika Corporation; Sikaflex - 2c NS.
 - 3). Tremco; DYmeric 511.
 - b. Type and Grade: M (multicomponent) and NS (nonsag).
 - c. Class: 25.
 - d. Additional Movement Capability: 50 percent movement in extension and 50 percent in compression when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719.
 - e. Exposure: Use NT (nontraffic).
 - f. Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
 2. For joints not subject to traffic, Type 5:
 - a. Products:
 - 1). Bostik Inc.; Chem-Calk 500.
 - 2). Tremco; DYmeric.
 - b. Type and Grade: M (multicomponent) and NS (nonsag).
 - c. Class: 25.
 - d. Exposure: Use NT (nontraffic).

- e. Substrates: Uses M, G, A, and, as applicable to joint substrates indicated, O.
- E. Single-Component Nonsag Urethane Sealant, Type 6:
- 1. For joints subject to traffic and not subject to traffic, provide the following:
 - a. Products:
 - 1). Sika Corporation; Sikaflex - 1a.
 - 2). Sonneborn Building Products Div., ChemRex Inc.; NP 1.
 - b. Type and Grade: S (single component) and NS (nonsag).
 - c. Class: 25.
 - 2. Exposure: Use NT (nontraffic).
 - 3. Substrates: Uses M, G, A, and, as applicable to joint substrates indicated, O.
 - 4. For joints not subject to traffic, provide the following:
 - a. Products:
 - 1). Bostik Inc.; Chem-Chalk 900.
 - 2). Pecora Corporation; Dynatrol I.
 - 3). Tremco; DyMonic.
 - b. Type and Grade: S (single component) and NS (nonsag).
 - c. Class: 25.
 - d. Exposure: Use NT (nontraffic).
 - e. Substrates: Uses M, A, and, as applicable to joint substrates indicated.
- F. Single-Component Pourable Urethane Sealant, Type 7
- 1. Products:
 - a. Bostik Inc.; Chem-Calk 950.
 - b. Pecora Corporation; NR-201.
 - c. Sonneborn Building Products Div., ChemRex Inc.; SL 1.
 - 2. Type and Grade: S (single component) and P (pourable).
 - 3. Class: 25.
 - 4. Exposure: Use T (traffic) and NT (nontraffic).
 - 5. Substrates: Uses M, G, A, and, as applicable to joint substrates indicated, O.

2.04 LATEX JOINT SEALANTS

- A. Latex Sealant: ASTM C 834.
- 1. Products:
 - a. Bostik Inc.; Chem-Calk 600.
 - b. Pecora Corporation; AC-20.

- c. Sonneborn Building Products Div., ChemRex, Inc.; Sonolac.
- d. Tremco; Tremflex 834.

2.05 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Type: C O, or B.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.06 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

3.00 EXECUTION

3.01 INSTALLATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.
 - 1. Remove foreign material from joint substrates that could interfere with adhesion of joint sealant.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles

remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues could interfere with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.
- D. Sealant Installation: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- E. Acoustical Sealant Installation: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- F. Install sealant backings to support sealants during application and at position required to produce optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- G. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.
- H. Place sealants so they directly contact and fully wet joint substrates.
1. Completely fill recesses provided for each joint configuration.
 2. Produce uniform, cross-sectional shapes and depths that allow optimum sealant movement capability.
- I. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealants from surfaces adjacent to joint.
 2. Use tooling agents that are approved by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Joint Configuration: Concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
- J. Installation of Preformed Silicone-Sealant System:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
 2. Complete installation of horizontal joints before installing vertical joints. Lap vertical joints over horizontal joints. At end of joints, cut silicone extrusion with a razor knife.
- K. Clean excess sealants or sealant smears adjacent to joints as installation progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.02 JOINT SEALANT SCHEDULE

- A. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
1. Control and Expansion Joints in Cast-in-Place Concrete: Type 1, 5, 6 sealant.
 2. Joints between Different Materials Listed above: Type 1, 5, 6 sealant.
 3. Perimeter Joints between Materials Listed above and Frames of Doors and Louvers: Type 1, 5, 6 sealant.
- B. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
1. Control and Expansion Joints on Exposed Interior Surfaces of Exterior Walls: Type 1, 5, 6 sealant.
 2. Perimeter Joints of Exterior Openings Where Indicated: Type 1, 5 sealant.
 3. Vertical Control Joints on Exposed Surfaces of Interior Concrete Walls and Partitions: Type 1, 5, 6 sealant.
 4. Perimeter Joints between Interior Wall Surfaces and Frames of Interior Doors, Windows, and Elevator Entrances: Type 1, 5, 6 sealant.
 5. Joints between Plumbing Fixtures and Adjoining Walls, and Floors: Type 4, 7 sealant.

END OF SECTION

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08 11 13 HOLLOW METAL DOORS AND FRAMES

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Standard hollow metal doors and frames – interior door.
2. Texas Department of Insurance (TDI) Product Evaluation listed hollow metal doors and frames – exterior doors.

B. Related Sections:

1. Division 03 Section "Cast-In-Place Concrete" for anchors and fasteners on concrete walls.
2. Division 08 Sections "Door Hardware" for included hardware for interior and exterior doors.
3. Division 09 Sections "Painting" for field painting hollow metal doors and frames.

1.03 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, and finishes.
- B. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of each different wall opening condition.
 6. Details of anchorages, joints, field splices, and connections.
 7. Details of accessories.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non vented plastic.
 - 1. Provide additional protection to prevent damage to finish of factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.07 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.08 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.09 WARRANTY

- A. Provide manufacturer's written warranty against defects in materials and workmanship upon final completion and acceptance of Work in this section.
- B. Warranty period is ten years.

2.00 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Interior Standard Doors and Frames subject to compliance with requirements, provide products by one of the following:
 - 1. Amweld Building Products, LLC.
 - 2. Benchmark; a division of Therma-Tru Corporation.
 - 3. Ceco Door Products; an ASSA ABLOY Group company.
 - 4. CURRIES Company; an ASSA ABLOY Group company.
 - 5. Deansteel Manufacturing Company, Inc.
 - 6. Firedoor Corporation.

7. Fleming Door Products Ltd.; an Assa Abloy Group company.
 8. Habersham Metal Products Company.
 9. Kewanee Corporation (The).
 10. Mesker Door Inc.
 11. Pioneer Industries, Inc.
 12. Security Metal Products Corp.
 13. Steelcraft; an Ingersoll-Rand company.
- B. Manufacturers: Per TDI Evaluation Index for Impact-Resistant, Exterior doors, frames hardware and connections. No substitutions permitted.
1. Cal-Royal Products, Inc. – DKS Series 1800 Single, Outswing doors.
 2. Ceco Door, a Division of ASSA ABLOY Door Group – Model 707 Opaque Commercial Steel Outswing, Side-Hinged doors.
 3. CURRIES, Division of AADG Inc. – Model 707 and Model 747 Commercial Flush Steel Outswing Side Hinged Doors.
 4. Daybar Industries LTD – Series LS20GA Flush Commercial Steel Outswing Side Hinged Door with Series AS 18-ga Steel Frame.
 5. Daybar Industries LTD – Series LS18 Flush Commercial Steel Outswing Side Hinged Door.
 6. Diamond Door Products – Diamond GEM 130 mph Series and Diamond GEM 150 mph Series Steel Opaque Side Hinged Doors, Outswing.
 7. JELD-WEN Windows & Doors – Series “Gladiator/Finishield” Outswing Opaque 25 Gauge Steel Side Hinged Doors.
 8. Masonite Exterior Door Products – Metal Edge, Steel, Opaque, Outswing Hinged Doors with Two-Piece Adjustable Frame, Singles and Doubles.
 9. Mesker Door, Inc. – “NVS” Series Commercial Steel Opaque Outswing Side Hinged Doors.
 10. Steelcraft Manufacturing Company, Schlage Lock Company – Commercial Steel Hinged Doors, Flush Outswing, Singles and Doubles.

2.02 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- I. Glazing: Comply with requirements in Division 08 Section "Glazing."
- J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.03 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
 1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard polystyrene, polyurethane or polyisocyanurate, core.
 - a. Thermal-Rated (Insulated) Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) when tested according to ASTM C 1363.
 - 1). Locations: Exterior doors and interior doors.
 3. Vertical Edges for Single-Acting Doors: Manufacturer's standard.
 4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).

- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.04 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as full profile welded unless otherwise indicated.
 - 3. Frames for Level 3 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as full profile welded unless otherwise indicated.
 - 3. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.05 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Post installed Expansion Type for In-Place Concrete: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.06 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 2. Fire Door Cores: As required to provide fire-protection ratings indicated.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Post installed Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c
 5. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.07 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive non templated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - b. Install frames with removable glazing stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.

- d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - f. Field apply bituminous coating to backs of frames that are filled with grout containing anti freezing agents.
 - g. At fire-rated openings, install frames according to NFPA 80.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

3.04 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION

08 33 23 OVERHEAD COILING DOORS

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Texas Department of Insurance (TDI) Product Evaluation listed Service doors only.
- B. Related Sections:
 - 1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
 - 1. Wind Loads: As indicated on Drawings Sheet S-1.
 - 2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
- C. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.
- D. Windborne-Debris-Impact-Resistance Performance: Provide impact-protective overhead coiling doors that pass missile-impact and cyclic-pressure tests when tested according to ASTM E1886 and ASTM E1996.
 - 1. Large Missile Test: For overhead coiling doors located within 30 feet (9.144 m) of grade.
 - 2. Small Missile Test: For overhead coiling doors located more than 30 feet (9.144 m) above grade.
- E. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:

1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
 3. For fire-rated doors, description of fire-release system including testing and resetting instructions.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. 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. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of seismic restraints.
 2. Summary of forces and loads on walls and jambs.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
1. Obtain operators and controls from overhead coiling door manufacturer.

1.08 WARRANTY

- A. Provide manufacturer's written warranty against defects in materials and workmanship upon final completion and acceptance of Work in this section.
- B. Warranty period is ten years.

2.00 PRODUCTS

2.01 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A6653M, with G90 (Z275) zinc coating; nominal sheet thickness 24-gauge and as required to meet requirements.
 - 2. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
 - 3. Gasket Seal: Provide insulated slats with manufacturer's standard interior-to-exterior thermal break or with continuous gaskets between slats.
- B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- C. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.

2.02 HOOD

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - 1. Galvanized Steel: 24-gauge thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A6653M.

2.03 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - 1. Lock Cylinders: Provide cylinders specified in Section 08 71 00 "Door Hardware".

2.04 CURTAIN ACCESSORIES

- A. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
 - 1. At door head, use 1/8-inch (3-mm) thick, replaceable, continuous sheet secured to inside of hood.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch (3-mm) thick seals of flexible vinyl, rubber, or neoprene.
- B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

1. Provide pull-down straps or pole hooks for doors more than 84 inches (2130 mm) high.

2.05 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in/ft. (2.5 mm/m) of span under full load.
- C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.
- F. Track: Galvanized steel. No welded track for ease of maintenance.

2.06 DOOR ASSEMBLY

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 1. Product: Subject to compliance with requirements in TDI Product Evaluation listing for Impact-Resistant Roll-up doors. No substitutions permitted.
 - a. Overhead coiling Doors.
 - 1). Amarr Garage Doors – CP0001/CP0651 Insulated Steel Roll-up Doors.
 - 2). Clopay Corporation – CP0001/CP0651 Insulated Steel Roll-up Doors.
 - 3). Cookson Company, Inc. – CP0001/CP0651 Insulated Steel Roll-up Doors.
 - 4). Cornell Iron Works, Inc. – CP0001/CP0651 Insulated Steel Roll-up Doors.
 - 5). Overhead Door Corporation – Steel Roll Up Service Doors.
 - 6). Raynor Garage Doors – Models 'FF' and 'IF' DuraCoil Steel Roll-up Doors.
- B. Operation Cycles: Not less than 20,000.
 1. Include tamperproof cycle counter.
- C. Curtain R-Value: 4.5 F x h x sq. ft./BTU (0.792 K x sq. m/W).
- D. Door Curtain Material: Galvanized steel.
- E. Door Curtain Slats: Flat profile slats of [2-5/8-inch (67-mm)] center-to-center height.
 1. Slat Interior Facing: Metal.

- F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
- G. Hood: Galvanized steel.
 - 1. Shape: Round.
 - 2. Mounting: Face of wall.
- H. Locking Devices: Equip door with locking device assembly.
 - 1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside with thumb turn and electronic interconnect with operator to assure door operator will not operate when door is locked.
- I. Door Finish:
 - 1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range of colors.
 - 2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.07 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

2.08 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

- B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.03 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.04 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide weathertight fit around entire perimeter.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

08 71 00 DOOR HARDWARE

1.00 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ASTM E1886 - Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
 - 3. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure difference.
 - 4. ASTM E1996 - Standard specification for performance of exterior windows, curtain walls, doors and storm shutters impacted by Windborne Debris in Hurricanes.
 - 5. ICC/IBC - International Building Code.
 - 6. NFPA 70 - National Electrical Code.
 - 7. NFPA 80 - Fire Doors and Windows.
 - 8. NFPA 101 - Life Safety Code.
 - 9. NFPA 105 - Installation of Smoke Door Assemblies.
 - 10. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series.
 - 2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
 - 3. ANSI/UL 294 - Access Control System Units.

4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.03 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Proof of Qualification: Provide copy of manufacturer(s) Factory Trained Installer documentation indicating proof of status as a qualified installer of Windstorm assemblies.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

- E. Informational Submittals:
 - 1. Hurricane Resistant Openings: Exterior hurricane opening assemblies to be tested according to ASTM E330, ASTM E1886, ASTM E1996 standards, and certified by a qualified independent third party testing agency acceptable to authority having jurisdiction, with labeling indicating compliance with the wind load and design pressure level requirements specified for the Project.
 - 2. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.04 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Windstorm Assembly Installer Qualifications: Installers are to be factory trained for shop and field installation prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project. A pre-installation site inspection of the frame and floor conditions shall be conducted by the factory trained installer prior to any Windstorm assembly hardware applied to the opening.
- F. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
- G. Hurricane Resistant Exterior Openings (State of Texas): Provide exterior hollow metal and door hardware assemblies approved by the Texas Department of Insurance, including anchorage, capable of withstanding wind load design pressures calculated for this project by

a registered architect or engineer and are part of the construction documents per the Texas Department of Insurance, authorities having jurisdiction, and the International Building Code Design Loads Section 1609.

1. Each unit to bear third party permanent label in accordance with the Texas Department of Insurance requirements applicable to project.
 2. Hurricane Resistance Test Performance: Provide hollow metal and door hardware approved assemblies that pass large missile-impact tests, as required by Texas Department of Insurance systems location above grade and cyclic-pressure tests according to testing requirements of authorities having jurisdiction.
 - a. Impact Resistance: Hollow metal with approved door hardware assemblies must satisfy the Texas Department of Insurance's criteria for protection from windborne debris in both the Inland I zone and the Seaward zone. Assemblies must pass the large missile impact test (which equates to Missile Level D specified in ASTM E 1996-02). Assemblies may be installed at any height on the structure as long as the design pressure rating for the assemblies is not exceeded.
- H. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- I. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
1. Function of building, purpose of each area and degree of security required.
 2. Plans for existing and future key system expansion.
 3. Requirements for key control storage and software.
 4. Installation of permanent keys, cylinder cores and software.
 5. Address and requirements for delivery of keys.
- J. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures

- K. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.06 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.07 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties 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. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.08 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

2.00 PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.02 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 - 4. Hinge Options: Comply with the following:

- a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
- 5. Manufacturers:
 - a. McKinney (MK) - TA/T4A Series, 5 knuckle.

2.03 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
 - 1. Manufacturers:
 - a. Match Existing, Field Verify.
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 - 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 - 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 - 4. Tubular deadlocks and other auxiliary locks.
 - 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 6. Keyway: Match Facility Standard.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - 3. Existing System: Field verify and key cylinders to match Owner's existing system.
- D. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Two (2)
 - 2. Master Keys (per Master Key Level/Group): Five (5).
 - 3. Construction Keys (where required): Ten (10).
- E. Construction Keying: Provide construction master keyed cylinders.
- F. Key Registration List (Bitting List):
 - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 - 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.04 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 - 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
 - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 - 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 - 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 - 4. Dustproof Strikes: BHMA A156.16.

2.05 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 - 1. Exit devices shall have a five-year warranty.
 - 2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 - 3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 - 4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 - 5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 - 6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
 12. Hurricane and Tornado Resistance Compliance: Conventional exit devices are to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.
- B. Security Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed rim panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be constructed of high grade, heat treated, corrosion resistant nickel steel alloy, and have a full 3/4" throw projection with slide action positive deadlocking.
1. Static Load Force Resistance: Minimum 3000 lbs certified independent tested.
 2. Manufacturers:
 - a. Yale (YA) - 7050 Series.

2.06 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete

spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.
2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC6000 Series.
 - b. Norton Rixson (NO) - 7500 Series.
 - c. Sargent Manufacturing (SA) - 351 Series.

2.07 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 1. Pemko (PE).
 2. Reese Enterprises, Inc. (RE).

2.08 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.09 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.02 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.03 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal,

storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.04 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.05 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.06 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.07 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.08 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not

included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

3.09 MANUFACTURER'S ABBREVIATIONS:

DOORS 100A AND 101B ARE SUBJECT TO COMPLIANCE FOR IMPACT RESISTANCE & WINDLOAD REQUIREMENTS OF TEXAS DEPARTMENT OF INSURANCE (TDI) PRODUCT EVALUATION LISTINGS.

1. MK - McKinney
2. YA - Yale
3. NO - Norton
4. PE - Pemko
5. RO - Rockwood

Hardware Sets				
Set: 1.0				
Doors: 100A, 101B				
3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D MK	MK
1	Rim Exit Device, Nightlatch	7150 WS AU627F 1109 x 6-Pin	630	YA
1	Surface Closer	CLP7500	689	NO
1	Threshold	171A		PE
1	Gasketing	316AV TKSP		PE
1	Sweep 315CN TKSP	315CN TKSP		PE
Set: 2.0				
Doors: 101C				
3	Hinge, Full Mortise TA2714 4-1/2" x 4-1/2"	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Rim Exit Device, Classroom	7150 WS AU626F 1109 x 6-Pin	630	YA
1	Surface Closer	CLP7500	689	NO
3	Silencer	608-RKW		RO
Set: 3.0				
Doors: 101A				
1	Hardware supplied with door			00

END OF SECTION

08 11 13 HOLLOW METAL DOORS AND FRAMES

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:

1. Standard hollow metal doors and frames – interior door.
2. Texas Department of Insurance (TDI) Product Evaluation listed hollow metal doors and frames – exterior doors.

B. Related Sections:

1. Division 03 Section "Cast-In-Place Concrete" for anchors and fasteners on concrete walls.
2. Division 08 Sections "Door Hardware" for included hardware for interior and exterior doors.
3. Division 09 Sections "Painting" for field painting hollow metal doors and frames.

1.03 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non vented plastic.
 - 1. Provide additional protection to prevent damage to finish of factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.07 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.08 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.09 WARRANTY

- A. Provide manufacturer's written warranty against defects in materials and workmanship upon final completion and acceptance of Work in this section.
- B. Warranty period is ten years.

2.00 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Interior Standard Doors and Frames subject to compliance with requirements, provide products by one of the following:
 - 1. Amweld Building Products, LLC.
 - 2. Benchmark; a division of Therma-Tru Corporation.
 - 3. Ceco Door Products; an ASSA ABLOY Group company.
 - 4. CURRIES Company; an ASSA ABLOY Group company.
 - 5. Deansteel Manufacturing Company, Inc.
 - 6. Firedoor Corporation.

7. Fleming Door Products Ltd.; an Assa Abloy Group company.
 8. Habersham Metal Products Company.
 9. Kewanee Corporation (The).
 10. Mesker Door Inc.
 11. Pioneer Industries, Inc.
 12. Security Metal Products Corp.
 13. Steelcraft; an Ingersoll-Rand company.
- B. Manufacturers: Per TDI Evaluation Index for Impact-Resistant, Exterior doors, frames hardware and connections. No substitutions permitted.
1. Cal-Royal Products, Inc. – DKS Series 1800 Single, Outswing doors.
 2. Ceco Door, a Division of ASSA ABLOY Door Group – Model 707 Opaque Commercial Steel Outswing, Side-Hinged doors.
 3. CURRIES, Division of AADG Inc. – Model 707 and Model 747 Commercial Flush Steel Outswing Side Hinged Doors.
 4. Daybar Industries LTD – Series LS20GA Flush Commercial Steel Outswing Side Hinged Door with Series AS 18-ga Steel Frame.
 5. Daybar Industries LTD – Series LS18 Flush Commercial Steel Outswing Side Hinged Door.
 6. Diamond Door Products – Diamond GEM 130 mph Series and Diamond GEM 150 mph Series Steel Opaque Side Hinged Doors, Outswing.
 7. JELD-WEN Windows & Doors – Series “Gladiator/Finishield” Outswing Opaque 25 Gauge Steel Side Hinged Doors.
 8. Masonite Exterior Door Products – Metal Edge, Steel, Opaque, Outswing Hinged Doors with Two-Piece Adjustable Frame, Singles and Doubles.
 9. Mesker Door, Inc. – “NVS” Series Commercial Steel Opaque Outswing Side Hinged Doors.
 10. Steelcraft Manufacturing Company, Schlage Lock Company – Commercial Steel Hinged Doors, Flush Outswing, Singles and Doubles.

2.02 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
 - F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
 - G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
 - H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
 - I. Glazing: Comply with requirements in Division 08 Section "Glazing."
 - J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.03 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
 1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard polystyrene, polyurethane or polyisocyanurate, core.
 - a. Thermal-Rated (Insulated) Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) when tested according to ASTM C 1363.
 - 1). Locations: Exterior doors and interior doors.
 3. Vertical Edges for Single-Acting Doors: Manufacturer's standard.
 4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).

- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
 - 1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.04 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as full profile welded unless otherwise indicated.
 - 3. Frames for Level 3 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet.
 - 1. Fabricate frames with mitered or coped corners.
 - 2. Fabricate frames as full profile welded unless otherwise indicated.
 - 3. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.05 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Post installed Expansion Type for In-Place Concrete: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.06 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 2. Fire Door Cores: As required to provide fire-protection ratings indicated.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Post installed Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c
 5. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.07 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive non templated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - b. Install frames with removable glazing stops located on secure side of opening.
 - c. Install door silencers in frames before grouting.

- d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - f. Field apply bituminous coating to backs of frames that are filled with grout containing anti freezing agents.
 - g. At fire-rated openings, install frames according to NFPA 80.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
 5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

3.04 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION

08 33 23 OVERHEAD COILING DOORS

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Texas Department of Insurance (TDI) Product Evaluation listed Service doors only.
- B. Related Sections:
 - 1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.

1.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design overhead coiling doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance, Exterior Doors: Exterior overhead coiling doors shall withstand the wind loads, the effects of gravity loads, and loads and stresses within limits and under conditions indicated according to SEI/ASCE 7.
 - 1. Wind Loads: As indicated on Drawings Sheet S-1.
 - 2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
- C. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.
- D. Windborne-Debris-Impact-Resistance Performance: Provide impact-protective overhead coiling doors that pass missile-impact and cyclic-pressure tests when tested according to ASTM E1886 and ASTM E1996.
 - 1. Large Missile Test: For overhead coiling doors located within 30 feet (9.144 m) of grade.
 - 2. Small Missile Test: For overhead coiling doors located more than 30 feet (9.144 m) above grade.
- E. Operation Cycles: Provide overhead coiling door components and operators capable of operating for not less than number of cycles indicated for each door. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:

1. Construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
 3. For fire-rated doors, description of fire-release system including testing and resetting instructions.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. 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. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For overhead coiling doors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Detail fabrication and assembly of seismic restraints.
 2. Summary of forces and loads on walls and jambs.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
1. Obtain operators and controls from overhead coiling door manufacturer.

1.08 WARRANTY

- A. Provide manufacturer's written warranty against defects in materials and workmanship upon final completion and acceptance of Work in this section.
- B. Warranty period is ten years.

2.00 PRODUCTS

2.01 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A6653M, with G90 (Z275) zinc coating; nominal sheet thickness 24-gauge and as required to meet requirements.
 - 2. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
 - 3. Gasket Seal: Provide insulated slats with manufacturer's standard interior-to-exterior thermal break or with continuous gaskets between slats.
- B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- C. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from manufacturer's standard hot-dip galvanized steel, stainless steel, or aluminum extrusions to match curtain slats and finish.

2.02 HOOD

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - 1. Galvanized Steel: 24-gauge thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A6653M.

2.03 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - 1. Lock Cylinders: Provide cylinders specified in Section 08 71 00 "Door Hardware".

2.04 CURTAIN ACCESSORIES

- A. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire perimeter of door for a weathertight installation, unless otherwise indicated.
 - 1. At door head, use 1/8-inch (3-mm) thick, replaceable, continuous sheet secured to inside of hood.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch (3-mm) thick seals of flexible vinyl, rubber, or neoprene.
- B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

1. Provide pull-down straps or pole hooks for doors more than 84 inches (2130 mm) high.

2.05 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in/ft. (2.5 mm/m) of span under full load.
- C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.
- F. Track: Galvanized steel. No welded track for ease of maintenance.

2.06 DOOR ASSEMBLY

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 1. Product: Subject to compliance with requirements in TDI Product Evaluation listing for Impact-Resistant Roll-up doors. No substitutions permitted.
 - a. Overhead coiling Doors.
 - 1). Amarr Garage Doors – CP0001/CP0651 Insulated Steel Roll-up Doors.
 - 2). Clopay Corporation – CP0001/CP0651 Insulated Steel Roll-up Doors.
 - 3). Cookson Company, Inc. – CP0001/CP0651 Insulated Steel Roll-up Doors.
 - 4). Cornell Iron Works, Inc. – CP0001/CP0651 Insulated Steel Roll-up Doors.
 - 5). Overhead Door Corporation – Steel Roll Up Service Doors.
 - 6). Raynor Garage Doors – Models 'FF' and 'IF' DuraCoil Steel Roll-up Doors.
- B. Operation Cycles: Not less than 20,000.
 1. Include tamperproof cycle counter.
- C. Curtain R-Value: 4.5 F x h x sq. ft./BTU (0.792 K x sq. m/W).
- D. Door Curtain Material: Galvanized steel.
- E. Door Curtain Slats: Flat profile slats of [2-5/8-inch (67-mm)] center-to-center height.
 1. Slat Interior Facing: Metal.

- F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.
- G. Hood: Galvanized steel.
 - 1. Shape: Round.
 - 2. Mounting: Face of wall.
- H. Locking Devices: Equip door with locking device assembly.
 - 1. Locking Device Assembly: Cremone type, both jamb sides locking bars, operable from inside with thumb turn and electronic interconnect with operator to assure door operator will not operate when door is locked.
- I. Door Finish:
 - 1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range of colors.
 - 2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.07 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assembled or installed to minimize contrast.

2.08 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

- B. Install overhead coiling doors, hoods, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

3.03 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.04 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide weathertight fit around entire perimeter.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

08 71 00 DOOR HARDWARE

1.00 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ASTM E1886 - Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials.
 - 3. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure difference.
 - 4. ASTM E1996 - Standard specification for performance of exterior windows, curtain walls, doors and storm shutters impacted by Windborne Debris in Hurricanes.
 - 5. ICC/IBC - International Building Code.
 - 6. NFPA 70 - National Electrical Code.
 - 7. NFPA 80 - Fire Doors and Windows.
 - 8. NFPA 101 - Life Safety Code.
 - 9. NFPA 105 - Installation of Smoke Door Assemblies.
 - 10. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series.
 - 2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
 - 3. ANSI/UL 294 - Access Control System Units.

4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.03 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Proof of Qualification: Provide copy of manufacturer(s) Factory Trained Installer documentation indicating proof of status as a qualified installer of Windstorm assemblies.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

- E. Informational Submittals:
 - 1. Hurricane Resistant Openings: Exterior hurricane opening assemblies to be tested according to ASTM E330, ASTM E1886, ASTM E1996 standards, and certified by a qualified independent third party testing agency acceptable to authority having jurisdiction, with labeling indicating compliance with the wind load and design pressure level requirements specified for the Project.
 - 2. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.04 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Windstorm Assembly Installer Qualifications: Installers are to be factory trained for shop and field installation prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project. A pre-installation site inspection of the frame and floor conditions shall be conducted by the factory trained installer prior to any Windstorm assembly hardware applied to the opening.
- F. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
- G. Hurricane Resistant Exterior Openings (State of Texas): Provide exterior hollow metal and door hardware assemblies approved by the Texas Department of Insurance, including anchorage, capable of withstanding wind load design pressures calculated for this project by

a registered architect or engineer and are part of the construction documents per the Texas Department of Insurance, authorities having jurisdiction, and the International Building Code Design Loads Section 1609.

1. Each unit to bear third party permanent label in accordance with the Texas Department of Insurance requirements applicable to project.
 2. Hurricane Resistance Test Performance: Provide hollow metal and door hardware approved assemblies that pass large missile-impact tests, as required by Texas Department of Insurance systems location above grade and cyclic-pressure tests according to testing requirements of authorities having jurisdiction.
 - a. Impact Resistance: Hollow metal with approved door hardware assemblies must satisfy the Texas Department of Insurance's criteria for protection from windborne debris in both the Inland I zone and the Seaward zone. Assemblies must pass the large missile impact test (which equates to Missile Level D specified in ASTM E 1996-02). Assemblies may be installed at any height on the structure as long as the design pressure rating for the assemblies is not exceeded.
- H. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- I. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
1. Function of building, purpose of each area and degree of security required.
 2. Plans for existing and future key system expansion.
 3. Requirements for key control storage and software.
 4. Installation of permanent keys, cylinder cores and software.
 5. Address and requirements for delivery of keys.
- J. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures

- K. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.06 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.07 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties 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. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

1.08 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

2.00 PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.02 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
 - 4. Hinge Options: Comply with the following:

- a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
- 5. Manufacturers:
 - a. McKinney (MK) - TA/T4A Series, 5 knuckle.

2.03 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
 - 1. Manufacturers:
 - a. Match Existing, Field Verify.
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
 - 1. Threaded mortise cylinders with rings and cams to suit hardware application.
 - 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 - 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 - 4. Tubular deadlocks and other auxiliary locks.
 - 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 - 6. Keyway: Match Facility Standard.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - 3. Existing System: Field verify and key cylinders to match Owner's existing system.
- D. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Two (2)
 - 2. Master Keys (per Master Key Level/Group): Five (5).
 - 3. Construction Keys (where required): Ten (10).
- E. Construction Keying: Provide construction master keyed cylinders.
- F. Key Registration List (Bitting List):
 - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 - 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.04 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 - 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
 - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 - 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 - 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 - 4. Dustproof Strikes: BHMA A156.16.

2.05 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 - 1. Exit devices shall have a five-year warranty.
 - 2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
 - 3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 - 4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 - 5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 - 6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
 12. Hurricane and Tornado Resistance Compliance: Conventional exit devices are to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or tornado resistant products that have been independent third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.
- B. Security Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed rim panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be constructed of high grade, heat treated, corrosion resistant nickel steel alloy, and have a full 3/4" throw projection with slide action positive deadlocking.
1. Static Load Force Resistance: Minimum 3000 lbs certified independent tested.
 2. Manufacturers:
 - a. Yale (YA) - 7050 Series.

2.06 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete

spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.
2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC6000 Series.
 - b. Norton Rixson (NO) - 7500 Series.
 - c. Sargent Manufacturing (SA) - 351 Series.

2.07 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 1. Pemko (PE).
 2. Reese Enterprises, Inc. (RE).

2.08 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.09 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.02 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.03 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal,

storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.04 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.05 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.06 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.07 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.08 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not

included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

3.09 MANUFACTURER’S ABBREVIATIONS:

DOORS 100A AND 101B ARE SUBJECT TO COMPLIANCE FOR IMPACT RESISTANCE & WINDLOAD REQUIREMENTS OF TEXAS DEPARTMENT OF INSURANCE (TDI) PRODUCT EVALUATION LISTINGS.

1. MK - McKinney
2. YA - Yale
3. NO - Norton
4. PE - Pemko
5. RO - Rockwood

Hardware Sets				
Set: 1.0				
Doors: 100A, 101B				
3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D MK	MK
1	Rim Exit Device, Nightlatch	7150 WS AU627F 1109 x 6-Pin	630	YA
1	Surface Closer	CLP7500	689	NO
1	Threshold	171A		PE
1	Gasketing	316AV TKSP		PE
1	Sweep 315CN TKSP	315CN TKSP		PE
Set: 2.0				
Doors: 101C				
3	Hinge, Full Mortise TA2714 4-1/2" x 4-1/2"	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Rim Exit Device, Classroom	7150 WS AU626F 1109 x 6-Pin	630	YA
1	Surface Closer	CLP7500	689	NO
3	Silencer	608-RKW		RO
Set: 3.0				
Doors: 101A				
1	Hardware supplied with door			00

END OF SECTION

08 90 00 LOUVERS AND VENTS

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
 - 1. Fixed, extruded-aluminum louvers.

1.03 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
- C. Vertical Louver: Louver with vertical blades; i.e., the axes of the blades are vertical.
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Storm-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.04 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Louver shall be Florida Product Approved, and tested in accordance with AMCA 540 "Test Method for Louvers Impacted by Wind Borne Debris"
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
 - 1. Temperature Change (Range): 120 F (67 C), ambient; 180 F (100 C), material surfaces.
- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
 - 3. Wiring Diagrams: For power, signal, and control wiring for motorized adjustable louvers.

1.06 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.07 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.08 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

2.00 PRODUCTS

2.01 MATERIALS

- A. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B209 (ASTM B209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Aluminum Castings: ASTM B26M, Alloy 319.
- D. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use Phillips flat-head, hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.

3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
 4. For fastening stainless steel, use 300 series stainless-steel fasteners.
 5. For color-finished louvers, use fasteners with heads that match color of louvers.
- E. Post-installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to four times the loads imposed, for concrete, or six times the load imposed, for masonry, as determined by testing per ASTM E488, conducted by a qualified independent testing agency.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

2.02 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
- C. Maintain equal louver blade spacing including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
1. Frame Type: Channel unless otherwise indicated.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
1. Fully Recessed Mullions: Where indicated, provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.
 2. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
 3. Exterior Corners: Prefabricated corner units with mitered and welded blades and with fully recessed mullions at corners.
- G. Provide subsills made of same material as louvers or extended sills for recessed louvers.

- H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.03 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Storm-Resistant Louver L-1, L-2, L-3:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Arrow United Industries; a division of Mestek, Inc.
 - b. Ruskin Company; Tomkins PLC.
2. Louver Depth: 6 inches (100 mm)
3. Frame and Blade Nominal Thickness: Not less than 0.080 inch (2.03 mm) for blades and 0.125 inch for frames.
4. Louver Performance Ratings:
 - a. Free Area: Not less than 9.41 ft for 48-inch (1220-mm) wide by 48-inch (1220-mm) high louver.
 - b. Air Performance: Not more than 0.10-inch wg static pressure drop 800-fpm (free-area intake velocity). Not more than 0.10-inch wg static pressure drop 850-fpm free-area exhaust velocity.
5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.04 LOUVER SCREENS

A. General: Provide screen at each exterior louver

1. Screen Location for Fixed Louvers: Interior face.
2. Screen Location for Louvers connected to radiator: Exterior.
3. Screening Type: Bird screening except where insect screening is indicated

B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches (150 mm) from each corner and at 12 inches (300 mm) o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
2. Type: Non-rewirable, U-shaped frames.

D. Louver Screening for Aluminum Louvers:

1. Bird Screening: Aluminum, 1/2-inch (13-mm) square mesh, 0.063-inch (1.60-mm) wire.
2. Insect Screening: Aluminum, 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire.

2.05 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.06 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
 - 1. Color: As selected by owner from full range of industry color and densities.
- C. Conversion-Coated Finish: AA-C12C42 (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating).
- D. Conversion-Coated and Factory-Primed Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below).
 - 1. Organic Coating: Air-dried primer of not less than 2-mil (0.05-mm) dry film thickness.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.03 INSTALLATION

- A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

- F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during louver installation.

3.04 ADJUSTING AND CLEANING

- A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.
- B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

09 91 00 PAINTING

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes surface preparation and the application of paint systems on exterior and interior substrates.
 - 1. Concrete.
 - 2. Steel and iron.
- B. Related Requirements:
 - 1. Section 08 11 13 "Hollow Metal Doors and Frames"

1.03 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.

2. Apply coats on Samples in steps to show each coat required for system.
 3. Label each coat of each Sample.
 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Paint: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.06 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

- C. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

2.00 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Basis of design: Benjamin Moore & Co. is preferred by the owner, but subject to compliance with requirements, provide optional products by one of the following:
 - 1. Behr Process Corporation.
 - 2. Benjamin Moore & Co.
 - 3. Dulux (formerly ICI Paints); a brand of AkzoNobel.
 - 4. Glidden Professional.
 - 5. PPG Architectural Finishes, Inc.
 - 6. Sherwin-Williams Company (The).
- B. Products: Subject to compliance with requirements, provide one of the products\ listed in the Interior Painting Schedule for the paint category indicated.

2.02 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.
- D. Colors: As indicated in finish schedule.

2.03 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with

rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer. But not less than the following:

1. SSPC-SP 2.
 2. SSPC-SP 3.
 3. SSPC-SP 7/NACE No. 4.
 4. SSPC-SP 11.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.03 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed in equipment rooms:
 - a. Uninsulated metal piping.
 - b. Uninsulated plastic piping.
 - c. Pipe hangers and supports.
 - d. Metal conduit.
 - e. Plastic conduit.

- f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.04 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 1. Water-Based Light Industrial Coating System MPI INT 3.1L:

- a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based (MPI Gloss Level 3), MPI #151.
- B. Steel Substrates:
- 1. Latex System, Alkyd Primer MPI INT 5.1Q:
 - a. Prime Coat: Primer, alkyd, quick dry, for metal, MPI #76.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), MPI #53.

3.07 EXTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
- 1. Latex System MPI EXT 3.1A:
 - a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
 - b. Intermediate Coat: Latex, exterior, matching topcoat.
 - c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.
 - d. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.
 - 2. Latex over Latex Aggregate System MPI EXT 3.1B:
 - a. Intermediate Coat: Latex, exterior, matching topcoat.
 - b. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.
 - c. Topcoat: Latex, exterior, low sheen (MPI Gloss Level 3-4), MPI #15.
 - 3. Latex Aggregate System MPI EXT 3.1N:
 - a. Prime Coat: As recommended in writing by topcoat manufacturer.
 - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
 - c. Topcoat: Textured coating, latex, flat, MPI #42.
 - 4. Water-Based Light Industrial Coating System MPI EXT 3.1C:
 - a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
 - b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #161.
 - d. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), MPI #163.
- B. Steel and Iron Substrates:
- 1. Water-Based Light Industrial Coating System MPI EXT 5.1M:

- a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
- b. Prime Coat: Shop primer specified in Section where substrate is specified.
- c. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
- d. Topcoat: Light industrial coating, exterior, water based (MPI Gloss Level 3), MPI #16.
- e. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), MPI #163.

END OF SECTION

10 44 01 FIRE EXTINGUISHERS

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.
- C. Warranty: Sample of special warranty.

1.04 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.05 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

2.00 PRODUCTS

2.01 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ansul Incorporated; Tyco International Ltd.
 - b. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - c. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - d. Larsen's Manufacturing Company.
 - e. Pyro-Chem; Tyco Safety Products.
2. Valves: Manufacturer's standard
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

2.02 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - a. Ansul Incorporated; Tyco International Ltd.
 - b. Fire End & Croker Corporation.
 - c. J. L. Industries, Inc.; a division of Activar Construction Products Group.
 - d. Larsen's Manufacturing Company.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

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23 05 13 COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.03 DEFINITIONS

- A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.05 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices and features that comply with the following:
 - 1. Compatible with the following:
 - a. Magnetic controllers.
 - b. Multispeed controllers.
 - c. Reduced-voltage controllers.
 - 2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
 - 3. Matched to torque and horsepower requirements of the load.
 - 4. Matched to ratings and characteristics of supply circuit and required control sequence.
 - 5. Ambient and environmental conditions of installed location.

2.00 PRODUCTS

2.01 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.
- C. Motor requirements apply to factory-installed motors except as follows:
 - 1. Different ratings, performance, or characteristics for a motor are specified in another Section.
 - 2. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

2.02 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 105 F (40 C) and at altitude of 3300 feet (1005 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.
- C. Enclosure: Unless indicated otherwise, provide the following enclosure type:
 - 1. Open Dripproof (ODP): Ventilation openings are arranged to prevent liquid drops from affecting performance when falling within a 15-degree angle from the vertical. Use: Indoors, in moderately clean environments.
 - 2. Totally Enclosed, Nonventilated (TENV): No ventilation openings in housing. Cooling by convection and radiation only. This enclosure type is limited to small integral (5 HP and smaller), fractional, and subfractional motor sizes. Use: In damp, dirty, corrosive, or contaminated environments.
 - 3. Totally Enclosed, Fan Cooled (TEFC): A fan on the motor shaft, outside the stator housing and within a protective shroud, blows cooling air over the motor. Use: Outdoors.
 - 4. Totally Enclosed, Air Over (TEAO): Motors used in vane- or tube-axial or propeller fan applications where the velocity and temperature of the airstream are appropriate for cooling the motor without the energy waste of another fan on the motor shaft.
 - 5. Severe Duty: Totally enclosed. The enclosure is designed to withstand harsh, wet, and chemically laden environments typically encountered in chemical and industrial processing plants. The motors have extra seals, gasketing, and corrosion-resistant finishes on both the interior and exterior enclosure surfaces. Motors are manufactured to IEEE 841 requirements. Use: In harsh, wet, and chemically laden environments.

6. Explosion Proof (EP): Totally enclosed. The enclosure is designed to withstand an internal explosion of a specific gas or vapor mixture and to prevent the escape of ignition products to the gas or vapor mixture surrounding the motor. Motors must be UL approved or CSA International (CSA) certified for specific hazard classifications, and are covered by NFPA 70, Article 500, for use in hazardous locations, Class I, Group A, B, C, or D.
7. Dust-Ignition-Proof: Totally enclosed. The enclosure is designed to exclude ignitable amounts of dust or amounts that might affect performance or rating, and to prevent the escape of ignition products to cause ignition of exterior accumulations or atmospheric suspensions of a specific dust on or in the vicinity of the enclosure. Motors must be UL approved or CSA certified for specific hazard classifications, and are covered by NFPA 70, Article 500, for use in hazardous locations, Class II, Group E, F, or G.

2.03 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient as defined in NEMA MG 1.
- C. Service factor: 1.15.
- D. Stator: Copper windings, unless otherwise indicated.
 1. Multispeed motors shall have separate winding for each speed.
- E. Rotor: Random wound 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, unless otherwise indicated.
- 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.

2.04 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- 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: Inverter – duty rated. 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. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

- 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.05 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. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- 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.

3.00 EXECUTION (NOT USED)

END OF SECTION

23 05 29 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes hangers and supports for mechanical system piping and equipment.
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Fastener systems.

1.03 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.04 SUBMITTALS

- A. Shop Drawings: Signed and sealed by a qualified professional engineer for each multiple piping support, trapeze and seismic restraint. Include design calculations and indicate size and characteristics of components and fabrication details.
- B. Welding Certificates: Copies of certificates for welding procedures and operators.

1.05 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.
 - 1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

2.00 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Pipe Hangers:
 - a. AAA Technology and Specialties Co., Inc.
 - b. B-Line Systems, Inc.
 - c. Carpenter & Patterson, Inc.
 - d. Empire Tool & Manufacturing Co., Inc.
 - e. Globe Pipe Hanger Products, Inc.
 - f. Grinnell Corp.
 - g. GS Metals Corp.
 - h. Michigan Hanger Co., Inc.
 - i. National Pipe Hanger Corp.
 - j. PHD Manufacturing, Inc.
 - k. PHS Industries, Inc.
 - l. Piping Technology & Products, Inc.
 - 2. Thermal-Hanger Shield Inserts:
 - a. Carpenter & Patterson, Inc.
 - b. Michigan Hanger Co., Inc.
 - c. PHS Industries, Inc.
 - d. Pipe Shields, Inc.
 - e. Rilco Manufacturing Co., Inc.
 - f. Value Engineered Products, Inc.
 - 3. Powder-Actuated Fastener Systems:
 - a. Gunnebo Fastening Corp.
 - b. Hilti, Inc.
 - c. ITW Ramset/Red Head.
 - d. Masterset Fastening Systems, Inc.

2.02 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to “Hanger and Support Applications” Article in Part 3 for where to use specific hanger and support types.
 - 1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
 - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

3. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
 4. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.
1. Material for Cold Piping: ASTM C552, Type I cellular glass or water-repellent-treated, ASTM C533, Type I calcium silicate with vapor barrier.
 2. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.

2.03 MISCELLANEOUS MATERIALS

- A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Do not use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick.
- B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Do not use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick.

3.00 EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification 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 (DN15 to DN750).
 2. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30 (DN15 to DN750).
 3. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN25 to DN750), from two rods if longitudinal movement caused by expansion and contraction might occur.
- D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500).
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.
- E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification 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 F (49 to 232 C) piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 F (49 to 232 C) piping installations.
- F. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification 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 by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

3.02 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
- C. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- D. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- E. Install hangers and supports to allow controlled thermal 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.
- F. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- H. Insulated Piping: Comply with the following:
 1. Attach clamps and spacers to piping.

- a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
- b. Do not exceed pipe stress limits according to ASME B31.9.
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 (DN100) and larger if pipe is installed on rollers.
3. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - c. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - d. NPS 8 to NPS 14 (DN200 to DN350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - e. NPS 16 to NPS 24 (DN400 to DN600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
4. Insert Material: Length at least as long as protective shield.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.05 PAINTING

- A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION

23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
 1. Equipment nameplates.
 2. Equipment markers.
 3. Equipment signs.
 4. Access panel and door markers.
 5. Duct markers.
 6. Stencils.
 7. Warning tags.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.

1.04 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.05 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 location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

2.00 PRODUCTS

2.01 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:
 - a. Manufacturer, product name, model number, and serial number.
 - b. Capacity, operating and power characteristics, and essential data.
 - c. Labels of tested compliances.
 2. Location: Accessible and visible.
 3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
1. Terminology: Match schedules as closely as possible.
 2. Data:
 - a. Name and plan number.
 - b. Equipment service.
 - c. Design capacity.
 - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
 3. Size: 2-1/2 by 4 inches (64 by 100 mm) for control devices, dampers, and valves; 4-1/2 by 6 inches (115 by 150 mm) for equipment.
- C. Equipment Signs: ASTM D709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Data: Instructions for operation of equipment and for safety procedures.
 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
 3. Thickness: 1/16 inch (1.6 mm) for units up to 20 sq. in. (130 sq. cm) or 8 inches (200 mm) in length, and 1/8 inch (3.2 mm) for larger units.
 4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- D. Access Panel and Door Markers: 1/16-inch (1.6-mm) thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch (3.2-mm) center hole for attachment.
1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.02 DUCT IDENTIFICATION DEVICES

- A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.03 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 markers, equipment markers, equipment signs, and similar operational instructions.
 - 1. Stencil Paint: Exterior, gloss, alkyd enamel or acrylic enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 2. Identification Paint: Exterior, alkyd enamel or acrylic enamel in colors according to ASME A13.1, unless otherwise indicated.

2.04 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
 - 1. Size: Approximately 4 by 7 inches (100 by 178 mm).
 - 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.

3.00 EXECUTION

3.01 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.02 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
 - 1. Letter Size: Minimum 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 2/3 to 3/4 the size of principal lettering.

2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
 - a. Meters, gages, thermometers, and similar units.
 - b. Fans, blowers, primary balancing dampers, and mixing boxes.
- C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
1. Identify mechanical equipment with equipment markers in the following color codes:
 - a. Green: For cooling equipment and components.
 - b. Yellow: For heating equipment and components.
 - c. Green and Yellow: For combination cooling and heating equipment and components.
 - d. Brown: For energy-reclamation equipment and components.
 2. Letter Size: Minimum 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 2/3 to 3/4 the size of principal lettering.
 3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
- D. Install access panel markers with screws on equipment access panels.

3.03 DUCT IDENTIFICATION

- A. Install duct markers with permanent adhesive on air ducts in the following color codes:
1. Blue: For exhaust.
 2. ASME A13.1 Colors and Designs: For hazardous material exhaust.
 3. Letter Size: Minimum 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 2/3 to 3/4 the size of principal lettering.
- B. Stenciled Duct Marker Option: Stenciled markers, showing service and direction of flow, may be provided instead of laminated-plastic duct markers, 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 markers 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.

3.04 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

3.05 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.06 CLEANING

- A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION

23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC

1.00 GENERAL

1.01 SUMMARY

A. This Section includes TAB to produce design objectives for the following:

1. Air Systems:
 - a. Constant-volume air systems.
2. HVAC equipment quantitative-performance settings.
3. Verifying that automatic control devices are functioning properly.
4. Reporting results of activities and procedures specified in this Section.

1.02 SUBMITTALS

- A. Strategies and Procedures Plan: Within 30 days from Contractor's Notice to Proceed, submit four copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- B. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- C. Warranties specified in this Section.

1.03 QUALITY ASSURANCE

- A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.
- B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," as applicable.

1.04 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
- B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.05 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.06 WARRANTY

- A. National Project Performance Guarantee: If AABC, provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.
- B. Special Guarantee: If NEBB, provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
 - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
 - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

2.00 PRODUCTS (NOT APPLICABLE)

3.00 EXECUTION

3.01 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.
 - 1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine Project Record Documents described in Division 01.

- 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 equipment performance data including fan and pump curves. 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. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine strainers for clean screens and proper perforations.
- L. Examine equipment for installation and for properly operating safety interlocks and controls.
- M. Examine automatic temperature system components to verify the following:
 - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
 - 2. Dampers and valves are in the position indicated by the controller.
 - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
 - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
 - 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
 - 6. Sensors are located to sense only the intended conditions.
 - 7. Sequence of operation for control modes is according to the Contract Documents.

8. Controller set points are set at indicated values.
 9. Interlocked systems are operating.
 10. Changeover from heating to cooling mode occurs according to indicated values.
- N. 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.

3.02 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
 1. Permanent electrical power wiring is complete.
 2. Automatic temperature-control systems are operational.
 3. Equipment and duct access doors are securely closed.
 4. Balance, smoke, and fire dampers are open.
 5. Isolating and balancing valves are open and control valves are operational.
 6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," as applicable, and this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.04 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. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- D. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling unit components.
- K. Check for proper sealing of air duct system.

3.05 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 fan static pressures to determine actual static pressure as follows:
 - a. Measure outlet static pressure as far downstream from the fan as practicable 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 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.
 - 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
 - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
 - 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
 - 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
 - 5. Obtain approval from Owners Representative for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes at no additional cost.
 - 6. 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 modes 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 static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
 - 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. 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 terminal 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 terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using 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.

3.06 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer, model, and serial numbers.
 - 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 for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.07 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

3.08 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.
- G. Check the interaction of electrically operated switch transducers.
- H. Check the interaction of interlock and lockout systems.
- I. Check main control supply-air pressure and observe compressor and dryer operations.
- J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.09 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
 - 2. Air Outlets and Inlets: 0 to minus 10 percent.
 - 3. Heating-Water Flow Rate: 0 to minus 10 percent.
 - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.10 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
 - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. 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, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
1. Title page.
 2. Name and address of TAB firm.
 3. Project name.
 4. Project location.
 5. Architect/Engineer's name and address.
 6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB firm 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, type size, and fittings.
 14. Notes to explain why certain final data in the body of reports varies from indicated values.
 15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outside-, 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. Settings for supply-air, static-pressure controller.
 - g. Other system operating conditions that affect performance.

- E. 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 outside, 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.

3.11 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing 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 testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION

23 31 13 METAL DUCTS

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg (minus 500- to plus 2500-Pa). Metal ducts include the following:
 - 1. Rectangular ducts and fittings.

1.03 SUBMITTALS

- A. Shop Drawings: CAD-generated and drawn to 1/4 inch equals 1 foot (1:50) scale. Show fabrication and installation details for metal ducts.
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Duct layout indicating sizes and pressure classes.
 - 3. Elevations of top and bottom of ducts.
 - 4. Dimensions of main duct runs from building grid lines.
 - 5. Fittings.
 - 6. Reinforcement and spacing.
 - 7. Seam and joint construction.
 - 8. Equipment installation based on equipment being used on Project.
 - 9. Duct accessories, including access doors and panels.
 - 10. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.

1.04 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports, AWS D1.2, "Structural Welding Code--Aluminum," for aluminum supporting members and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. NFPA Compliance:
 - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
 - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

2.00 PRODUCTS

2.01 SHEET METAL 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: Lock-forming quality; complying with ASTM A653/A653M and having G60 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Aluminum Sheets: ASTM B209 (ASTM B209M), alloy 3003, temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.
- D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- E. 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).

2.02 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.
- B. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
- C. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
- D. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.
- E. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use O.
- F. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.03 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
 - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.

2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Nexus Inc.
 - c. Ward Industries, Inc.
- C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
1. Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Lockformer.
 2. Duct Size: Maximum 30 inches (750 mm) wide and up to 2-inch wg (500-Pa) pressure class.
 3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.
- D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches (480 mm) and larger and 0.0359 inch (0.9 mm) thick or less, with more than 10 sq. ft. (0.93 sq. m) of nonbraced panel area unless ducts are lined.

2.04 APPLICATION OF LINER IN RECTANGULAR DUCTS

- A. 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.
- B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
- C. Butt transverse joints without gaps and coat joint with adhesive.
- D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
- E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

3.00 EXECUTION

3.01 DUCT APPLICATIONS

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
 1. Exhaust Ducts (Negative Pressure): 2-inch wg.

3.02 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards-- Metal and Flexible," unless otherwise indicated.
- B. Install ducts with fewest possible joints.
- C. Install fabricated fittings for changes in directions, size, and shape and for connections.
- D. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches (300 mm), with a minimum of three screws in each coupling.
- E. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
- H. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- I. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- J. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- K. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

3.03 SEAM AND JOINT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards-- Metal and Flexible" for duct pressure class indicated.
- B. Seal ducts before external insulation is applied.

3.04 HANGING AND SUPPORTING

- A. Support horizontal ducts within 24 inches (600 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
- B. Support vertical ducts at maximum intervals of 16 feet (5 m) and at each floor.
- C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- D. Install concrete inserts before placing concrete.
- E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.

3.05 CONNECTIONS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.06 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:
 1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give 7 days' advance notice for testing.
 3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (500-Pa) (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg (500- to 2500-Pa).
 4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

3.07 CLEANING NEW SYSTEMS

- A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.
- B. Use service openings, as required, for physical and mechanical entry and for inspection.
 1. Create other openings to comply with duct standards.
 2. Disconnect flexible ducts as needed for cleaning and inspection.
 3. Remove and reinstall ceiling sections to gain access during the cleaning process.
- C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.
- D. Clean the following metal duct systems by removing surface contaminants and deposits:
 1. Air outlets and inlets.
- 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.
 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.
- F. Cleanliness Verification:
1. Visually inspect metal ducts for contaminants.
 2. Where contaminants are discovered, re-clean and reinspect ducts.

END OF SECTION

23 34 23 HVAC POWER VENTILATORS

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Propeller fans.

1.03 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base air ratings on actual site elevations.
- B. Operating Limits: Classify according to AMCA 99.

1.04 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.

1.05 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.

1.06 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.

1.07 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. Concrete, reinforcement, and formwork requirements are specified in Division 03 Sections.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 08 Sections.

1.08 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.

2.00 PRODUCTS

2.01 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: Subject to compliance with requirements, provide products by one of the following:
 - 1. Propeller Fans:
 - a. Aerovent; a Twin City Fan Company.
 - b. Breidert Air Products, Inc.
 - c. Carnes Company HVAC.
 - d. Chicago Blower Corp.
 - e. Cincinnati Fan & Ventilator Co.

- f. Cook, Loren Company.
- g. Hartzell Fan, Inc.
- h. ILG Industries, Inc./American Coolair Corp.
- i. JennFan; Div. of Breidert Air Products, Inc.
- j. PennBarry.

2.02 PROPELLER FANS

- A. Description: Direct-driven propeller fans consisting of fan blades, hub, housing, orifice ring, motor, drive assembly, and accessories.
- B. Housing: Galvanized steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
- C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
- D. Accessories:
 - 1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
 - 2. Wall Sleeve: Galvanized steel to match fan and accessory size.
 - 3. Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent.
 - 4. Disconnect Switch: Non-fusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

2.03 MOTORS

- A. Refer to specification "23 05 13 Common Motor Requirements for HVAC Equipment" for general requirements for factory-installed motors.
- B. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.
- C. Enclosure Type: Guarded drip-proof.

2.04 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."

3.00 EXECUTION

3.01 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Install units with clearances for service and maintenance.
- C. Label units according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

3.02 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. Flexible connectors are specified in Section 23 33 00 "Air Duct Accessories."
- 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.

3.03 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 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 Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" 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.

3.04 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Lubricate bearings.

3.05 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.

END OF SECTION

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23 35 16 ENGINE EXHAUST PIPING AND SPECIALTIES

1.00 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 piping and related specialties for engine exhaust systems.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Pipes and fittings
 - 2. Expansion Joints
 - 3. Accessories
- B. Welding certificates.
- C. Qualification Data: For Installers.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For engine exhaust piping specialties to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to AWS D1.1/D1.1M.

1.5 MEASUREMENT AND PAYMENT

- 1. No separate measurement and payment will be made for the installation of the piping, fittings, and accessories. Payment will be included in the applicable Contract lump sum or unit prices for which the work is incidental thereto. Price and payment shall constitute full compensation for furnishing all plant, labor, materials, and equipment, including accessories, all as shown on the drawings and as specified herein.

2.00 PRODUCTS

2.1 PIPES AND FITTINGS

- A. Schedule 20, Steel Pipe: ASTM A312, Type 304, Schedule 20, stainless steel as per ANSI B36.10.
 - 1. Flanges sized up to 8" shall be butt welded, 150 lb., ASTM A 182, F 304, raised face, slip on flange, B 16.5, in accordance with ANSI/ASME.
 - 2. Fittings shall be ASTM A403, standard wall, Type 304 stainless steel.

2.2 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for high temperature service.
 - 1. 1/8-inch maximum thickness, Garlock Style 3123.
 - a. Narrow-Face Type: For raised-face, Class 150, steel flanges.
- B. Flange Bolts and Nuts: ASTM A 193 Grade B8M and ASTM A 194 Grade 8M, stainless steel, unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 METAL EXPANSION JOINTS FOR ENGINE EXHAUST

- A. Expansion joints for high temperature service shall be supplied on the generator engine exhaust piping where shown on the drawings and as specified herein. These shall be sized to facilitate axial and lateral thermal expansion from the exhaust system.
- B. These joints shall be AISI 321 stainless steel, corrugated, flanged end, with internal sleeves suitable for rotational as well as axial movement. Joints shall be fitted with 150 lb. Standard flanges.
- C. Expansion joints shall be capable of 4 3/4" of axial movement, 1" of lateral travel, an axial spring rate no greater than 142 lb./in. and shall perform at exhaust temperatures up to 1000 deg.
- D. The engine exhaust expansion joint shall be BOA Series 3025E or approved equal.

2.4 EXHAUST PIPING INSULATION

- A. Pre-molded, calcium silicate, temperature range 100 degrees F to 1200 degrees F, "Clatemp" as manufactured by PABCO or equal, with #26 gauge aluminum sheet banded with # 22 gauge stainless steel straps.
- B. Terminate all insulation at building interior wall with aluminum cap.
- C. Exhaust insulation shall be 3 inches thick for piping 8 inches and larger, 2 inches thick for piping 6 inches and smaller.

2.5 WALL THIMBLE

- A. Ventilated stainless steel wall thimble. Conforms to NFPA 37 and 110. The thermal barrier used within the thimbles is to be composed of high density, type "E" fibers, fibrous glass heavy-duty insulation. Apply high-temp silicone caulking where needed. NETT Technologies/th-sscb-08000 or approved equal. Install per manufactures instructions.

3.00 EXECUTION

3.1 PIPING APPLICATIONS

- A. High-Temperature Engine Exhaust Piping: Use the following piping materials for each size range:
 - 1. NPS 18 and Smaller: Schedule 20, type 304 pipe; butt-welded, ASTM A403 butt-weld fittings.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of exhaust piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. 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 otherwise indicated.
- C. Equipment and Specialty Flanged Connections:
 - 1. Use steel companion flange with gasket for connection to existing silencer.
- D. Flanged joints may be used instead of specified joint for any piping system.
- E. Install piping free of sags and bends.
- F. Install fittings for changes in direction and branch connections.

- G. Install sleeves for piping penetrations of walls.
- H. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with all architectural requirements.

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Welded Joints for Steel Piping: Join according to AWS D10.12/D10.12M.
- D. Flanged Joints: Use asbestos-free, gasket suitable for high temperature exhaust. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with specification "23 05 29 Hangers And Supports For HVAC Piping And Equipment"

3.5 FIELD QUALITY CONTROL

- A. Perform field tests and inspections.
- B. Tests and Inspections:
 - 1. Piping Leak Tests for Exhaust Piping: Soap Bubble Test new and modified parts of exhaust piping.
 - 2. Repair leaks and retest until no leaks exist.

END OF SECTION

26 05 00 BASIC ELECTRICAL METHODS

1.00 GENERAL

1.01 SUMMARY

A. RELATED REQUIREMENTS

1. Division 01 Specification Sections apply to Work of this Section.

1.02 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

A. Regulatory Agencies: Installation, materials, equipment and workmanship shall conform to the applicable provisions of the following:

1. National Electrical Code (NEC).
2. National Electrical Safety Code (NESC).
3. Terms and conditions of the electrical utility and other authorities having lawful jurisdiction pertaining to the work required.

B. All temperature control wiring and associated conduit and boxes, shall be provided under other Sections of the Specifications. All power and control wiring, not identified under Divisions 22 and 23, shall be provided under Division 26.

C. The Work covered by Division 26 of the Specifications includes the furnishing of all materials, labor, transportation, tools, permits, and fees for the complete installation of all Electrical Work required in the Contract Drawings.

D. In the event that additional or special construction is required, Contractor is responsible for providing all material and equipment which are usually furnished with such construction in order to complete the installation, whether indicated or not.

E. Contractor shall familiarize himself with the existing conditions of the site and advise Architect of any discrepancy or conflict prior to bidding.

F. Contractor shall be responsible for all permits, fees, and licenses required for the Project. All cost of such permits or fees shall be included in the bid.

G. All equipment and material shall be installed in accordance with the applicable manufacturer's recommendations and standards.

H. Install sleeves, sealant pans, and roof penetrations as required for the installation of the Electrical Work. All such Work is subject to the approval of Architect.

I. Contractor shall be responsible for coordinating with the utility service provider to verify all locations, routing, equipment, and labor that will be furnished as a part of this Contract.

J. Any fees or charges associated with delivering permanent power for the Project shall be included in Contractor's bid.

1.03 SUBMITTALS

A. The intent of this Section is to give general submittal information; refer to specific submittal information in subsequent Mechanical Sections.

- B. Within 10 days after award of the Contract, and 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. Minimum of six copies, or as directed by Architect, of each shall be submitted and shall include all items mentioned by model number and/or manufacturer's name in the Specifications or in schedules on the Drawings.
- C. Requirements for Each Submittal:
1. Bear a dated stamp or specific written indication that Contractor has reviewed and approved all submittal prior to submission to Architect.
 2. Have all information deleted by Contractor that pertains to the means and methods of construction or to fabrication, assembly, installation, or erection (approval by Architect shall not extend to these areas unless specifically noted by Architect).
 3. Be clearly and SPECIFICALLY 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.
 5. Be complete with respect to quantities, dimensions, specific performance, materials, and similar data to enable the Architect to review the proposed equipment.

Omission by Contractor of any of the above requirements or submittals will subject submittal to automatic rejection without review.

Any submittals received by Architect that were not requested shall be returned without review of any kind.

2.00 PRODUCTS

2.01 EQUIPMENT REQUIREMENTS

- A. The electrical requirements for equipment specified or indicated on the Drawings are based on information available at the time of design. If equipment furnished for installation has electrical requirements other than indicated on the Electrical Drawings, Contractor shall make any required changes to wire and conduit size, controls, overcurrent protection, and installation as required to accommodate the equipment supplied, without additional charge to Owner. The complete responsibility and costs for such adjustments shall be assigned to the respective Section of this Specification under which the equipment is furnished.

2.02 MATERIALS

- A. All similar materials and equipment shall be the product of the same manufacturer unless specified otherwise.
- B. Materials and equipment shall be the standard products of manufacturers regularly engaged in the production of such material and shall be the manufacturer's current and standard design.

- C. Altitude: Equipment affected by altitude shall perform satisfactorily for the function intended at the altitude of the Project site.
- D. Detectable Warning Tape: Acid and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.
- E. Backfill Material:
 - 1. Material 4 inches below and 12 inches above pipes and conduit shall be natural or manufactured sand complying to ASTM C 33.
 - 2. Material more than 12 inches above pipes and conduits shall be sand indicated above or native fill free of rock or gravel larger than 3/8 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

3.00 EXECUTION

3.01 GENERAL

- A. Fabrication, erection, and installation of the complete electrical system shall be done in accordance with accepted good practice by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to impede the progress of the Project. Electrical Contractor shall check all areas and surfaces where electrical equipment material is to be installed, removed, or relocated, and report any unsatisfactory conditions before starting Work. Commencement of Work signifies this Contractor's acceptance of existing conditions. In the acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of workers. Surfaces requiring coatings will be completed prior to installation of any Electrical Work on these surfaces.
- B. The Electrical Drawings are diagrammatic. The installation requirements shall be carefully coordinated with structural, architectural, and mechanical conditions and shall be adjusted to avoid conflict.
- C. All Work shall be concealed in walls, ceilings, or chases unless specifically noted to be exposed or otherwise approved.
- D. The locations of electrical equipment are approximate and are not intended to convey the exact details and mounting of location of outlets, equipment and other items. Exact locations are to be field determined by actual measurements.
- E. The location height and projection of fixtures illuminating signs or special features shall be approved by Architect prior to installation.

- F. Contractor shall coordinate the location of all exterior fixtures with Architectural Drawings and Specifications.
- G. Consult the Architectural Drawings to determine wall finishes and locations of wall-mounted equipment, countertop splashes, and similar items to avoid conflict with electrical equipment. At locations where surface or pendant mounted light fixtures are noted, provide for all necessary framing channels, pendants, chains, canopies, and other hardware as required for a complete and operable system.
- H. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- I. Excavation for Pipe and Conduit:
 - 1. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 2. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 - 3. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - a. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
 - b. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
 - c. Excavate trenches 4 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
 - 4. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
 - 5. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - a. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material at 95 percent.
 - b. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 92 percent.
 - c. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.
 - 6. Install detectable warning tape above conduits and pipe, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

7. Protection:

- a. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- b. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1). Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- c. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1). Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible

8. Disposal of Surplus and Waste Materials:

- a. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property unless otherwise directed by Owner.
- b. Repair: Any damage to shrubs, grass or structures shall be repaired to previous condition by Contractor at no additional expense to Owner.

J. It shall be the responsibility of Division 26 Contractor to provide for all disconnecting and motor control devices for all equipment. Contractor shall coordinate to determine voltage, phase, and configurations. Any changes necessary to coordinate these items between Divisions 22 and 23 and Division 26 shall be considered part of this Contract.

K. Division 26 Contractor shall be responsible for providing for all power requirements associated with the mechanical systems including power, control devices, smoke dampers, etc. Refer to Division 22 and 23 Drawings for locations and requirements. Connect all smoke dampers to the fire alarm control panel.

3.02 PERFORMANCE TESTS

- A. Thoroughly test all control circuits, fixtures, services, and all circuits for proper operating condition and freedom from grounds and short circuits before acceptance is requested. All equipment, appliances, and devices shall be operated under load conditions.
- B. After the interior wiring system installation is complete, conduct operating tests for approval. When requested, test all the wire, cable, devices, and equipment after installation, to assure that all material continues to possess all the original characteristics as required by governing codes and standards listed in these Specifications.
- C. After motor operation has been verified make voltage readings at all panelboards and starters. Based on these readings, make final adjustments of primary taps on all transformers in the building as directed, or coordinate with the utility proper building voltage.

- D. Perform such other tests as required by other Sections of these Specifications or as requested to prove acceptability.
- E. Furnish all instruments and labor for testing.
- F. All material installed shall be listed, inspected, and approved by a nationally accepted testing laboratory such as UL and/or ETL. All material shall bear the UL or ETL label where available.

3.03 SUBMITTAL AND APPROVAL OF MATERIALS

- A. All requirements for submittals shall comply with the applicable provisions included in the individual Specification Sections.
- B. Unless identified as a sole source item, the listing of product manufacturers, catalog numbers, etc., on the Drawings is intended to establish a standard of quality of the product. It is the responsibility of Contractor to review all items he intends to submit. If equipment other than that indicated on Drawings is proposed by Contractor, the information will be reviewed at the time of the submission of the submittal.

END OF SECTION

26 05 19 EQUIPMENT WIRING SYSTEMS

1.00 GENERAL

1.01 SUMMARY

- A. Section includes electrical connections to equipment specified under other Sections.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 26 05 00 "Basic Electrical Methods."

1.02 REFERENCES

- A. NEMA WD 1 - General Purpose Wiring Devices.
- B. NEMA WD 6 - Wiring Device Configurations.
- C. ANSI/NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 "Document Management."
- B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

1.05 COORDINATION

- A. Coordinate Work under provisions of Section 01 31 00 "Project Management and Coordination."
- B. Obtain and review shop drawings, product data, and manufacturer's instructions for equipment furnished under other Sections.
- C. Determine connection locations and requirements.
- D. Sequence rough-in of electrical connections to coordinate with installation schedule for equipment.
- E. Sequence electrical connections to coordinate with startup schedule for equipment.

2.00 PRODUCTS

2.01 CORDS AND CAPS

- A. Attachment Plug Construction: Conform to NEMA WD 1.
- B. Configuration: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
- C. Cord Construction: ANSI/NFPA 70, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
- D. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
- E. Division 26 Contractor shall be responsible for providing matching cord/receptacle for all equipment not furnished with such equipment.

3.00 EXECUTION

3.01 EXAMINATION

- A. Verify conditions under provisions of Section 01 31 00 "Project Management and Coordination."
- B. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations.
- C. Make wiring connections using wire and cable with insulation suitable for temperatures encountered in heat producing equipment.
- D. Provide receptacle outlet where connection with attachment plug is indicated. Provide cord and cap where field-supplied attachment plug is indicated.
- E. Provide suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- F. Install disconnect switches, controllers, control stations, and control devices as indicated.
- G. Modify equipment control wiring with terminal block jumpers as indicated.
- H. Provide interconnecting conduit and wiring between devices and equipment where indicated.
- I. Check and modify phase connections as required for proper motor rotation.
- J. Provide power to equipment only after equipment supplier verifies acceptance to receive and approves.
- K. Contractor shall coordinate with all equipment to verify exact power and control wiring as required to properly serve equipment.

END OF SECTION

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26 05 26 GROUNDING AND BONDING

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Grounding electrodes and conductors.
2. Equipment grounding conductors.
3. Bonding.

B. Related Requirements:

1. Division 01 Specification Sections apply to Work of this Section.
2. Section 01 40 00 "Quality Requirements" for requirements for references and standards.

1.02 REFERENCES

- A. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).
- B. NFPA 70 - National Electrical Code.

1.03 GROUNDING SYSTEM DESCRIPTION

- A. Grounding and bonding in accordance with NEC, Article 250.
- B. Metal underground water pipe.
- C. Metal frame of the building.
- D. Rod electrodes.

1.04 PERFORMANCE REQUIREMENTS

- A. Grounding System Maximum Resistance: 10 ohms.

1.05 SUBMITTALS FOR REVIEW

- A. Refer to Section 01 33 00 "Submittal Procedures" for submittal procedures.
- B. Product Data: Provide for grounding electrodes and connections.

1.06 SUBMITTALS FOR CLOSEOUT

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for procedures for submittals.
- B. Project Record Documents: Record actual locations of components and grounding electrodes.
- C. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

C. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience, and with service facilities within 100 miles of Project.

1.08 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by UL as suitable for the purpose specified and indicated.

2.00 PRODUCTS

2.01 ROD ELECTRODES

A. Material: Copper.

B. Diameter: 3/4 inch.

C. Length: 10 feet.

2.02 MECHANICAL CONNECTORS

A. Description: In lieu of exothermic connections, high compression type as manufactured by Burndy using the 12-ton Hy-Ground series.

2.03 EXOTHERMIC CONNECTIONS

A. Manufacturers: Cadweld.

2.04 WIRE

A. Material: Stranded tin-plated copper.

B. Grounding Electrode Conductor: Minimum size to meet NFPA 70 requirements or as indicated on the Drawings.

3.00 EXECUTION

3.01 EXAMINATION

A. Refer to Section 01 30 00 "Administrative Requirements" for verification of existing conditions prior to beginning Work.

B. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 INSTALLATION

- A. Refer to Section 01 40 00 "Quality Requirements" for manufacturer's instructions.
- B. Install rod electrodes. Install additional rod electrodes as required to achieve a resistance to ground of 5 ohms or less. Rods shall be installed with a minimum separation of 6 feet. Provide bonding to meet Regulatory Requirements.
- C. Bond together metal siding not attached to grounded structure; bond to ground.
- D. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- E. Grounding Electrode System: The new grounding electrode system shall consist of the common bonding of building steel, underground steel water piping and supplemental ground rods, concrete re-enforcing bar, as detailed on the Drawings and as required by the NEC, Article 250.
- F. Provide proper bonding of the electrical system's grounded conductor (neutral) and the grounding electrode system sized in accordance with NEC Article 250. This bonding shall occur at all locations where there are separately derived systems.

3.03 FIELD QUALITY CONTROL

- A. Refer to Section 01 40 00 "Quality Requirements" for field inspection, testing, and adjusting.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.

END OF SECTION

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26 05 29 SUPPORTING DEVICES

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Conduit and equipment supports.
2. Anchors and fasteners.

B. Related Requirements:

1. Division 01 Specification Sections apply to Work of this Section.

1.02 REFERENCES

- A. NECA - National Electrical Contractors Association.
- B. ANSI/NFPA 70 - National Electrical Code.

1.03 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by UL as suitable for purpose specified and shown.

2.00 PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Materials and Finishes: Provide adequate corrosion resistance.
- B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
- C. Anchors and Fasteners:
 1. Concrete Structural Elements: Use expansion anchors, powder actuated anchors and preset inserts.
 2. Steel Structural Elements: Use beam clamps, spring steel clips and steel ramset fasteners.
 3. Concrete Surfaces: Use self-drilling anchors and expansion anchors.
 4. Sheet Metal: Use sheet metal screws.
 5. Wood Elements: Use wood screws.
 6. Roof Support/Jacks: Advanced supports products # SS1000A or approved equal.

3.00 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation."
- C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- D. Obtain permission from Architect before drilling or cutting structural members. Fabricate supports from structural steel as indicated on drawings. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use lock washers under all nuts.
- E. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- F. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1 inch off wall.
- G. Install conduit supports a maximum spacing specified in the NEC.

END OF SECTION

26 05 33 CONDUIT

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal conduit.
2. Flexible metal conduit.
3. Liquidtight flexible metal conduit.
4. Electrical metallic tubing.
5. Fittings and conduit bodies.

B. Related Requirements:

1. Division 01 Specification Sections apply to Work of this Section.
2. Section 07 84 13 "Penetration Firestopping."
3. Section 26 05 26 "Grounding and Bonding."
4. Section 26 05 29 "Supporting Devices."
5. Section 26 05 33.16 "Boxes."
6. Section 26 05 53 "Electrical Identification."

1.02 REFERENCES

- A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
- C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- D. ANSI/NFPA 70 - National Electrical Code.
- E. NECA "Standard of Installation."
- F. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.03 DESIGN REQUIREMENTS

- A. Conduit Size: ANSI/NFPA 70.

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 "Document Management."
- B. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, nonmetallic conduit, fittings and conduit bodies.

- 1.05 PROJECT RECORD DOCUMENTS
 - A. Submit under provisions of Section 01 70 00 "Execution and Closeout Requirements."
 - B. Accurately record actual routing of conduits.
- 1.06 REGULATORY REQUIREMENTS
 - A. Conform to requirements of ANSI/NFPA 70.
 - B. Furnish products listed and classified by UL as suitable for purpose specified and shown.
- 1.07 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver, store, protect, and handle products to site under provisions of Section 01 60 00 "Product Requirements."
 - B. Accept conduit on site. Inspect for damage.
 - C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
 - D. Protect PVC conduit from sunlight.
- 1.08 PROJECT CONDITIONS
 - A. Verify that field measurements are as shown on Drawings.
 - B. Verify routing and termination locations of conduit prior to rough-in.
 - C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.
- 2.00 PRODUCTS**
- 2.01 CONDUIT REQUIREMENTS
 - A. Minimum Size: 3/4 inch unless otherwise specified.
 - B. Wet and Damp Locations above grade: Use rigid aluminum or liquid tight flexible conduit.
 - C. Dry Locations: Use electrical metallic tubing for concealed and exposed locations.
 - D. Below Slab: Non-metallic PVC conduit is acceptable within limitations specified.
 - E. Below Grade: Use only PVC coated rigid galvanized aluminum, wrapped rigid aluminum, or non-metallic PVC conduit within limitations specified.
 - F. MC Cable: Shall not be utilized on this Project.

2.02 METAL CONDUIT

A. Manufacturers:

1. Allied.
2. Wheatland.
3. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."

B. Rigid Steel Conduit: ANSI C80.1.

C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; all steel fittings.

2.03 FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Electri-Flex.
3. Greenfield.
4. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."

B. Description: Interlocked steel construction. Aluminum is not permitted.

C. Fittings: ANSI/NEMA FB 1 with fittings approved for steel flex.

D. Applications: Use for final connections to motorized equipment, connections to recessed lighting fixtures located in accessible ceilings, and connections to dry type transformers. Utilization of 3/8 inch in lieu of the minimum 1/2 inch is acceptable under the limitations of the National Electrical Code.

2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Electri-flex.
2. Ultratite.
3. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."

B. Description: Interlocked steel construction with PVC jacket.

C. Fittings: ANSI/NEMA FB 1.

D. Applications: Use for final connections to motorized equipment in exterior locations and areas subjected to moisture (kitchen).

2.05 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied.
2. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."

- B. Description: ANSI C80.3; galvanized tubing.
- C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; all steel, compression.
- D. Applications: Do not use below grade or in exterior locations. Use only in interior locations.

2.06 PVC COATED METAL CONDUIT

- A. Manufacturers:
 - 1. Levy.
 - 2. Robroy Industries.
 - 3. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."
- B. Description: NEMA RN-1, rigid steel conduit with external PVC coating, 20 mil thick.
- C. General: Protective layer may be factory applied or galvanized rigid steel conduit may be applied with two layers of corrosion resistant tape.
- D. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel fittings with external PVC coatings to match conduit.

2.07 NON-METALLIC PVC CONDUIT

- A. Manufacturers:
 - 1. Allied.
 - 2. Carlon.
 - 3. Substitutions: Under provisions of Section 01 60 00 "Product Requirements."
- B. Description: NEMA TC2; Schedule 40 PVC. Flame retardant type resistant to bending and cracking.
- C. Fittings and conduit bodies: NEMA TC3.
- D. Vertical risers and ells installed below grade shall be rigid steel with wrapping.
- E. Do not use above grade.
- F. Joints made with PVC fittings shall be applied with solvent compound after thorough cleaning.
- G. Refer to Part 3. Do not use PVC conduit for conduits passing vertically through the slab.

3.00 EXECUTION

3.01 INSTALLATION

- A. Install conduit in accordance with NECA "Standard of Installation."
- B. Install nonmetallic conduit in accordance with manufacturer's instructions.
- C. Arrange supports to prevent misalignment during wiring installation.
- D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

- E. Group related conduits; support using conduit rack. Construct rack using steel channel.
- F. Fasten conduit supports to building structure and surfaces under provisions of Section 26 05 29 "Supporting Devices."
- G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
- H. Do not attach conduit to ceiling support wires.
- I. Arrange conduit to maintain headroom and present neat appearance.
- J. Route exposed conduit parallel and perpendicular to walls.
- K. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- L. Maintain adequate clearance between conduit and piping.
- M. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.
- N. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- O. Bring conduit to shoulder of fittings; fasten securely.
- P. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- Q. Install no more than equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2-inch size.
- R. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- S. Provide suitable fittings to accommodate expansion and deflection where conduit crosses, control and expansion joints.
- T. Provide suitable pull string in each empty conduit except sleeves and nipples.
- U. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- V. Ground and bond conduit under provisions of Section 26 05 26 "Grounding and Bonding."
- W. Identify conduit under provisions of Section 26 05 53 "Electrical Identification."
- X. Ducts shall be cleaned with a flexible mandrel assembly.
- Y. All conduits passing vertically through slabs or through earth on grade shall be PVC-coated, rigid steel. Rigid steel conduits shall be applied with protective coatings as indicated herein. All transitions from PVC to rigid steel shall occur below the slab.
- Z. Underground branch circuit extensions to parking lot lighting fixtures and other branch circuits may be direct buried PVC conduit. Service entrance PVC conduit shall be concrete encased in accordance with the Drawings unless otherwise approved by Architect.
- AA. Minimum cover for underground conduits shall be 24 inches unless otherwise noted.

BB. All conduit shall be routed concealed as much as possible including conduit serving roof-mounted equipment. Roof penetrations for conduits shall adhere to the requirements and details as indicated on the Architectural Drawings.

3.02 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Section 07 84 13 "Penetration Firestopping."
- B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.

END OF SECTION

26 05 33.16 BOXES

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Wall and ceiling outlet boxes.
2. Pull and junction boxes.
3. Floor boxes.

B. Related Requirements:

1. Division 01 Specification Sections apply to Work of this Section.
2. Section 07 84 13 "Penetration Firestopping."
3. Section 26 27 26 "Wiring Devices" for wall plates in finished areas.

1.02 REFERENCES

- A. NECA - Standard of Installation.
- B. NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
- C. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- D. NEMA 250 - Enclosures for Electrical Equipment (1,000 Volts Maximum).
- E. NFPA 70 - National Electrical Code.

1.03 SUBMITTALS FOR CLOSEOUT

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for submittals for Project closeout.
- B. Record actual locations and mounting heights of outlet, pull, and junction boxes on Project record documents.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Provide products listed and classified by UL as suitable for the purpose specified and indicated.

2.00 PRODUCTS

2.01 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

- B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include half-inch male fixture studs where required.
- C. Cast Boxes: NEMA FB 1, Type FD, cast ferrous alloy. Provide gasketed cover by box manufacturer.
- D. Wall Plates for Finished Areas: As specified in Section 26 27 26 "Wiring Devices."

2.02 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.
- B. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box.
- C. Material: Galvanized cast iron.
- D. Cover: Furnish with ground flange, neoprene gasket, and stainless-steel cover screws.
- E. Fiberglass boxes are allowed in landscaping areas. Equipment shall be pedestrian rated.

2.03 FLOOR BOXES

- A. Stamped steel boxes with a minimum of 16-gauge steel for use in concrete slab applications.
- B. 16-gauge steel powder coated finish for use with carpet inserts or without. Provide cover with cable door.
- C. Provide a minimum of two duplex receptacles and two data outlet locations.
- D. In addition to the required power conduits, provide a spare 1-inch conduit to above an accessible ceiling.
- E. Boxes located on first floor shall be Hubbell No. HBLCFB4G30 BASE with covers, faceplates, devices, and other accessories as noted.
- F. Boxes located on second floor shall be Hubbell System One Recessed 6-inch diameter core hole, fire rated poke-thru.

3.00 EXECUTION

3.01 EXAMINATION

- A. Verify all locations of outlets areas prior to rough-in.

3.02 INSTALLATION

- A. Install boxes in accordance with NECA "Standard of Installation."
- B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- C. Set wall mounted boxes at elevations to accommodate mounting heights specified in Section for outlet device.

- D. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet if required to accommodate intended purpose.
- E. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26 "Wiring Devices."
- F. Maintain headroom and present neat mechanical appearance.
- G. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- H. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- I. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 13 "Penetration Firestopping."
- J. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes with Architectural drawings and other trades.
- K. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- L. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- M. Use flush mounting outlet box in finished areas.
- N. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- O. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.
- P. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- Q. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- R. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- S. Use adjustable steel channel fasteners for hung ceiling outlet box.
- T. Do not fasten boxes to ceiling support wires.
- U. Support boxes independently of conduit.
- V. Use gang box where more than one device is mounted together. Do not use sectional box.
- W. Use gang box with plaster ring for single device outlets.
- X. Use cast outlet box in exterior locations exposed to the weather and wet locations and at all locations serving kitchen equipment.
- Y. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.
- Z. Coordinate with other trades for box rough-in, such that control devices are grouped (i.e., thermostats, wall switches, volume controls, etc.).

3.03 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate installation of outlet box for equipment connected under Section 26 05 19 "Equipment Wiring Systems."

3.04 ADJUSTING

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for adjusting installed Work.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused box openings.

3.05 CLEANING

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for cleaning installed Work.
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

3.06 REPAIR

- A. Repair any areas or surfaces damaged during conduit installation.
- B. Paint (resurface) to original condition.

END OF SECTION

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26 05 53 ELECTRICAL IDENTIFICATION

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Nameplates and labels.
2. Wire and cable markers.

B. Related Requirements:

1. Division 01 Specification Sections apply to Work of this Section.

1.02 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.

2.00 PRODUCTS

2.01 NAMEPLATES AND LABELS

- A. Nameplates and Labels: Engraved three-layer laminated plastic, white letters on black background.

B. Locations:

1. Each electrical distribution and control equipment enclosure.
2. Communication cabinets and computer cabinets.
3. Field disconnects, start stop stations, control panels.

C. Letter Size:

1. Use 1/4-inch letters for identifying individual equipment and loads.
2. Use 1/4-inch letters for identifying grouped equipment and loads.
3. Use 3/8-inch letters for identifying main disconnect equipment.
4. Use 1/4-inch letters for identifying receptacle and light switches.

2.02 WIRE/CONDUIT/BOX MARKERS

- A. Description: Brady B-321 Heat-Shrink Polyolefin markers. Typed label to identify each termination end point of the conductor. DC conductors shall identify polarity.

- B. Locations: Each conductor at wireway, pull boxes, outlet and junction boxes, and each load connection. All conduit penetrations identifying the location of each end.

C. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number indicated on Drawings.

D. Boxes:

1. Label each junction box in accessible locations to indicate the type of system (i.e.; security; power circuit - 1, 3, 5; etc.)
2. Boxes serving fire alarm system shall have box covers painted red.
3. Provide label in each light switch and receptacle black box.

E. Panelboards and Switchboards:

1. Provide phenolic label with maximum available fault current at main switchboard. Utilize number as indicated in panel schedule.
2. Provide warning labels with arc-flash hazard warning for all electrical equipment as indicated in Article 110.16 of NEC.

3.00 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.

3.02 APPLICATION

- A. Install nameplate and label parallel to equipment lines.
- B. Secure nameplate to equipment front using screws or rivets.
- C. Identify underground conduits using underground warning tape. Install one tape per trench at 12 inches below finished grade. Identify all conduit at exposed locations into all boxes, cabinets, etc. (see Specification Section 26 05 00 "Basic Electrical Methods").
- D. Identify all conductors at every termination indicating endpoints of termination and tag identification as required.
- E. Color Coding for Phase Identification:

<u>120/208 Volts</u>	<u>Phase</u>	<u>277/480 Volts</u>
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray
Green	Ground	Green

- F. Conductor phase and voltage identification shall be made by color-coded insulation for all conductors smaller than No. 6 AWG. For conductors No. 6 AWG and larger, identification shall be made by color-coded insulation, or conductors with black insulation may be furnished and identified by colored electrical tape. Conductor identification shall be provided within each enclosure where a tap, splice, or termination is made.

END OF SECTION

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26 05 73 POWER SYSTEM STUDIES

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Short-Circuit Analysis.
2. Protective Device Time-Current Coordination Analysis.
3. Arc-Flash Hazard Analysis.

B. Related Requirements:

1. Division 01 Specification Sections apply to Work of this Section.

1.02 SUBMITTALS

A. Completed studies shall be bound and submitted to Primary Designer.

1. Short-Circuit Analysis.
2. Protective Device Time-Current Coordination Analysis.
3. Arc-Flash Hazard Analysis.

2.00 PRODUCTS

2.01 APPROVED MANUFACTURERS

- A. Eaton Cutler-Hammer.
- B. G.E. by ABB
- C. Square D Company by Schneider Electric.

2.02 POWER SYSTEM STUDIES

A. Short-Circuit Analysis:

1. Calculation of the maximum root mean squared (rms) symmetrical three-phase, short-circuit current at each significant location in the electrical system shall be made using a digital computer.
2. Appropriate motor short-circuit contribution shall be included at the appropriate locations in the system so that the computer calculated values represent the highest short-circuit current the equipment will be subjected to under fault conditions.
3. A tabular computer printout shall be included which lists the calculated short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings, and notes regarding the adequacy or inadequacy of the equipment.
4. The study shall include a computer printout of input circuit data including conductor lengths, number of conductors per phase, conductor impedance values, insulation types,

transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.

5. Include a computer printout identifying the maximum available short-circuit current in rms symmetrical amperes and the X/R ratio of the fault current for each bus/branch calculation.
 6. The system one-line diagram shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the computer analysis.
 7. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.
 8. Contractor shall be responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in a timely manner to allow the short-circuit analysis to be completed prior to final installation.
 9. Any inadequacies shall be called to the attention of Primary Designer and recommendations made for improvements as soon as they are identified.
- B. Protective Device Time-Current Coordination Analysis:
1. The time-current coordination analysis shall be performed with the aid of computer software intended for this purpose, and will include the determination of settings, ratings, or types for the overcurrent protective devices supplied.
 2. Where necessary, an appropriate compromise shall be made between system protection and service continuity with system protection considered more important than service continuity.
 3. A sufficient number of computer-generated log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
 4. Computer printouts shall accompany the log-log plots and will contain descriptions for each of the devices shown, settings of the adjustable devices, the short-circuit current availability at the device location when known, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.
 5. The study shall include a separate, tabular computer printout containing the suggested device settings of all adjustable overcurrent protective devices, the equipment where the device is located, and the device number corresponding to the device on the system one-line diagram.
 6. A computer-generated system one-line diagram shall be provided which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.

7. A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.
 8. Significant deficiencies in protection and/or coordination shall be called to the attention of Primary Designer and recommendations made for improvements as soon as they are identified.
 9. Contractor shall be responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in a timely manner to allow the time-current analysis to be completed prior to final installation.
- C. Arc-Flash Hazard Analysis:
1. The Arc-Flash Hazard Analysis shall be performed with the aid of computer software intended for this purpose in order to calculate Arc-Flash Incident Energy (AFIE) levels and flash protection boundary distances.
 2. The Arc-Flash Hazard Analysis shall be performed in conjunction with a short-circuit analysis and a time-current coordination analysis.
 3. Results of the Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.
 4. The analysis shall be performed under worst-case Arc-Flash conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.
 5. The Arc-Flash Hazard Analysis shall be performed by a registered professional engineer.
 6. The Arc-Flash Hazard Analysis shall be performed in compliance with IEEE Standard 1584-2002, the IEEE Guide for Performing Arc-Flash Calculations.
 7. The Arc-Flash Hazard Analysis shall include recommendations for reducing AFIE levels and enhancing worker safety.
 8. The proposed vendor shall demonstrate experience with Arc-Flash Hazard Analysis by submitting names of at least ten actual Arc-Flash Hazard Analyses it has performed in the past year.
 9. The proposed vendor shall demonstrate capabilities in providing equipment, services, and training to reduce Arc-Flash exposure and train workers in accordance with NFPA 70E and other applicable standards.
 10. The proposed vendor shall demonstrate experience in providing equipment labels in compliance with NEC-2014 Section 110 and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment classes.

END OF SECTION

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26 24 16 PANELBOARDS AND SWITCHBOARDS

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Distribution and Branch circuit panelboards.
2. Switchboard.

B. Related Requirements:

1. Division 01 Specification Sections apply to Work of this Section.
2. Section 26 05 29 "Supporting Devices."
3. Section 26 05 53 "Electrical Identification" for engraved nameplates.

1.02 REFERENCES

- A. NECA (National Electrical Contractors Association) "Standard of Installation."
- B. NEMA AB 1 - Molded Case Circuit Breakers.
- C. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- D. NEMA KS 1 - Enclosed Switches.
- E. NEMA PB 1 - Panelboards.
- F. NEMA PB-2 - Switchboards.
- G. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- H. NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

A. Submit under provisions of General Conditions.

1. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
- C. Switchboard and panelboard manufacturer shall provide short circuit calculations per NEC requirements. Equipment shall be rated per calculations.

- 1.04 PROJECT RECORD DOCUMENTS
 - A. Submit under provisions of General Conditions. Record actual locations of products; indicate actual branch circuit arrangement.
- 1.05 OPERATION AND MAINTENANCE DATA
 - A. Submit under provisions of General Conditions. Maintenance Data: Include spare parts data listing; and recommended maintenance procedures and intervals.
- 1.06 QUALITY ASSURANCE
 - A. Perform Work in accordance with NECA Standard of Installation.
- 1.07 QUALIFICATIONS
 - A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' experience.
- 1.08 REGULATORY REQUIREMENTS
 - A. Conform to requirements of NFPA 70. Furnish products listed and classified by UL as suitable for purpose specified and indicated.
- 1.09 FIELD MEASUREMENTS
 - A. Verify that field measurements are as indicated.
- 1.10 MAINTENANCE MATERIALS
 - A. Provide maintenance materials under provisions of General Conditions. Provide two of each panelboard key if required.
- 2.00 PRODUCTS**
- 2.01 PANELBOARDS
 - A. Manufacturers:
 - 1. Eaton Cutler-Hammer
 - 2. G.E by ABB.
 - 3. Siemens.
 - 4. Square-D.
 - B. Description: NEMA PB-1, circuit breaker type.
 - C. Panelboard Bus: Copper with ratings as indicated. Provide a copper ground bus in each panelboard.

- D. Minimum integrated short circuit rating: Fully rated devices with minimum levels as indicated. Series rated systems will not be allowed. Minimum calculated values are labeled on each panelboard and are indicated as "AIC."
- E. Molded Case Circuit Breakers: NEMA AB 1, bolt-on, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as type HACR for air-conditioning equipment loads and type SWD for switching applications.
- F. Enclosure: NEMA PB-1, Type 1.
- G. Cabinet Front: Surface or recessed type as indicated on the Drawings, fastened with concealed trim clamps, hinged door with flush lock, metal directory frame, and finished in manufacturer's standard gray enamel.

2.02 SWITCHBOARDS

- A. Manufacturers:
 - 1. Eaton Cutler-Hammer.
 - 2. G.E by ABB.
 - 3. Siemens.
 - 4. Square D.
- B. Construction: Unit shall be constructed of steel members bolted or welded to form a rigid frame. All closure plates shall be constructed to allow a single individual to install. All sections shall be rear aligned and shall be front accessible. Sections shall be bolted together to form a mechanically and electrically continuous unit in a NEMA 3R enclosure.
- C. Bussing: Tin or silver-plated copper for all sections. Brace bars for indicated interrupting ratings. Bus joints shall be bolted with grade 5 bolts. Horizontal bussing shall be full size and full length of the switchboard. Install vertical bussing the full height of the switchboard with a minimum of ampacity of 80 percent of the total of all protective devices of the bussed space. Provide a full size full length neutral bus with the same ampacity as the phase bus. Provide a copper ground bus the full length.
- D. Main Device: Thermal-Magnetic Molded Case circuit breaker with electronic trip and adjustable long time, short time and instantaneous settings. Interrupting rating shall be as indicated on the Drawings and shown as "AIC" on the schedule for a fully rated system. Series rated systems will not be allowed.
- E. Feeder Devices: Instantaneous thermal and magnetic trips, molded case circuit breakers. Provide adjustable magnetic trip option on frame sizes larger than 225 amps. Feeder breakers shall be group mounted.
- F. Surge Protective Device (SPD): Unit shall be mounted integral in panel. Provide circuit breaker for SPD unit as required by manufacturer. Equipment shall be Square D TVS4XGA- INT 240KA/phase: Standard Protection Modes: L-N, L-G, L-L, and N-G or approved equal.
- G. Provide an integral monitoring and metering device to monitor the following for all phases:
 - 1. Phase current.

2. Phase voltage (L-L and L-N).
 3. Real Power.
 4. Apparent power.
 5. Power factor.
 6. Frequency.
 7. Energy (KWH).
 8. Front Display.
 9. THD.
 10. Current and Power Demand.
 11. Alarms.
 12. Min/Max Readings.
 13. Date/Event Logs.
- H. Provide energy reduction maintenance switch with lock status indicator where overcurrent device installed in circuit breaker rated or can be adjusted is 1,200 A or higher in accordance with NEC, 240.87.

3.00 EXECUTION

3.01 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1. Install panelboards plumb. Provide supports in accordance with Drawings and Section 26 05 29 "Supporting Devices." Height: 6 feet maximum to top of panelboard. Provide filler plates for unused spaces in panelboards. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads. Spare slots shall be labeled as such in erasable pencil on directory. Provide engraved plastic nameplates under the provisions of Section 26 05 53 "Electrical Identification."
- B. Provide two empty 1-inch conduits from each recessed panelboard to an accessible location above and label as "spare."
- C. Ground each panelboard in accordance with Section 26 05 26 "Grounding and Bonding."
- D. Provide a 4-inch concrete housekeeping pad for switchboard.

3.02 FIELD QUALITY CONTROL

- A. Field inspection and test for grounds on each circuit after installation is completed. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION

26 22 13 LOW VOLTAGE DISTRIBUTION TRANSFORMERS

1.00 GENERAL

1.01 WORK INCLUDED

- A. Furnish labor, materials, equipment and incidentals necessary to install transformers. Electrical work shall be in accordance with Section 26 05 00, "Common Work Results for Electrical".

1.02 QUALITY ASSURANCE

- A. Transformers shall comply with the specifications and shall be produced by the following Manufacturers:
 - 1. ABB/General Electric
 - 2. Eaton
 - 3. Siemens
 - 4. No Approved Equal

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00, "Document Management" and shall include:
 - 1. Bill of Material
 - 2. Equipment Data Sheets showing impedance weights, dimensions, etc. for each transformer.
 - 3. Product data on specified product documenting the following:
 - a. Dimensions
 - b. Weight
 - c. KVA
 - d. Voltage
 - e. % Impedance
 - f. Magnetizing current magnitude and duration
 - g. Taps
 - h. Insulation Class
 - i. Sound Level
 - j. Wiring Diagram
 - k. Installation Instructions

1.04 STANDARDS

- A. The applicable provisions of the following standards shall apply as if written here in their entirety:

ANSI/IEEE C57.96	Distribution and Power Transformers, Guide for Loading Dry-Type appendix to ANSI C57.12 standards
ANSI/IEEE C89.2	Dry Type Transformers for General Applications
IEEE C57.12.01	General Requirements for Dry-Type Distribution and Power Transformers Including Those with Solid Cast and / or Resin-Encapsulated Windings
IEEE C57.12.91	Test Code for Dry-Type Distribution and Power Transformers UL 506, Specialty Transformers
NEMA/ANSI ST20	Dry type transformers for General Applications
IEEE	Institute of Electrical and Electronic Engineers
NEMA TR1	Transformers, Regulators and Reactors
NEMA TP-1 2002	Guide for Determining Energy Efficiency for Distribution Transformers

2.00 PRODUCTS

A. DRY TYPE TRANSFORMERS

1. Provide dry type, 3-phase, delta wye connected transformers with KVA rating as required.
2. Transformers shall be suitable for indoor or outdoor installation as indicated on the plans, or as required by conditions. Transformers 75 KVA and less shall be suitable for floor, wall or trapeze mounting. Transformers larger than 75 KVA shall be suitable for floor or trapeze mounting.
3. Transformer shall be enclosed in a steel enclosure with covers secured with captive type hardware. Transformer shall be cooled by natural convection of air. The transformer enclosure shall be degreased, cleaned, phosphatized, primed and finished with a gray baked on enamel.
4. The average audible sound level shall not exceed 50 DB for transformers rated at 75 KVA and below, nor 60 DB for transformers rated above 75 KVA, when measured in accordance with NEMA Standard TR1.
5. The percent impedance for transformers shall not exceed 4.6 for up to 112 1/2 KVA, 6 for 150 KVA to 750 KVA.
6. The transformers shall have the following characteristics:
 - a. Class H insulation
 - b. 150 degree Centigrade temperature rise rating at 40 degrees C ambient at full rated load.
 - c. Compartment for primary and secondary connections.

- d. Transformer coils shall be of continuous copper wound construction with terminations brazed or welded. Coils shall be impregnated with non hygroscopic, thermosetting varnish.
 - e. The maximum temperature of top of the enclosure shall not exceed 50 degrees C rise above a 40 degrees C ambient.
 - f. The core of the transformer shall be visibly grounded to the enclosure by means of a flexible copper grounding conductor sized in accordance with applicable NEMA, IEEE, or ANSI standards.
 - g. Transformers shall have two (2) 2-1/2% full ampacity taps below and two (2) 2-1/2% taps above rated voltage in primary.
 - h. The basic impulse level shall be 10 KV for transformers less than 30 KVA, 30 KV for transformers 300 KVA and larger.
 - i. Transformer primary and secondary windings shall be copper. Aluminum windings shall not be permitted.
 - j. Transformers shall have efficiencies in accordance with NEMA TP-1. Provide written documentation as part of submittal process stating this and showing actual transformer efficiencies.
7. Three-phase transformer efficiency, total losses, shall not exceed losses @ 35% and 75°C per the NEMA Premium program tested per 10 C.F.R. Part 431 (“Test Procedures for Distribution Transformers”). Maximum losses at 35% and 75% (respectively) are:
- a. 15 kVA: 97.88% 112.30 W; 121.28 W
 - b. 30 kVA: 98.24% 185.52 W; 200.35 W
 - c. 45 kVA: 98.38% 256.42 W; 276.93 W
 - d. 75 kVA: 98.59% 362.89 W; 391.92 W
 - e. 112.5 kVA: 98.73% 500.31 W; 540.33 W
 - f. 150 kVA: 98.80% 576.14 W; 622.22 W
 - g. 225 kVA: 98.95% 764.14 W; 825.26 W
 - h. 300 kVA: 99.02% 1010.010 W; 1090.81 W.

3.00 EXECUTION

3.01 LOCATION

- A. Electrical Contractor to verify proper location for the unit.
- B. The transformer shall be installed in a location where the sides with ventilated openings are a minimum distance of six inches from noncombustible structures or equipment to ensure adequate air circulation

3.02 INSTALLATION

- A. Set the transformer plumb and level. Provide solderless lug bonding connection on the inside of the transformer enclosure in accordance with the NEC. Make primary and secondary connections with liquid tight flexible metal conduit to isolate transformer noise from the building structure or conduit system.
- B. When final connection has been made, check secondary voltage at dry transformers and make tap adjustments required to obtain correct voltage.
- C. Perform the following isolation procedures in addition to those provided by the transformer Manufacturer. Provide pad-type vibration isolators or waffle pads sized to load 50 pounds per square inch. Install one (1) at each corner of the transformer at floor mount or trapeze installations. Locate pads between hanger and wall for wall hung installations
- D. For critical installations, spring type isolation may be required by the Engineer consisting of steel, spring-type isolators, sized for 1/2" deflection based on the weight of the transformer. Install at each corner or in hanger rods so that vibration is not transmitted to the building structure.
- E. Secure transformer to concrete base according to manufacturer's written instructions.
- F. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

3.03 CONNECTIONS

- A. Ground equipment according to Section 26 05 26, "Grounding & Bonding for Electrical Systems".
- B. 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-486B.
- C. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.04 FIELD QUALITY CONTROL

- A. Inspect installed dry type transformers for anchoring, alignment, grounding and physical damage.
- B. Check tightness of all accessible mechanical and electrical connections with calibrated torque wrench. Minimum acceptable values are specified in manufacturer's instructions.

3.05 CLEANING

- A. Repaint scratched or marred exterior surfaces to match original finish.

3.06 TESTING

- A. Testing: All testing required shall be per Specification 26 01 26, "Testing of Electrical Systems".

3.07 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 5 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.

END OF SECTION

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26 24 19 MOTOR-CONTROL CENTERS

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes MCCs for use with ac circuits rated 600 V and less and having the following factory-installed components:
 1. Incoming main lugs and OCPDs.
 2. Full-voltage magnetic controllers.
 3. Reduced-voltage magnetic controllers.
 4. Reduced-voltage, solid-state controllers.
 5. Multispeed controllers.
 6. VFCs.
 7. Feeder-tap units.
 8. TVSS.
 9. Instrumentation.
 10. Auxiliary devices.

1.03 DEFINITIONS

- A. CE: Conformance Europeene (European Compliance).
- B. CPT: Control power transformer.
- C. DDC: Direct digital control.
- D. EMI: Electromagnetic interference.
- E. GFCI: Ground fault circuit interrupting.
- F. IGBT: Insulated-gate bipolar transistor.
- G. LAN: Local area network.
- H. LED: Light-emitting diode.
- I. MCC: Motor-control center.
- J. MCCB: Molded-case circuit breaker.
- K. MCP: Motor-circuit protector.
- L. NC: Normally closed.
- M. NO: Normally open.

- N. OCPD: Overcurrent protective device.
- O. PCC: Point of common coupling.
- P. PID: Control action, proportional plus integral plus derivative.
- Q. PT: Potential transformer.
- R. PWM: Pulse-width modulated.
- S. RFI: Radio-frequency interference.
- T. SCR: Silicon-controlled rectifier.
- U. TDD: Total demand (harmonic current) distortion.
- V. THD(V): Total harmonic voltage demand.
- W. TVSS: Transient voltage surge suppressor.
- X. VFC: Variable-frequency controller.

1.04 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: MCCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.05 SUBMITTALS

- A. Product Data: For each type of controller and each type of MCC. Include shipping and operating weights, features, performance, electrical ratings, operating characteristics, and furnished specialties and accessories.
- B. LEED Submittals:
 - 1. Product Data for Credit EA 5: For continuous metering equipment for energy consumption.
- C. Shop Drawings: For each MCC, manufacturer's approval drawings as defined in UL 845. In addition to requirements specified in UL 845, include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.
 - 1. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Each installed unit's type and details.
 - b. Factory-installed devices.
 - c. Enclosure types and details.
 - d. Nameplate legends.
 - e. Short-circuit current (withstand) rating of complete MCC, and for bus structure and each unit.

- f. Features, characteristics, ratings, and factory settings of each installed controller and feeder device and installed devices.
 - g. Specified optional features and accessories.
2. Schematic Wiring Diagrams: For power, signal, and control wiring for each installed controller.
 3. Nameplate legends.
 4. Vertical and horizontal bus capacities.
 5. Features, characteristics, ratings, and factory settings of each installed unit.
- D. Harmonic Analysis Study and Report: Comply with IEEE 399 and NETA Acceptance Testing Specification; identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible operating scenarios, including recommendations for VFC input filtering to limit TDD and THD(V) at each VFC to specified levels.

1.06 INFORMATIONAL SUBMITTALS

- A. Standard Drawings: For each MCC, as defined in UL 845.
- B. Production Drawings: For each MCC, as defined in UL 845.
- C. Product Certificates: For each MCC, from manufacturer.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
- G. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.
- H. Warranty: Sample of special warranty.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For MCCs, all installed devices, and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 33 04 "Operation and Maintenance Data," include the following:
 1. Manufacturer's Record Drawings: As defined in UL 845. In addition to requirements specified in UL 845, include field modifications and field-assigned wiring identification incorporated during construction by manufacturer, Contractor, or both.
 2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
 3. Manufacturer's written instructions for setting field-adjustable overload relays.

4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage, solid-state controllers.
5. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
6. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.

1.08 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. Power Fuses: Equal to 10 of quantity installed for each size and type, but no fewer than three of each size and type.
 2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
 3. Indicating Lights: Two of each type and color installed.
 4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
 5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.09 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. Source Limitations: Obtain MCCs and controllers of a single type from single source from single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver MCCs in shipping splits of lengths that can be moved past obstructions in delivery paths.
- B. Handle MCCs according to the following:
 1. NEMA ICS 2.3, "Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers Rated Not More Than 600 Volts."
 2. NECA 402, "Recommended Practice for Installing and Maintaining Motor Control Centers."

- C. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside MCCs; connect factory-installed space heaters to temporary electrical service.

1.11 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service or Distribution Systems: Do not interrupt electrical service to, or distribution systems within, a facility occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Owner no fewer than 14 days in advance of proposed interruption of electrical service.
 - 2. Indicate method of providing temporary electrical service.
 - 3. Do not proceed with interruption of electrical service without Owner's written permission.
 - 4. Comply with NFPA 70E.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for MCCs, including clearances between MCCs and adjacent surfaces and other items.

1.12 COORDINATION

- A. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.
- B. Coordinate features of MCCs, installed units, and accessory devices with remote pilot devices and control circuits to which they connect.
- C. Coordinate features, accessories, and functions of each MCC, each controller, and each installed unit with ratings and characteristics of supply circuits, motors, required control sequences, and duty cycle of motors and loads.
 - 1. Warranty Period: Five years from date of Substantial Completion.

2.00 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Square D; Schneider Electric USA.
- A. General Requirements for MCCs: Comply with NEMA ICS 18 and UL 845.

2.02 FUNCTIONAL FEATURES

- A. Description: Modular arrangement of main units, controller units, control devices, feeder-tap units, instruments, metering, auxiliary devices, and other items mounted in vertical sections of MCC.
- B. Controller Units: Combination controller units.

1. Install units up to and including Size 3 on drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
 2. Equip units in Type B and Type C MCCs with pull-apart terminal strips for external control connections.
- C. Feeder-Tap Units: Through 225-A rating shall have drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.
- D. Future Units: Compartments fully bused and equipped with guide rails or equivalent, ready for insertion of drawout units.
- E. Spare Units: Installed in compartments indicated "spare."

2.03 INCOMING MAINS

- A. Incoming Mains Location: Top.
- B. Main Lugs Only: Conductor connectors suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Main and Neutral Lugs: Compression type.
- C. MCCB: Comply with UL 489, with interrupting capacity 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. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
 6. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

- c. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 - d. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."
 - e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at **55**percent of rated voltage.
 - f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - g. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 - h. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
- D. Insulated-Case Circuit Breaker: 100 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.
- 1. Drawout circuit-breaker mounting.
 - 2. Two-step, stored-energy closing.
 - 3. Standard-function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time time adjustments.
 - c. Ground-fault pickup level, time delay, and I^2t response.
 - 4. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 - 5. Remote trip indication and control.
 - 6. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."
 - 7. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - 8. Control Voltage: 120-V ac.

2.04 COMBINATION CONTROLLERS

- A. Full-Voltage Controllers:
- 1. General Requirements for Full-Voltage Enclosed Controllers: Comply with NEMA ICS 2, general purpose, Class A.
 - 2. Magnetic Controllers: Full voltage, across the line, electrically held.
 - a. Configuration: Nonreversing and reversing.

- B. Reduced-Voltage Magnetic Controllers:
1. General Requirements for Reduced-Voltage Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A; closed transition; adjustable time delay on transition.
 2. Reduced-Voltage Magnetic Controllers: Reduced voltage, electrically held.
 - a. Configuration:
 - b. Wye-Delta Controller: Four contactors, with a three-phase starting resistor/reactor bank.
 - c. Part-Winding Controller: Separate START and RUN contactors, field-selectable for one-half or two-thirds winding start mode, with either six- or nine-lead motors; with separate overload relays for starting and running sequences.
 - d. Autotransformer Reduced-Voltage Controller: Medium-duty service, with integral overtemperature protection; taps for starting at 50, 65, and 80 percent of line voltage; two START and one RUN contactors.
- C. Reduced-Voltage, Solid-State Controllers:
1. General Requirements for Reduced-Voltage, Solid-State Controllers: Comply with UL 508.
 2. Reduced-Voltage, Solid-State Controllers: An integrated unit with power SCRs, heat sink, microprocessor logic board, door-mounted digital display and keypad, bypass contactor, and overload relay; suitable for use with NEMA MG 1, Design B, polyphase, medium-induction motors.
 - a. Configuration: Standard duty; nonreversible.
 - b. Starting Mode: Current limit.
 - c. Stopping Mode: Coast to stop.
 - d. Shorting (Bypass) Contactor: Operates automatically when full voltage is applied to motor, and bypasses the SCRs. Solid-state controller protective features shall remain active when the shorting contactor is in the bypass mode.
 - e. Shorting and Input Isolation Contactor Coils: Pressure-encapsulated type; manufacturer's standard operating voltage, matching control power or line voltage, depending on contactor size and line-voltage rating.
 - f. Logic Board: Identical for all ampere ratings and voltage classes, with environmental protective coating.
 - g. Adjustable acceleration-rate control using voltage or current ramp, and adjustable starting torque control with up to 400 percent current limitation for 20 seconds.
 - h. SCR bridge shall consist of at least two SCRs per phase, providing stable and smooth acceleration without external feedback from the motor or driven equipment.
 - i. Keypad, front accessible; for programming the controller parameters, functions, and features; shall be manufacturer's standard and include not less than the following functions:

- j. Adjusting motor full-load amperes, as a percentage of the controller's rating.
- k. Adjusting current limitation on starting, as a percentage of the motor full-load current rating.
- l. Adjusting linear acceleration and deceleration ramps, in seconds.
- m. Initial torque, as a percentage of the nominal motor torque.
- n. Adjusting torque limit, as a percentage of the nominal motor torque.
- o. Adjusting maximum start time, in seconds.
- p. Adjusting voltage boost, as a percentage of the nominal supply voltage.
- q. Selecting stopping mode and adjusting parameters.
- r. Selecting motor thermal-overload protection class between 5 and 30.
- s. Activating and de-activating protection modes.
- t. Selecting or activating communications modes.
- u. Digital display, front accessible; for showing motor, controller, and fault status; shall be manufacturer's standard and include not less than the following:
- v. Controller Condition: Ready, starting, running, stopping.
- w. Motor Condition: Amperes, voltage, power factor, power, and thermal state.
- x. Fault Conditions: Controller thermal fault, motor overload alarm and trip, motor underload, overcurrent, shorted SCRs, line or phase loss, phase reversal, and line frequency over or under normal.
- y. Controller Diagnostics and Protection:
- z. Microprocessor-based thermal protection system for monitoring SCR and motor thermal characteristics and providing controller overtemperature and motor overload alarm and trip; settings selectable via the keypad.
- aa. Protection from line-side reverse phasing; line-side and motor-side phase loss; motor jam, stall, and underload conditions; and line frequency over or under normal.
- bb. Input isolation contactor that opens when the controller diagnostics detect a faulted solid-state component, or when the motor is stopped.
- cc. Remote Output Features:
- dd. All outputs prewired to terminal blocks.
- ee. Form C status contacts that change state when controller is running.
- ff. Form C alarm contacts that change state when a fault condition occurs.
- gg. Optional Features:
- hh. Analog output for field-selectable assignment of motor operating characteristics; 4 to 20-mA dc.
- ii. Additional field-assignable Form C contacts for alarm outputs.

- jj. Surge suppressors in solid-state power circuits providing three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
- kk. Full-voltage bypass contactor operating manually, with NORMAL/BYPASS selector switch. Power contacts shall be totally enclosed, double break, and silver-cadmium oxide; and assembled to allow inspection and replacement without disturbing line or load wiring.

D. Disconnecting Means and OCPDs:

1. 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.
- c. Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.

2. MCP Disconnecting Means:

- a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
- b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
- c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.

3. MCCB Disconnecting Means:

- a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
- b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
- d. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.

4. Molded-Case Switch Disconnecting Means:

- a. UL 489, NEMA AB 1, and NEMA AB 3, with in-line fuse block for Class J or L power fuses (depending on ampere rating), providing an interrupting capacity to comply with available fault currents; MCCB with fixed, high-set instantaneous trip only.
- b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
- c. Auxiliary contacts "a" and "b" arranged to activate with molded-case switch handle.

E. Overload Relays:

1. Melting-Alloy Overload Relays:
 - a. Inverse-time-current characteristic.
 - b. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 2. Bimetallic Overload Relays:
 - a. Inverse-time-current characteristic.
 - b. Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - c. Ambient compensated.
 3. Solid-State Overload Relays:
 - a. Switch or dial selectable for motor running overload protection.
 - b. Sensors in each phase.
 - c. Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
 4. External overload reset push button.
- F. Control Power:
1. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - a. CPT Spare Capacity: 200VA.

2.05 FEEDER-TAP UNITS

- A. MCCB: Comply with UL 489, with interrupting capacity 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. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. 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. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - c. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
 - d. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."
 - e. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
 - f. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
- B. Fusible Switch: NEMA KS 1, Type HD, clips to accommodate specified fuses with lockable handle.
- C. Fuses are specified in Section 262813 "Fuses."

2.06 TRANSIENT VOLTAGE SUPPRESSION DEVICES

2.07 MCC CONTROL POWER

- A. Control Circuits: 120-Vac, supplied through secondary disconnecting devices from CPT.

2.08 ENCLOSURES

- A. Indoor Enclosures: Freestanding steel cabinets unless otherwise indicated. NEMA 250, Type 2 unless otherwise indicated to comply with environmental conditions at installed location.
- B. Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.
 1. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.
 2. Space-Heater Power Source: [Transformer, factory installed in MCC] [120-V external branch circuit].
- C. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
 1. Power for Space Heaters, Ventilation, Lighting, and Receptacle: Include a CPT within the switchboard. Supply voltage shall be 120/208-V ac.

2. Power for space heaters, ventilation, lighting, and receptacle provided by a remote source.
- D. Compartments: Modular; individual doors with concealed hinges and quick-captive screw fasteners. Interlocks on units requiring disconnecting means in off position before door can be opened or closed, except by operating a permissive release device.
- E. Interchangeability: Compartments constructed to allow for removal of units without opening adjacent doors, disconnecting adjacent compartments, or disturbing operation of other units in MCC; same size compartments to permit interchangeability and ready rearrangement of units, such as replacing three single units with a unit requiring three spaces, without cutting or welding.
- F. Wiring Spaces:
 1. Vertical wireways in each vertical section for vertical wiring to each unit compartment; supports to hold wiring in place.
 2. Horizontal wireways in bottom and top of each vertical section for horizontal wiring between vertical sections; supports to hold wiring in place.

2.09 AUXILIARY DEVICES

- 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. Push Buttons: Unguarded types contact unless otherwise indicated.
 - b. Pilot Lights: LED types.
 - c. Selector Switches: Rotary type.
 2. Elapsed-Time Meters: Heavy duty with digital readout in hours resettable.
- B. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.
- C. Space heaters, with NC auxiliary contacts, to mitigate condensation in enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
- D. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.
- E. Cover gaskets for Type 1 enclosures.
- F. Terminals for connecting power factor correction capacitors to the load side of overload relays.
- G. Spare control-wiring terminal blocks.
- H. Spare-Fuse Cabinet: Identified cabinet with hinged lockable door.
- I. Fully rated with its main overcurrent device; 42kA.
- J. Environmental Ratings:

1. Ambient Temperature Rating: Not less than 0 deg F (minus 18 deg C) and not exceeding 104 deg F (40 deg C), with an average value not exceeding 95 deg F (35 deg C) over a 24-hour period.
 2. Ambient Storage Temperature Rating: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C)
 3. Humidity Rating: Less than 95 percent (noncondensing).
 4. Altitude Rating: Not exceeding 6600 feet (2000 m), or 3300 feet (1000 m) if MCC includes solid-state devices.
- K. Main-Bus Continuous Rating: 600A.
- L. Vertical-Bus Continuous Rating: 300A.
- M. Horizontal and Vertical Bus Bracing (Short-Circuit Current Rating): Match MCC short-circuit current rating.
- N. Main Horizontal and Equipment Ground Buses: Uniform capacity for entire length of MCC's main and vertical sections. Provide for future extensions from both ends.
- O. Vertical Phase and Equipment Ground Buses: Uniform capacity for entire usable height of vertical sections, except for sections incorporating single units.
- P. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity, tin plated.
- Q. Neutral buses, when required, can be reduced in size if a substantial portion of the loads are balanced three-phase types (e.g., motors and transformers). See "Neutral buses" Paragraph in "Accessory Components and Features" Article in the Evaluations. Retain one of two "Neutral Buses" paragraphs below or delete both for three-phase, three-wire systems.
- R. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables
- S. Ground Bus: Minimum size required by UL 845, hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit equipment grounding conductors.[
- a. Front-Connected, Front-Accessible MCCs:
 - b. Main Devices: Drawout.
 - c. Controller Units: Drawout.
 - d. Feeder-Tap Units: Drawout.
 - e. Sections front and rear aligned.

2.10 SOURCE QUALITY CONTROL

- A. MCC Testing: Inspect and test MCCs according to requirements in NEMA ICS 18.

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine areas and surfaces to receive MCCs, with Installer present, for compliance with requirements for installation tolerances 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.

3.02 HARMONIC ANALYSIS STUDY

- A. Perform a harmonic analysis study to identify the effects of nonlinear loads and their associated harmonic contributions on the voltages and currents throughout the electrical system. Analyze possible operating scenarios, including recommendations for VFC input filtering to limit TDD and THD(V) at the defined PCC to specified levels.
- B. Prepare a harmonic analysis study report complying with IEEE 399 and NETA Acceptance Testing Specification.

3.03 INSTALLATION

- A. Coordinate layout and installation of MCCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Floor-Mounting Controllers: Install MCCs on 4-inch (100-mm) nominal thickness concrete base.
 - 1. 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.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Seismic Bracing: Comply with requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in each fusible switch.
- F. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
- G. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

- H. Install power factor correction capacitors. Connect to the load side of overload relays. If connected to the load side of overload relays, adjust overload heater sizes to accommodate the reduced motor full-load currents.
- I. Comply with NECA 1.

3.04 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for identification of MCC, MCC components, and control wiring.
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label MCC and each cubicle with engraved nameplate.
 - 3. Label each enclosure-mounted control and pilot device.
 - 4. Mark up a set of manufacturer's connection wiring diagrams with field-assigned wiring identifications and return to manufacturer for inclusion in Record Drawings.

3.05 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers and remote devices and facility's DDC system for HVAC. Comply with requirements in Section 260523 "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 within 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.

3.06 CONNECTIONS

- A. Comply with requirements for installation of conduit in Section 260533 "Boxes." Drawings indicate general arrangement of conduit, fittings, and specialties.
- B. Comply with requirements in Section 260526 "Grounding and Bonding."

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
 2. Test continuity of each circuit.
- E. 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 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).
 5. Test each motor for proper phase rotation.
 6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 8. Perform the following infrared (thermographic) 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 multipole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each multipole enclosed controller 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
 10. Mark up a set of manufacturer's drawings with all field modifications incorporated during construction and return to manufacturer for inclusion in Record Drawings.
- F. Enclosed controllers will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports, including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.08 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.

3.09 ADJUSTING

- A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- B. Adjust overload relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.
- C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner before increasing settings.
- D. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage, solid-state controllers.

3.10 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.
- B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers, and to use and reprogram microprocessor-based, reduced-voltage, solid-state controllers.

END OF SECTION

26 27 26 WIRING DEVICES

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 1. Receptacles, receptacles with integral GFCI, receptacles with integral USB ports, and associated device plates.
 2. Snap switches.
 3. Cord and plug sets.

1.03 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.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.05 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.

1.06 COORDINATION

- A. Cord and Plug Sets: Match equipment requirements.

2.00 PRODUCTS

2.01 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).

2.02 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Cooper; 5351 (single), 5352 (duplex).
 - b. Hubbell; HBL5351 (single), CR5352 (duplex).
 - c. Leviton; 5891 (single), 5352 (duplex).
 - d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.03 GFCI RECEPTACLES

- A. General Description: Straight blade, 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. Pass & Seymour.
 - b. Hubbell Incorporated; Wiring Device-Kellems.
 - c. Leviton Manufacturing Co., Inc.

2.04 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.

2.05 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).

2.06 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: Smooth, high-impact thermoplastic. Color selected by Architect.
 - 3. Material for Damp Locations and Kitchens: Screw heads shall have color to match plate, 302/304 stainless steel. Damp locations shall include restrooms, exterior locations, kitchens and any other areas where moisture or water is present.
- B. Weatherproof device covers shall have a NEMA 3R rating while receptacle is in use rating with die cast aluminum construction as manufactured by Thomas & Betts Model No. CKMUV or approved equal.
- C. Mark power/receptacle outlets with voltage, phase, panel name and circuit number.
- D. Identify all wall switches, disconnect switches, etc. with nametags, circuit served and panel origin, nametags shall be approved by the ENGINEER/OWNER'S REPRESENTATIVE. Receptacle and light switch cover plates shall be Pass & Seymour, or approved equal, custom laser engraved plates.
- E. Identify all push-button stations with their function and equipment served.

3.00 EXECUTION

3.01 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Existing outlet boxes and associated raceway may be used for new devices/wiring, provided height of outlet box is compliant with the latest ADA and TAS requirements.
- C. In areas that contain plaster or masonry walls, installation of devices and their boxes are intended to be surface mounted.
- D. 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 wiring devices after all wall preparation, including painting, is complete.
- E. 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. a. Cut back and pigtail or replace all damaged conductors.
 - b. b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. c. Pigtailing existing conductors is permitted provided the outlet box is large enough.
- F. Device Installation:
 - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

5. 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.
- G. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
- H. 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.
- I. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical. Group adjacent switches under single, multigang wall plates.

3.02 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.

3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
1. Test Instruments: Use instruments that comply with UL 1436.
 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or

similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION

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26 28 16 LOW VOLTAGE ENCLOSED CIRCUIT BREAKERS AND SWITCHES

1.00 GENERAL

1.01 WORK INCLUDED

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Section Includes:
 - 1. Fusible switches.
 - 2. Non fusible switches.
 - 3. Receptacle switches.
 - 4. Shunt trip switches.
 - 5. Molded-case circuit breakers (MCCBs).
 - 6. Molded-case switches.
 - 7. Enclosures.

1.02 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.03 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, for interior air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 3R, galvanized-steel box with removable interior panel and removable lockable front for exterior locations; Type 4X Stainless steel for Kitchen areas.
 - 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 over-current protective device; include selectable ranges for each type of overcurrent protective device. Submit on translucent log-log graph paper.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.
- C. Qualification Data: For qualified testing agency.
- D. Field quality-control reports.
 1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Manufacturer's field service report.
- F. 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. Submit on translucent log-log graph paper.

1.04 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.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

1.05 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
 2. Altitude: Not exceeding 6600 feet.

1.06 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.07 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Fuse Pullers: Two for each size and type.

2.00 PRODUCTS

2.01 FUSIBLE 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 Cutler-Hammer
 - 2. G.E. by ABB
 - 3. Square D
 - 4. No other manufacturers will be accepted.
- B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 5. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - 6. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.02 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton Cutler-Hammer
 - 2. G.E. by ABB
 - 3. Square D

4. No other manufacturers will be accepted.
- B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Accessories:
 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 4. Hookstick Handle: Allows use of a hookstick to operate the handle.
 5. Lugs: Mechanical type, suitable for number, size, and conductor material.
 6. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.03 SHUNT TRIP 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 Bussmann, Inc.
 2. Eaton Cutler-Hammer
 3. Ferraz Shawmut, Inc.
 4. Littelfuse, Inc.
- B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- E. Accessories:
 1. Oiltight key switch for key-to-test function.
 2. Oiltight green ON pilot light.
 3. Isolated neutral lug; 100 percent rating.
 4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
 5. Form C alarm contacts that change state when switch is tripped.

6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac coil voltage.
7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.04 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 1. Indoor, Dry and Clean Locations: TNEMA 250, Type 1, with continuous-hinge cover with flush latch, for interior air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 12, with continuous-hinge cover with flush latch, for interior non-air conditioned locations, finished inside and out with manufacturer's standard enamel; Type 3R, galvanized-steel box with removable interior panel and removable lockable front for exterior locations; Type 4X Stainless steel for Kitchen areas.
 2. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

3.00 EXECUTION

3.01 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.

3.02 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

3.03 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.

3.04 FIELD QUALITY CONTROL

- A. Enclosed switches will be considered defective if they do not pass tests and inspections.
- B. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

6 32 13.13 DIESEL ENGINE DRIVE GENERATOR SETS

1.00 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Furnish labor, materials, equipment and incidentals necessary to install generator sized to start the loads as indicated.
- C. The engine manufacturer's authorized distributor shall supply the complete power system to include the generator and related components specified in this section, so that there is one source of responsibility for coordination and testing.
- D. Equipment that shall be provided by the generator manufacturer that is further specified in other sections of these documents is as follows:
 - 1. Section 26 05 19 "Equipment Wiring Systems"
 - 2. Section 26 05 26 "Grounding & Bonding"
 - 3. Section 26 05 33.16 "Boxes"
 - 4. Section 26 24 16 "Panelboards and Switchboards"
 - 5. Section 26 27 26 "Wiring Devices"

1.02 SUMMARY

- A. This Section includes packaged diesel engine generator sets with the following features and accessories:
 - 1. Battery charger.
 - 2. Sub-base fuel tank.
 - 3. Engine generator set.
 - 4. Muffler.
 - 5. Remote annunciator.
 - 6. Remote stop switch.
 - 7. Starting battery.
 - 8. Generator Set Controller and Panel

1.03 DEFINITIONS

- A. Standby Rating: Power output rating equal to the power the generator set delivers continuously under normally varying load factors for the duration of a power outage.
- B. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

- C. Steady State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hertz or cycles per second.

1.04 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00, "Document Management" and shall include shop drawings with the following minimum information:
- B. Pre-and Post-Submittal Meeting
 - 1. Supplier shall include in his bid the cost of attending a one-day pre-submittal meeting and a one-day post-submittal meeting in the offices of Freese and Nichols– exact location to be determined at a later date.
 - a. A pre-submittal meeting shall be held before any shop drawings are submitted.
 - b. A post-submittal meeting shall be held after the Engineer's shop drawing review comments have been submitted.
 - c. Vendor shall determine the exact number of people attending the meeting per the specification requirements and cover each person's cost.
 - 2. Any shop drawings submitted before the pre-submittal meeting will be rejected and sent back Not Approved, Revise and Re-submit. The Generator Supplier shall bring with them a detailed list of the items their submittal will include for review by the Engineer.
 - a. A draft copy of the actual submittal shall be provided to the Engineer a minimum of two weeks before the pre-submittal meeting.
 - 3. As a minimum the following shall attend the meeting:
 - a. General Contractor,
 - b. Electrical Contractor,
 - c. Generator Supplier and Engineer. Representatives from the Generator Supplier shall include:
 - d. The Project Manager who will be responsible for putting together the submittal and who will be responsible for the project at the factory, no exceptions.
 - e. The Project Engineer at the factory who has technical knowledge of the equipment, no exceptions.
 - f. A sales person may attend, but not as a substitute for the Project Manager and/or Project Engineer.
- C. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
 - 1. Thermal damage curve for generator.
 - 2. Time-current characteristic curves for generator protective device.
- D. 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. Letter of Coordination: The Generator supplier shall issue a letter of coordination stating that the Generator supplier has coordinated with the Automatic Transfer Switch manufacturer for exact control wiring requirements to insure a complete and operational system.
2. Diesel consumption at 25%, 50% 75% and 100% load.
3. Dimensioned outline plan and elevation drawings of engine generator set/enclosure and other components specified.
4. Data Sheet: Submit information requested on the Data Sheet included as "Attachment A" at the end of this specification.
5. Wiring Diagrams: Project specific detail wiring for power and control connections and differentiate between factory installed and field installed wiring. Generic drawings are not acceptable.
6. Clearly indicate on the drawing the area for the conduits associated with the load center, controller and main protective device.
7. Clearly indicate the mounting height of the top of the controller display/indication lights, etc.
8. Clearly indicate the mounting locations for the following items: load center panel, receptacle, light switches, etc.
9. Clearly indicate the elevation to the main circuit breaker handle and load bank circuit breaker handle.
10. Clearly indicate the vertical distance between lugs/terminations at the main breaker to where the conduits are stubbed up.
11. Complete Bill of Material for all major generator components including panelboard, lights, etc. Provide cut sheets for all major equipment clearly identifying components being provided.
12. Provide information on enclosure color options for Owner to select from.
13. Provide time current curves for main circuit breaker.
14. Generator sizing analysis.
 - a. Detailed sizing analysis shall clearly identify assumptions made for loads being started/operated by the generator.
 - b. The generator manufacturer and Contractor shall be responsible for obtaining all information to run the generator sizing analysis.
 - c. Any changes to the generator size shall be brought to the Engineer's attention. Sizing analysis shall be submitted to the Engineer with the generator's initial submittal. Submittals submitted without sizing analysis shall not be accepted.
15. Indicate fabrication details, dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases for the project site.

- b. Vibration Isolation Base Details: Project specific detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
- E. A minimum of 60 days prior to the equipment being shipped the manufacturer as a formal submittal shall provide:
 - 1. A detailed addresses (memory map) for the software I/O points that are communicated over Ethernet, RS485, etc. that are applicable to this project – this would include but not be limited to the data highways associated with the generator controller, etc.
 - a. A list of I/O that will be transmitted over the data highways will be provided during the review of the generator’s shop drawing submittal; the manufacturer shall verify with the OWNER if any changes have been made to the lists prior to submitting the memory map.
 - b. Provide a list of the settings for the generator controller and what the project specific set points will be.
- F. Factory Test Reports: For units to be shipped for this Project, showing evidence of compliance with specified requirements. Factory test reports shall be provided to the Engineer for approval prior to the unit being released for shipment.
- G. Certified summary of prototype unit test report.
- H. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
- I. Field Test Data – Equipment Installation Report
 - 1. Equipment Installation Report: Field test data shall include summary of all tests performed in the field specifically identified in this specification and other factory standard tests.
 - 2. Field Test and Observation Reports: Indicate and interpret test results and inspection records relative to compliance with performance requirements.
- J. Operation and Maintenance Manuals:
 - 1. Operation and maintenance manuals shall contain the shop drawings, submittals, schematics, final wiring diagrams with any changes made during start-up, equipment installation report and maintenance procedures.
 - 2. Operation and maintenance manuals shall include warranty information as well as a warranty information page that shall include information on the warranty start and end date as well as contact information for service.
 - 3. Operation and maintenance manuals shall include a list of the project specific programmable set points. Providing a copy of the manufacturer’s standard programmable set points with factory default settings and/or including optional set points that are not provided under this project will not be approved.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

- B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- C. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- D. 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.
- E. Comply with ASME B15.1.
- F. Comply with NFPA 37.
- G. Comply with NFPA 70.
- H. Comply with NFPA 110 requirements.
- I. Comply with UL 2200.
- J. Engine Exhaust Emissions: Comply with applicable Federal, State and Local government requirements.
- K. Comply with UL 1008
- L. Comply with ATS Standard.
- M. Comply with NEMA MG-1 and SG-1

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver engine generator set and system components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is safe from such hazards.
- B. Store the generator as recommended by manufacturer.

1.07 COORDINATION

- A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases.

1.08 WARRANTY

- A. General Warranty: 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. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace packaged engine generator and auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Project Final Acceptance. The generator may be used during the course of the project, but the Warranty shall not be impacted by the potential use of the generator prior to the date of Substantial Completion.

1.09 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
 1. In accordance with OCA 252:565-7-4(b)(1), post a complete set of operational instructions, emergency procedures and maintenance schedules at the station.

1.10 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
 2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
 3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.

1.11 PROJECT CONDITIONS

- A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 1. Ambient Temperature: 5 to 50 deg C.
 2. Relative Humidity: 0 to 95 percent.
 3. Altitude: Sea level to 1000 feet.

2.00 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Generator manufacturers:
 1. Caterpillar; Engine Div.
 2. Onan/Cummins Power Generation; Industrial Business Group
 3. Kohler Power Systems.
 4. No others shall be accepted

2.02 ENGINE GENERATOR SET

- A. Furnish a coordinated assembly of compatible components.

- B. Output Connections: 480Y/277V, three phase, four wire.
- C. Safety Standard: Comply with ASME B15.1.
- D. Nameplates: Each major system component is equipped with a conspicuous nameplate of component manufacturer. Nameplate identifies manufacturer of origin and address, and model and serial number of item. Limiting dimensions indicated for system components are not exceeded. Coordinate paragraph below with prototype test requirements in "Submittals" and "Source Quality Control" articles.
- E. Power Output Ratings: Nominal ratings as indicated on plans, with capacity as required to operate as a unit as evidenced by records of prototype testing.
- F. Skid: Adequate strength and rigidity to maintain alignment of mounted components without depending on a concrete foundation. Skid is free from sharp edges and corners. Lifting attachments are arranged to facilitate lifting with slings without damaging any components.

2.03 GENERATOR SET PERFORMANCE

- A. Steady State Voltage Modulation Frequency: Less than 1 Hz.
- B. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step load increase or decrease. Voltage recovers to remain within the steady state operating band within three seconds.
- C. Steady State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
- D. Steady State Frequency Stability: When system is operating at any constant load within rated load, there are no random speed variations outside the steady state operational band and no hunting or surging of speed.
- E. Transient Frequency Performance: Less than 5 percent variation for a 50 percent step load increase or decrease. Frequency recovers to remain within the steady state operating band within five seconds.
- F. Output Waveform: At no load, harmonic content measured line to line or line to neutral does not exceed 5 percent total and 3 percent for single harmonics. The telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.
- G. Sustained Short Circuit Current: For a three phase, bolted short circuit at system output terminals, the system will supply a minimum of 250 percent of rated full load current for not less than 10 seconds and then clear the fault automatically, without damage to any generator system component.
- H. Start Time: Comply with NFPA 110, Type 10, system requirements.
- I. Generator shall produce 480Y/277V, 60Hz
- J. The Generator shall be suitable for use with solid state reduced voltage starters and across the line starters.
- K. Generator Sizing
 - 1. There shall be a minimum of one (3) steps. When conducting the generator sizing analysis, the voltage drop of the generator shall be set at a maximum of 15% and the

maximum frequency dip shall be 20%. The nominal load on the generator shall not exceed 85% of the rated load capacity of the generator under any operation scenarios as described above. The generator shall be large enough to start:

Load	HP	KVA	NEMA	Fed From	Starter (New MCC)	Controls (New MCC)
Air Compressor #1	7.5	9.1		MCC	ATL- NEMA 1	
Air Compressor #2	7.5	9.1		MCC	ATL- NEMA 1	
Oil Pump #1	0.5	0.91		MCC	ATL- NEMA 1	
Oil Pump #2	0.5	0.91		MCC	ATL- NEMA 1	
Raw Water Pump				MCC	Not longer needed.	
Rake Feed #1	1.5	2.5		MCC	ATL- NEMA 1	
Rake Feed #2	1.5	2.5		MCC	ATL- NEMA 1	
Sump Pump #7	60	64	C	MCC	Reduced Voltage Starter	
Sump Pump #8	60	64	C	MCC	Reduced Voltage Starter	
MOV #1	1.5	2.5		MCC	ATL- NEMA 1	
MOV #2	1.5	2.5		MCC	ATL- NEMA 1	
MOV #3	1.5	2.5		MCC	ATL- NEMA 1	
Exhaust Fan 1A	1	0.83		MCC	ATL- NEMA 1	Thermostat
Exhaust Fan 1B	1	0.83		MCC	ATL- NEMA 1	Thermostat
Exhaust Fan 1C	1	0.83		MCC	ATL- NEMA 1	Thermostat
Supply Fan 1A	1	0.83		MCC	ATL- NEMA 1	

- L. Generator manufacturer shall provide a detailed sizing analysis to the Engineer for approval.
 - 1. Detailed sizing analysis shall clearly identify assumptions made for loads being started/operated by the generator.
 - 2. The generator manufacturer and Contractor shall be responsible for obtaining all information to run the generator sizing analysis.
 - 3. Any changes to the generator size shall be brought to the Engineer's attention. Sizing analysis shall be submitted to the Engineer with the generator's initial submittal. Submittals submitted without sizing analysis shall not be accepted.

2.04 ENGINE

- A. Comply with NFPA 37.
- B. Fuel: Fuel oil, Grade DF 2.
- C. Rated Engine Speed: 1800 rpm.
- D. Maximum Piston Speed for Four Cycle Engines: 2250 fpm.
- E. Lubrication System: Pressurized by a positive displacement pump driven from engine crankshaft. The following items are mounted on engine or skid:
 - 1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.

2. Thermostatic Control Valve: Controls flow in system to maintain optimum oil temperature. Unit is capable of full flow and is designed to be fail safe.
 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps or siphons or special tools or appliances.
- F. Engine Fuel System: Comply with NFPA 37. System includes the following:
1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
 2. Relief/Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- G. Coolant Jacket Heater: Electric immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment. Jacket heater shall operate on 208V, single phase.

2.05 GOVERNOR

- A. Type: Adjustable isochronous, with speed sensing.

2.06 ENGINE COOLING SYSTEM

- A. Description: Closed loop, liquid cooled, with radiator factory mounted on engine generator set skid and integral engine driven coolant pump.
- B. Radiator: Rated for specified coolant.
- C. Coolant: Solution of 50 percent ethylene glycol based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
- D. Expansion Tank: Constructed of welded steel plate and equipped with gage glass and petcock.
- E. Temperature Control: Self contained, thermostatic control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
- F. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging , ultraviolet , and abrasion resistant fabric.
1. Rating: 50 psig (345 kPa) maximum working pressure with 180 deg F (82 deg C) coolant, and non-collapsible under vacuum.
 2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
 3. The generator shall be rated for continuous standby duty with a temperature rise of 80 deg C.

2.07 FUEL SUB-BASE STORAGE TANK

- A. The generator sub-base tank shall be listed and labeled as UL142.

- B. The tank shall be clearly labeled indicating the type of product, the volume capacity, the top loading capacity, and the manufacturer.
- C. The tank is intended for stationary installation and in accordance with NFPA 30 and NFPA 37. Comply with all federal, state and local codes.
- D. Sub-Base Tanks should have a second contained tanks for 110% of the tank capacity.
- E. Sub-Base Mounted Fuel Oil Tank: Factory installed and piped, U.L. listed and labeled fuel oil tank. The following accessories shall be installed in the tank:
 - 1. Capacity: Fuel 260 gallon sub-base tank
 - 2. Leak sensor switch installed in interstitial space and wired to generator control panel.
 - 3. Low level alarm switch wired to generator control panel.
 - 4. Mechanical fill limiter, Morrison 9095A or equal, with tight fill adapter, installed inside spill containment fill area.
 - 5. Mechanical level gauge.
 - 6. Engine supply pick-up tube and return connections with suction drop tube.
 - 7. Electrical stub-up, rectangular type, located directly beneath the generator terminal box.
 - 8. Tank level indicator.
 - 9. Vandal resistant fill cap.
 - 10. Emergency pressure relief vent.

2.08 ENGINE EXHAUST SYSTEM

- A. Muffler: Hospital Grade, sized as recommended by engine manufacturer. Measured sound level at a distance of 1 meter from exhaust discharge, is 85 dBA or less.
- B. Connection from Exhaust Pipe to Muffler: Stainless steel expansion joint with liners.

2.09 STARTING SYSTEM

- A. Description: 24 V electric, with negative ground and including the following items:
 - 1. Components: Sized so they will not be damaged during a full engine cranking cycle with ambient temperature at maximum specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above.
 - 2. Cranking Motor: Heavy duty unit that automatically engages and releases from engine flywheel without binding.
 - 3. Cranking Cycle: As required by NFPA 110 for system level specified.
 - 4. Battery: Adequate capacity within ambient temperature range specified in "Environmental Conditions" Paragraph in "Service Conditions" Article above to provide specified cranking cycle at least three times without recharging.
 - 5. Battery Cable: Size as recommended by generator set manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.

6. Battery Charging Alternator: Factory mounted on engine with solid state voltage regulation and 35 A minimum continuous rating.
7. Battery Charger: Current limiting, automatic equalizing and float charging type. Unit complies with UL 1236 and includes the following features:
 - a. Operation: Equalizing charging rate of 10 A is initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit then automatically switches to a lower float charging mode and continues operating in that mode until battery is discharged again.
 - b. Automatic Temperature Compensation: Adjusts float and equalizes voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
 - c. Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to plus or minus 10 percent.
 - d. Ammeter and Voltmeter: Flush mounted in door. Meters indicate charging rates.
 - e. Safety Functions: Include sensing of abnormally low battery voltage arranged to close contacts providing low battery voltage indication on control and monitoring panel. Also include sensing of high battery voltage and loss of ac input or dc output of battery charger. Either condition closes contacts that provide a battery charger malfunction indication at system control and monitoring panel.
 - f. Enclosure and Mounting: NEMA 250, Type 4X 316 Stainless Steel, wall mounted cabinet.
 - g. Charger shall operate on 120V, 1 phase.

2.10 CONTROL AND MONITORING FUNCTIONAL DESCRIPTION:

- A. Provide a fully solid-state, microprocessor based, generator set control. The control panel shall be designed and built by the engine manufacturer. The control shall provide all operating, monitoring, and control functions for the generator set. The control panel shall provide real time digital communications to all engine and regulator controls via SAE J1939.
- B. Environmental: The generator set control shall be tested and certified to the following environmental conditions:
 1. -40°C to +70°C Operating Range
 2. 95% humidity non-condensing, 30°C to 60°C
 3. IP22 protection
 4. 5% salt spray, 48 hours, +38°C, 36.8V system voltage
 5. Sinusoidal vibration 4.3G's RMS, 24-1000Hz
 6. Electromagnetic Capability (89/336/EEC, 91/368/EEC, 93/44/EEC, 93/68/EEC, BS EN 50081-2, 50082-2)
 7. Shock: withstand 15G
- C. Functional Requirements: The following functionality shall be integral to the control panel:

1. The control shall include a minimum 64 x 240 pixel, 28mm x 100mm, white backlight graphical display with text-based alarm/event descriptions
 2. The control shall include a minimum of 3-line data display
 3. Audible horn for alarm and shutdown with horn silence switch
 4. Standard ISO labeling
 5. Multiple language capability
 6. Remote start/stop control
 7. Local run/off/auto control integral to system microprocessor
 8. Cooldown timer
 9. Speed adjust
 10. Lamp test
 11. Push button emergency stop button
 12. Voltage adjust
 13. Voltage regulator V/Hz slope – adjustable
 14. Password protected system programming
- D. Digital Monitoring Capability: The controls shall provide the following digital readouts for the engine and generator. All readings shall be indicated in either metric or English units:
1. Engine
 - a. Engine oil pressure
 - b. Engine oil temperature
 - c. Engine coolant temperature
 - d. Engine RPM
 - e. Battery volts
 - f. Engine hours
 - g. Engine crank attempt counter
 - h. Engine successful start counter
 - i. Service maintenance interval
 - j. Real time clock
 2. Generator
 - a. Generator AC volts (Line to Line, Line to Neutral and Average)
 - b. Generator AC current (Avg and Per Phase)
 - c. Generator AC Frequency
 - d. Generator kW (Total and Per Phase)
 - e. Generator kVA (Total and Per Phase)

- f. Generator kVAR (Total and Per Phase)
 - g. Power Factor (Avg and Per Phase)
 - h. Total kW-hr
 - i. Total kVAR-hr
 - j. % kW
 - k. % kVA
 - l. % kVAR
3. Voltage Regulation
- a. Excitation voltage
 - b. Excitation current
- E. Alarms and Shutdowns: The control shall monitor and provide alarm indication and subsequent shutdown for the following conditions. All alarms and shutdowns are accompanied by a time, date, and engine hour stamp that are stored by the control panel for first and last occurrence:
1. Engine Alarm/Shutdown
 - a. Low oil pressure alarm/shutdown
 - b. High coolant temperature alarm/shutdown
 - c. Loss of coolant shutdown
 - d. Overspeed shutdown
 - e. Overcrank shutdown
 - f. Emergency stop depressed shutdown
 - g. Low coolant temperature alarm
 - h. Low battery voltage alarm
 - i. High battery voltage alarm
 - j. Control switch not in auto position alarm
 - k. Battery charger failure alarm
 2. Generator Alarm/Shutdown
 - a. Generator over voltage
 - b. Generator under voltage
 - c. Generator over frequency
 - d. Generator under frequency
 - e. Generator reverse power
 - f. Generator overcurrent
 3. Voltage Regulator Alarm/Shutdown

- a. Loss of excitation alarm/shutdown
 - b. Instantaneous over excitation alarm/shutdown
 - c. Time over excitation alarm/shutdown
 - d. Rotating diode failure
 - e. Loss of sensing
 - f. Loss of PMG
4. Above Ground Fuel Tank
- a. Vent tank switch placed within vent line to report alarm for anytime when oil in the main tank overfills and migrates up the vent line.
5. Outdoor Fuel Storage Tank
- a. Spill container to have integral overfill alarm station with overfill alarm light, alarm horn and silence pushbutton
- F. Inputs and Outputs
1. Digital Inputs: The Controller shall include the ability to accept six (6) to eighteen (18) programmable digital input signals. The signals may be programmed for either high or low activation using programmable Normally Open or Normally Closed contacts.
 2. Digital Outputs: The control shall include the ability to operate six (6) programmable relay output signals, integral to the controller. The output relays shall be rated for 2A @ 30VDC and consist of six (6) Form A (Normally Open) contacts and two (10) Form C (Normally Open & Normally Closed) contacts.
 3. Discrete Outputs: The control shall include the ability to operate two (2) discrete outputs, integral to the controller, which are capable of sinking up to 300mA.
- G. Maintenance: All engine, voltage regulator, control panel and accessory units shall be accessible through a single electronic service tool. The following maintenance functionality shall be integral to the generator set control
1. Engine running hours display
 2. Service maintenance interval (running hours or calendar days)
 3. Engine crank attempt counter
 4. Engine successful starts counter
 5. 20 events are stored in control panel memory
- H. Remote Communications
1. Remote Communications: The control shall include Modbus RTU and Ethernet communications as standard via RS-485 half duplex with configurable baud rates from 2.4k to 57.6k. The remote communications shall also be capable of communicating Modbus RTU and Ethernet.
 2. Remote Monitoring Software: The control shall provide Monitoring Software with the following functionality:

- a. Provide access to all data and events on generator set communications network
 - b. Provide remote control capability for the generator set
 - c. Ability to communicate via Modbus RTU and Ethernet.
3. Remote Indication: Provide a remote indication to SCADA.
- a. Provide the following individual digital outputs for the following indications for protection and diagnostics
 - 1). Overcrank
 - 2). Low coolant temperature
 - 3). High coolant temperature warning
 - 4). High coolant temperature shutdown
 - 5). Low oil pressure warning
 - 6). Low oil pressure shutdown
 - 7). Overspeed
 - 8). Low coolant level
 - 9). EPS supplying load
 - 10). Control switch not in auto
 - 11). High battery voltage
 - 12). Low battery voltage
 - 13). Battery charger AC failure
 - 14). Emergency stop
 - 15). Low Fuel Level
 - 16). Fuel Leak
 - 17). Outdoor fuel storage tank overflow
 - 18). Vent tank switch alarm for overflow
 - b. The following additional metering shall be provided via Ethernet Communication protocol and Modbus RTU for each Engine:
 - 1). Generator kW, kVA, kVAR, PF, Volts, Amps and frequency
 - 2). Generator AC Amperes – Phase A, Phase B and Phase C
 - 3). Generator AC Voltage – Phase A-B, Phase B-C, Phase C-A, Phase A, Phase B and Phase C (verify phase rotation)
 - 4). Engine RPM Meter
 - 5). Engine Battery Voltage Meter
 - 6). Engine Oil Pressure Gauge
 - 7). Engine Coolant Temperature Gauge

- 8). Engine Running Hour Meter
- 9). Engine Start Counter
- 10). Atmospheric Pressure
- 11). Boost Pressure
- 12). Air Filter Restriction
- 13). Left Turbo Inlet Pressure
- 14). Right Turbo Inlet Pressure
- 15). Engine Hour meter
- 16). Total Fuel Burned
- 17). Engine Coolant Level Status
- 18). Local Engine Control Switch Position
- 19). Overspeed Switch Status
- 20). Remote Emergency Stop Actuated
- 21). Percent Engine Load
- 22). Oil Filter Pressure Differential
- 23). Fuel Filter Pressure Differential
- 24). After-coolant Temperature
- 25). Right Exhaust Temperature
- 26). Left Exhaust Temperature
- 27). Crankcase Air Pressure
- 28). Filtered Fuel Pressure
- 29). Right Air Filter Restriction
- 30). Left Air Filter Restriction
- 31). Fuel Consumption Rate
- 32). Engine Oil Temperature.

2.11 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker:

1. Generator shall include a main circuit breaker and a dedicated load bank circuit breaker.
2. Molded case, thermal magnetic type; 100 percent rated for breakers below 800A; complying with NEMA AB 1 and UL 489.
3. Main devices and feeder devices 800 amps and above shall be individually mounted circuit breakers (100% rated)
4. Breakers shall have solid-state adjustable trip settings with Long time, Short time, Instantaneous and Ground settings (LSIG)

- 5. All circuit protective devices shall have the following minimum symmetrical current interrupting capacity: 65kA.
- 6. Series rated feeder devices shall not be acceptable.
- 7. Breakers shall have trip indication of Overload, Short Circuit, and Ground Fault trip.
- B. All breakers shall be capable of being locked in the OFF position.
- C. Tripping Characteristic: Designed specifically for generator protection.
- D. Trip Rating: Matched to generator rating.
- E. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
- F. Mounting: Adjacent to or integrated with control and monitoring panel

2.12 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1 and specified performance requirements.
- B. Drive: Generator shaft is directly connected to engine shaft. Exciter is rotated integrally with generator rotor.
- C. Electrical Insulation: H.
- D. Stator Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction prevents mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Excitation uses no slip or collector rings, or brushes, and is arranged to sustain generator output under short circuit conditions as specified.
- G. Enclosure: Drip proof.
- H. Voltage Regulator: Solid state type, separate from exciter, providing performance as specified.
 - 1. Adjusting rheostat on control and monitoring panel provides plus or minus 5 percent adjustment of output voltage operating band.
- I. Windings: Two thirds pitch stator winding and fully linked amortisseur winding.

2.13 FINISHES

- A. Indoor Enclosures and Components: Manufacturer's standard enamel over corrosion resistant pretreatment and compatible standard primer.
- B. All external hardware to be type 316 stainless steel (e.g. latches, handles, hinges, fasteners, screws, anchor bolts, rods, bolts, nuts, etc.) including those for factory assembly of components. Field apply nickel anti-seize compound to threads prior to assembly.

2.14 FUEL MAINTENANCE SYSTEM

- A. Each fuel storage tank shall include two stage fuel maintenance system that will remove dirt and water. The maintenance system shall be plumbed into the tank per the manufacturer's recommendations.
- B. The separator shall remove 99.9% of the water in the fuel line and 95% of the solids.
- C. The stabilizer shall decontaminate and stabilize the fuel without the use of chemical additives.
- D. The system shall operate on 120V, 1 phase, 60HZ, circuit sourced from generator internal panelboard. The fuel maintenance system panel to be in a NEMA 4X, 316 stainless steel enclosure.
- E. Programmable controller:
 - 1. The controller shall be a UL 508 listed assembly.
 - 2. Provide dry contact for general alarms.
- F. The system shall be capable of treating the maximum amount of fuel that the entire sub-base tank fuel system is capable of being filled with. Acceptable manufacturer is Fuel Technologies International LLC product number FTI-2.8.
- G. The fuel tank shall be provided with all the necessary and required pipe and fittings for installation and proper operation of the system.

2.15 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor.
 - 1. Include the following tests:
 - a. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
 - b. 4 Hour full load
 - c. Maximum power.
 - d. Voltage regulation.
 - e. Transient and steady-state governing.
 - f. Single-step load pickup.
 - g. Safety shutdown.
 - h. Report factory test results within 10 days of completion of test.

2.16 DISTRIBUTION

- A. Generator manufacturer shall be responsible for providing panelboard, Surge Protection Device (SPD), circuit breakers and all associated cabling and conduits to devices requiring power in the generator and the generator enclosure. Cabling shall be per Specification 26 05 19 "Low Voltage Electrical Power Conductors and Cables", 26 05 23 "Low Voltage Electrical Conductors & Cables" and conduit shall be per Specification 26 05 33.01 "Conduits".
- B. The Manufacturer shall provide circuit breakers for shore power, at a minimum but not limited to the following functions:
 - 1. One Circuit Breaker for Interior Lights
 - 2. One Circuit Breaker for Exterior Lights
 - 3. One Circuit Breaker for Receptacles
 - 4. One Circuit Breaker for Battery Charger
 - 5. One Circuit Breaker for each block heater.
 - 6. One Circuit Breaker for Fuel Maintenance System.

2.17 MISCELLANEOUS ITEMS

- A. Cabling and conduit shall be per Specification 26 05 19, "Equipment Wiring Systems" and Specification 26 05 33, "Conduit".

3.00 EXECUTION

3.01 EXAMINATION

- A. Examine areas, equipment foundations, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine roughing in of electrical connections. Verify actual locations of connections before packaged engine generator installation.

3.02 CONCRETE BASES

- A. Install concrete bases of dimensions indicated for packaged engine generators.

3.03 INSTALLATION

- A. Comply with packaged engine generator manufacturers' written installation and alignment instructions, and with NFPA 110.
- B. Set packaged engine generator set on concrete pads.
 - 1. Support generator set mounting feet on rectangular metal blocks and shims or on metal wedges having small taper, at points near foundation bolts to provide 3/4 to 1 1/2 inch gap between pump base and foundation for grouting.

2. Adjust metal supports or wedges until generator is level.
- C. Install packaged engine generator to provide access for periodic maintenance, including removal of drivers and accessories. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted.
 1. Verify that electrical wiring is installed according to manufacturers' submittal and installation requirements in Division 26 Sections. Proceed with equipment startup only after wiring installation is satisfactory.
- D. All testing performed by the Contractor shall be witnessed by the Owner.
- E. The Contractor shall test the generator voltage and configuration on site prior to connecting to Owner's system.
- F. The Contractor shall provide an inductive load bank test on site for 4 hours.
- G. Contractor shall perform operational demonstration testing. Contractor shall start-up, test and verify all equipment is operational prior to scheduling the Owner to witness demonstration testing. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with the Owner a minimum of two (2) weeks in advance.
- H. The contractor shall provide all fuel for testing of the generator. The contractor shall be responsible for providing a 90% full tank of fuel upon completion of all testing.

3.04 CONNECTIONS

- A. 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.
 2. Provide two NEMA 2-hole ground pads located at the corners of the generator. Ground pads shall be stainless steel and suitable for terminating #2/0 ground conductor.

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory authorized service representative to inspect field assembled components and equipment installation, including piping and electrical connections, and to assist in testing. Report results in writing. Provide onsite field service as needed for start-up/training.
- B. All testing performed by the Contractor shall be witnessed by the Owner.
- C. Testing: Perform field quality control testing under the supervision of the manufacturer's factory authorized service representative.
 1. Tests recommended by manufacturer, including under load tests.
 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, the following:
 - a. Single step full load pickup test at 100% load.
 - b. 4-hour load bank test at 100% load

3. Battery Tests: Measure charging voltage and voltages between available battery terminals for full charging and float charging conditions. Check electrolyte level and specific gravity under both conditions. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery. Verify acceptance of charge for each element of battery after discharge. Verify measurements are within manufacturer's specifications.
 4. Battery Charger Tests: Verify specified rates of charge for both equalizing and float charging conditions.
 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
 6. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step load increases and decreases, and verify that performance is as specified.
 7. Harmonic Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
 8. Perform field load testing of the Generator set. Field load testing shall include but not be limited to simulating a power outage and running the generator under load with the number and size of loads it is specified to be rated for.
 9. The Contractor shall provide fuel for the testing of the generator and shall fill the fuel tank to 90% capacity upon final completion.
- D. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
 - E. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
 - F. Test instruments shall have been calibrated within the last 12 months, traceable to standards of the National Institute for Standards and Technology, and adequate for making positive observation of test results. Make calibration records available for examination on request.

3.06 COMMISSIONING

- A. Battery Equalization: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

3.07 CLEANING

- A. On completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.
- B. Provide 1 gallon of touchup paint.

3.08 DEMONSTRATION

- A. Contractor shall perform operational demonstration testing. Contractor shall start-up, test and verify all equipment is operational prior to scheduling the Owner to witness demonstration testing.

3.09 TRAINING

- A. Operator training shall be conducted on a separate day after demonstration testing. Contractor shall coordinate schedule with the Owner a minimum of two(2) weeks in advance.
- B. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators as specified below:
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment. Owner Training: Provide one day for Owner Training. These times do not include travel time and include a minimum of 8 working hours per day.
 - 2. Review data in maintenance manuals. Refer to Division 1 Section 01 33 00 "Document Management" for additional information.
 - 3. Schedule training with Owner, with at least seven days advance notice.
 - 4. Minimum Instruction Period: Eight hours.

END OF SECTION

ATTACHMENT A
GENERATOR SUBMITTAL DATA SHEET

Submit the following data with the shop drawing submittal:

Generator		
Item No.	Description	Generator
1	Manufacturer of Generator	
2	Model of Generator	
3	Stand-by Rating (KW)/(KVA)	
4	Power Factor	
5	Voltage Rating	
6	RPM	
7	Fuel Emissions (EPA Tier)	
8	Enclosure Dimensions (inches): Length x Width x Height	
9	Enclosure Sound Rating at 7meters in free air:	
10	Fuel Consumption at 100% load (gallons/hour)	
11	Capacity of Fuel Tank (gallons)	

Item No.	Description	
1	Generator and Enclosure (dry weight) (lbs.):	
2	Full Tank of Fuel (lbs.):	
3	Total (wet weight) (lbs.):	

END OF ATTACHMENT

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26 36 00 AUTOMATIC TRANSFER SWITCHES

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes automatic transfer switches rated 600 V and less, including the following:
 1. Service Entrance Rated
 2. Bypass/isolation switches.
 3. Remote annunciator system.
 4. Remote annunciator and control system.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for transfer switches.
 2. Include rated capacities, operating characteristics, electrical characteristics, and accessories.
- B. Shop Drawings:
 1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
 2. Include material lists for each switch specified.
 3. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.
 4. Riser Diagram: Show interconnection wiring between transfer switches, bypass/isolation switches, annunciators, and control panels.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer-authorized service representative.
- B. Seismic Qualification Certificates: For transfer switches, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.
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 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.
 1. In addition to items specified in Section 01 33 04 "Operation and Maintenance Data," include the following:
 - a. Features and operating sequences, both automatic and manual.
 - b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

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- b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Member company of NETA.
2. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.07 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:

1. Notify Owner no fewer than 10 days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.08 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 2 years from date of Substantial Completion.

2.00 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

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 NEMA ICS 1.

C. Comply with NFPA 99.

- D. Comply with NFPA 110.
- E. Comply with UL 1008 unless requirements of these Specifications are stricter.
- F. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- G. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 - 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
 - 2. Short-time withstand capability for 30 cycles.
- H. Repetitive Accuracy of Solid-State Controls: All settings shall be +/- 2 percent or better over an operating temperature range of -20 to +70 deg C.
- I. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- J. Electrical Operation: Accomplish by a non-fused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.
- K. Service-Rated Transfer Switch:
 - 1. Comply with UL 869A and UL 489.
 - 2. Provide terminals for bonding the grounding electrode conductor to the grounded service conductor.
 - 3. In systems with a neutral, the bonding connection shall be on the neutral bus.
 - 4. Provide removable link for temporary separation of the service and load grounded conductors.
 - 5. Surge Protective Device: Service rated.
 - 6. Ground-Fault Protection: Comply with UL 1008 for normal and alternative buses.
 - 7. Service Disconnecting Means: Externally operated, manual mechanically actuated.
- L. Neutral Terminal: Solid and fully rated unless otherwise indicated.
- M. Heater: Equip switches exposed to cool temperatures and high humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
- N. Battery Charger: For generator starting batteries.
 - 1. Float type, rated 10 A.
- O. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or

annunciator and control panels shall have communication capability matched with remote device.

- P. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed markers at terminations. Color-coding and wire and cable markers are specified in Section 26 05 53 "Identification for Electrical Systems."
 - 1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
 - 2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
 - 3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
 - 4. Accessible via front access.
- Q. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.02 CONTACTOR-TYPE AUTOMATIC TRANSFER SWITCHES

- A. Acceptable Manufacturers:
 - 1. G.E. ABB, Electrification Business.
 - 2. Caterpillar, Inc; Electric Power Division.
 - 3. Cummins Power Generation.
 - 4. Eaton.
- B. Comply with Level 2 equipment according to NFPA 110.
- C. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Contacts: Silver composition or silver alloy for load-current switching. Contactor-style automatic transfer-switch units, rated 600 A and higher, shall have separate arcing contacts.
 - 2. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 3. Material: Hard-drawn copper, 98 percent conductivity.
 - 4. Main and Neutral Lugs: Mechanical type.
 - 5. Ground Lugs and Bus-Configured Terminators: Mechanical type.
 - 6. Connectors shall be marked for conductor size and type according to UL 1008.
 - 7. Automatic Open-Transition Transfer Switches:
 - 8. Interlocked to prevent the load from being closed on both sources at the same time.
 - 9. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.

- 10. Fully automatic break-before-make operation with transfer when two sources have near zero phase difference.
 - D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
 - E. Large-Motor-Load Power Transfer:
- 2.03 MOLDED-CASE-TYPE AUTOMATIC TRANSFER SWITCHES
- A. Acceptable Manufacturers:
 - 1. ABB, Electrification Business.
 - 2. Caterpillar, Inc; Electric Power Division.
 - 3. Cummins Power Generation.
 - 4. Eaton.
 - B. Comply with Level 2 equipment according to NFPA 110.
 - C. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using contactor-based components are unacceptable.
 - 2. Contacts: Silver composition or silver alloy for load-current switching.
 - 3. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 4. Material: Hard-drawn copper, 98 percent conductivity.
 - 5. Main and Neutral Lugs: Mechanical type.
 - 6. Ground bar.
 - 7. Connectors shall be marked for conductor size and type according to UL 1008.
 - D. Automatic Open-Transition Transfer Switches:
 - 1. Interlocked to prevent the load from being closed on both sources at the same time.
 - 2. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
 - E. Automatic Delayed-Transition Transfer Switches: Pauses or stops in intermediate position to momentarily disconnect both sources, with transition controlled by programming in the automatic transfer-switch controller. Interlocked to prevent the load from being closed on both sources at the same time.
 - 1. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals for alternative source. Adjustable from 0 to 6 seconds, and factory set for 1 second.
 - 2. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
 - 3. Fully automatic break-before-make operation with center off position.

4. Fully automatic break-before-make operation with transfer when two sources have near zero phase difference.
 - a. Automatic transfer-switch controller takes active control of generator to match frequency, phase angle, and voltage.
 - b. Controls ensure that closed-transition load transfer closure occurs only when the two sources are within +/- 5 electrical degrees maximum, and +/- 5 percent maximum voltage difference.
5. Failure of power source serving load initiates automatic break-before-make transfer.
- F. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
- G. Transfer Switches Based on Molded-Case-Switch Components: Comply with UL 489 and UL 869A.
- H. Automatic Transfer-Switch Controller Features:
 1. Controller operates through a period of loss of control power.
 2. Undervoltage Sensing for Each Phase of Normal and Alternative Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
 3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
 4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 5. Test Switch: Simulate normal-source failure.
 6. Switch-Position Pilot Lights: Indicate source to which load is connected.
 7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
 - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
 - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
 8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240 VAC.
 9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.

10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32 VDC minimum.

2.04 TRANSFER SWITCH ACCESSORIES

A. Bypass/Isolation Switches:

1. Source Limitations: Same manufacturer as transfer switch in which installed.
2. Comply with requirements for Level 1 equipment according to NFPA 110.
3. Description: Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources. Include the following features for each combined automatic transfer switch and bypass/isolation switch:
 - a. Means to lock bypass/isolation switch in the position that isolates transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. Interlocks shall prevent transfer-switch operation, except for testing or maintenance, while automatic transfer switch is isolated.
 - b. Provide means to make power available to transfer-switch control circuit for testing and maintenance purposes.
 - c. Drawout Arrangement for Transfer Switch: Provide physical separation from live parts and accessibility for testing and maintenance operations. Transfer switch and bypass/isolation switch shall be in isolated compartments.
 - d. Transition: Provide closed-transition operation when transferring between power sources.
 - e. Contact temperatures of bypass/isolation switches shall not exceed those of automatic transfer-switch contacts when they are carrying rated load.
 - f. Automatic and Nonautomatic Control: Automatic transfer-switch controller shall also control the bypass/isolation switch.

2.05 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.
- B. Prepare test and inspection reports.
 1. For each of the tests required by UL 1008, performed on representative devices, for emergency systems. Include results of test for the following conditions:
 - a. Overvoltage.
 - b. Undervoltage.
 - c. Loss of supply voltage.
 - d. Reduction of supply voltage.
 - e. Alternative supply voltage or frequency is at minimum acceptable values.

- f. Temperature rise.
- g. Dielectric voltage-withstand; before and after short-circuit test.
- h. Overload.
- i. Contact opening.
- j. Endurance.
- k. Short circuit.
- l. Short-time current capability.
- m. Receptacle withstand capability.
- n. Insulating base and supports damage.

3.00 EXECUTION

3.01 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Wiring Method:
 - 1. Install cables in raceways and cable trays except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.
 - 2. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
- D. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" and Section 27 15 00 "Communications Horizontal Cabling."
- F. Route and brace conductors according to manufacturer's written instructions and Section 26 50 29 "Hangers and Supports for Electrical Systems." Do not obscure manufacturer's markings and labels.
- G. Final connections to equipment shall be made with liquid tight, flexible metallic conduit no more than 18 inches in length.

3.02 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

- C. Perform the following tests and inspections:
1. After installing equipment, test for compliance with requirements according to NETA ATS.
 2. Visual and Mechanical Inspection:
 - a. Compare equipment nameplate data with the Drawings and Specifications.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, grounding, and required clearances.
 - d. Verify that the unit is clean.
 - e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
 - f. Verify that manual transfer warnings are attached and visible.
 - g. Verify tightness of all control connections.
 - h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:
 - 1). Use of low-resistance ohmmeter.
 - 2). Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.
 - i. Perform manual transfer operation.
 - j. Verify positive mechanical interlocking between normal and alternate sources.
 - k. Perform visual and mechanical inspection of surge arresters.
 - l. Inspect control power transformers.
 - 1). Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
 - 2). Verify that primary and secondary fuse or circuit-breaker ratings match the Drawings.
 - 3). Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.
 3. Electrical Tests:
 - a. Perform insulation-resistance tests on all control wiring with respect to ground.
 - b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
 - c. Verify settings and operation of control devices.
 - d. Calibrate and set all relays and timers.
 - e. Verify phase rotation, phasing, and synchronized operation.
 - f. Perform automatic transfer tests.

- g. Verify correct operation and timing of the following functions:
 - 1). Normal source voltage-sensing and frequency-sensing relays.
 - 2). Engine start sequence.
 - 3). Time delay on transfer.
 - 4). Alternative source voltage-sensing and frequency-sensing relays.
 - 5). Automatic transfer operation.
 - 6). Interlocks and limit switch function.
 - 7). Time delay and retransfer on normal power restoration.
 - 8). Engine cool-down and shutdown feature.
- 4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.
- 5. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.
 - a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
 - b. Simulate loss of phase-to-ground voltage for each phase of normal source.
 - c. Verify time-delay settings.
 - d. Verify pickup and dropout voltages by data readout or inspection of control settings.
 - e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
- 6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
 - a. Verify grounding connections and locations and ratings of sensors.
- D. Coordinate tests with tests of generator and run them concurrently.
- E. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- F. Transfer switches will be considered defective if they do not pass tests and inspections.
- G. Remove and replace malfunctioning units and retest as specified above.

- H. Prepare test and inspection reports.
- I. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.
 - 1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
 - 3. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

3.03 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.
- B. Training shall include testing ground-fault protective devices and instructions to determine when the ground-fault system shall be retested. Include instructions on where ground-fault sensors are located and how to avoid negating the ground-fault protection scheme during testing and circuit modifications.
- C. Coordinate this training with that for generator equipment.

END OF SECTION

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26 43 13 SURGE PROTECTION DEVICE FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes field-mounted SPD's for low-voltage (120 to 600 V) power distribution and control equipment.
- B. Related Sections:
 - 1. Division 26 Section "Panelboards" for factory-installed SPD.

1.03 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. SVR: Suppressed voltage rating.
- C. SPD: Surge Protection Device(s), both singular and plural.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.
- B. Qualification Data: For qualified testing agency.
- C. Product Certificates: For SPD's, from manufacturer.
- D. Field quality-control reports.
- E. Operation and Maintenance Data: For SPD's to include in emergency, operation, and maintenance manuals.
- F. Warranties: Sample of special warranties.

1.05 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 testing agency, and marked for intended location and application.
- C. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.
- D. Comply with NEMA LS 1.
- E. Comply with UL 1449.

F. Comply with NFPA 70.

1.06 PROJECT CONDITIONS

A. Service Conditions: Rate SPD's 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.
3. Humidity: 0 to 85 percent, noncondensing.
4. Altitude: Less than 20,000 feet above sea level.

1.07 COORDINATION

A. Coordinate location of field-mounted SPD's to allow adequate clearances for maintenance.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

1.09 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Replaceable Protection Modules: Two of each size and type installed.

2.00 PRODUCTS

2.01 SERVICE ENTRANCE SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Current Technology Inc.; Danaher Power Solutions.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
4. Leviton Mfg. Company Inc.
5. Square D; a brand of Schneider Electric.

B. Surge Protection Devices:

1. Comply with UL 1449.
2. Modular design with field-replaceable modules.

3. Fuses, rated at 200-kA interrupting capacity.
 4. Fabrication using bolted compression lugs for internal wiring.
 5. Redundant suppression circuits.
 6. Redundant replaceable modules.
 7. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 8. LED indicator lights for power and protection status.
 9. Audible alarm, with silencing switch, to indicate when protection has failed.
 10. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
 11. Four-digit transient-event counter set to totalize transient surges.
- C. Peak Single-Impulse Surge Current Rating: 240 kA per mode/480 kA per phase.
- D. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2
1. Line to Neutral: 70,000 A.
 2. Line to Ground: 70,000 A.
 3. Neutral to Ground: 50,000 A.
- E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 800 V for 480Y/277 V.
 2. Line to Ground: 800 V for 480Y/277 V.
 3. Neutral to Ground: 800 V for 480Y/277 V.

2.02 PANELBOARD SUPPRESSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Current Technology Inc.; Danaher Power Solutions.
 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
 4. Leviton Mfg. Company Inc.
 5. Square D; a brand of Schneider Electric.
- B. Surge Protection Devices:
1. Comply with UL 1449.
 2. Modular design with field-replaceable modules.

3. Short-circuit current rating complying with UL 1449, and matching or exceeding the panel-board short-circuit rating and redundant suppression circuits; with individually fused met-al-oxide varistors.
 4. Fuses, rated at 200-kA interrupting capacity.
 5. Fabrication using bolted compression lugs for internal wiring.
 6. Redundant suppression circuits.
 7. Redundant replaceable modules.
 8. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 9. LED indicator lights for power and protection status.
 10. Audible alarm, with silencing switch, to indicate when protection has failed.
 11. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. .
 12. Four-digit transient-event counter set to totalize transient surges.
- C. Peak Single-Impulse Surge Current Rating: 150 kA per mode/300 kA per phase.
- D. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2:
1. Line to Neutral: 70,000 A.
 2. Line to Ground: 70,000 A.
 3. Neutral to Ground: 50,000 A.
- E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V or 208Y/120 V, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 1200 V for 480Y/277 V and 800 V for 208Y/120 V.
 2. Line to Ground: 1200 V for 480Y/277 V and 900 V for 208Y/120 V.
 3. Neutral to Ground: 1000 V for 480Y/277 V and 700 V for 208Y/120 V.

2.03 ENCLOSURES

- A. Indoor Enclosures: NEMA 250 Type 12.
- B. Outdoor Enclosures: NEMA 250 Type 3R.

3.00 EXECUTION

3.01 INSTALLATION

- A. Install SPD's at service entrance on load side, with ground lead bonded to service entrance ground.

- B. Install SPD's 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 multiple, 30-A circuit breaker minimum as a dedicated disconnecting means for SPD's unless otherwise indicated. Coordinate circuit breaker with the SPD manufacturer.

3.02 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
 - 1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

3.03 STARTUP SERVICE

- A. Do not energize or connect service entrance equipment panelboards to their sources until SPD's are installed and connected.
- B. Do not perform insulation resistance tests of the distribution wiring equipment with the SPD's installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.04 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to maintain SPD's.

END OF SECTION

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26 51 00 INTERIOR LIGHTING

1.00 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Luminaires.
 - 2. Exit signs.
- B. Related Requirements:
 - 1. Division 01 Specification Sections apply to Work of this Section.

1.02 REFERENCES

- A. NEMA WD 6 - Wiring Devices-Dimensional Requirements.
- B. NFPA 70 - National Electrical Code.
- C. NFPA 101 - Life Safety Code.

1.03 SUBMITTALS

- A. Refer to Section 01 33 00 "Submittal Procedures" for submittals.
- B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, and performance data.

1.04 SUBSTITUTIONS

- A. Refer to Section 26 05 00 "Basic Electrical Methods" for requirements.

1.05 CLOSEOUT SUBMITTALS

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for submittals for Project closeout.
- B. Operation and Maintenance Data: Submit manufacturer's operation and maintenance instructions for each product.

1.06 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.07 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70.
- B. Conform to requirements of NFPA 101.

C. Products: Listed and classified by UL as suitable for the purpose specified and indicated.

2.00 PRODUCTS

2.01 LUMINAIRES

A. Furnish products as scheduled. Refer to Section 01 60 00 "Product Requirements" for substitutions and product options.

2.02 EXIT SIGNS

A. Furnish products as scheduled.

3.00 EXECUTION

3.01 INSTALLATION

A. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

B. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

C. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

D. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure.

E. Install recessed luminaires to permit removal from below.

F. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating in locations where fire rated ceilings are present.

G. Install clips to secure recessed grid-supported luminaires in place.

H. Install wall mounted luminaires, emergency lighting units and exit signs at height as indicated on the Drawings or as scheduled.

I. Install accessories furnished with each luminaire.

J. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.

3.02 FIELD QUALITY CONTROL

A. Refer to Section 01 40 00 "Quality Requirements" for field inspection, testing, and adjusting.

B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.03 ADJUSTING

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for adjusting installed work.
- B. Aim and adjust luminaires as directed.
- C. Position exit sign directional arrows as indicated.
- D. Contractor shall re-adjust occupancy sensor (time and sensitivity) at or before the end of one-year warranty period.

3.04 CLEANING

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for cleaning installed Work.
- B. Clean electrical parts to remove conductive and deleterious materials.
- C. Remove dirt and debris from enclosures.
- D. Clean photometric control surfaces as recommended by manufacturer.
- E. Clean finishes and touch up damage.

3.05 DEMONSTRATION AND INSTRUCTIONS

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for demonstrating installed Work.

3.06 PROTECTION OF FINISHED WORK

- A. Refer to Section 01 70 00 "Execution and Closeout Requirements" for protecting installed Work.
- B. Re-lamp or replace luminaires that have failed lamps at Substantial Completion.

END OF SECTION

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26 56 00 EXTERIOR LIGHTING

1.00 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Exterior luminaires with lamps and driver

1.03 DEFINITIONS

- A. CRI: Color-rendering index.
- B. LED: Light emitting diode
- C. Luminaire: Complete lighting fixture, including driver housing if provided.

1.04 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. Photoelectric relays.
 - 7. Drivers, including energy-efficiency data.
 - 8. Lamps, including life, output, and energy-efficiency data.
 - 9. Materials, dimensions, and finishes of light fixtures.
 - 10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
- B. Qualification Data: For agencies providing photometric data for lighting fixtures.
- C. Field quality-control test reports.
- D. Warranty: Special warranty specified in this Section.

1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with IEEE C2, "National Electrical Safety Code."
- C. Comply with NFPA 70.

1.06 WARRANTY

- A. 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.

2.00 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified in Lighting Fixture Schedule.

2.02 LUMINAIRES, GENERAL REQUIREMENTS

- 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.
- B. 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. 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.
- J. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- K. 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.
- L. 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.
- M. 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.
 - 1. Color: As indicated on Lighting Fixture Schedule.

3.00 EXECUTION

3.01 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicated supports.

3.02 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."

3.03 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.

END OF SECTION

31 05 13 SOILS FOR EARTHWORK

1.00 GENERAL

1.01 WORK INCLUDED

- A. This Section of the specifications describes the various classes of Earth Fill. All of the classes of Earth Fill contained in this specification may not be used on this project. The classes of Earth Fill used on this project are shown on the drawings or specified in other sections of the specifications. This Section does not include specifications for placement and compaction of Earth Fill. Specifications for placement and compaction of Earth Fill are included in other sections of the specifications and/or shown on the drawings.

1.02 STANDARDS

- A. Soil materials shall be classified into the appropriate class of Earth Fill shown below according to ASTM D2487 "Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)" or other appropriate methods as designated by the Engineer.

2.00 PRODUCTS

2.01 MATERIALS; CLASSIFICATIONS

- A. Class 1 Earth Fill: Limited to clays and sandy clays classified as CH material with a liquid limit greater than or equal to 50, a plasticity index greater than or equal to 25, and a minimum of 60 percent passing the No. 200 sieve, which are free of organic materials.
- B. Class 2 Earth Fill: Limited to clays and sandy clays classified as CH and CL materials with a coefficient of permeability less than or equal to 1.0×10^{-7} cm/sec, a liquid limit greater than or equal to 30, a plasticity index greater than or equal to 15, and more than 50 percent passing the No. 200 sieve, which are free of organic materials.
- C. Class 3 Earth Fill: Consist of any materials classified as CH, CL, SM, SP, SP-SM, SC, and GC, which have a minimum plasticity index of 4, which are free of organic materials.
- D. Class 4 Earth Fill: Consist of materials which are classified as SP, SM, SC, CL, or dual classifications thereof, which have a liquid limit less than or equal to 35 and a plasticity index of a minimum of 4 and a maximum of 15, which are free of organic materials.
- E. Class 5 Earth Fill: Consist of materials classified as SP or SP-SM which have a plasticity index less than or equal to 4 and a maximum of 12 percent passing the No. 200 sieve, which are free of organic materials.
- F. Class 12 Earth Fill: Consist of soils suitable for topsoil which are relatively free of stones or other objectionable debris, which have sufficient humus content to readily support vegetative growth. The suitability of soils for topsoil shall be subject to the approval of the Engineer.

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

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31 23 10 STRUCTURAL EXCAVATION AND BACKFILL

1.00 GENERAL

1.01 SUMMARY

- A. This Section specifies excavation, backfill materials, backfill placement and compaction procedures, and other construction activities incidental to project structures.
- B. The Specification does not include excavation and backfilling for utility lines, manholes, valve boxes, and other minor structures related to utility lines. Refer to Section 31 23 33 “Trenching and Backfill [Utilities]” for utility line related excavation and backfill.

1.02 QUALIFICATION ASSURANCE

- A. Testing Agency: An independent testing agency that is AASHTO accredited.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 “Document Management” and shall include:
 - 1. Qualification Data: For testing agency.
 - 2. Provide list of compaction equipment to be used.
 - 3. Backfill material classifications: For each soil or aggregate backfill material provide a certification by the testing agency.
 - 4. Compaction Test Results: Submit test results within 24 hours of successful testing.

1.04 STANDARDS

- A. Material classification, placing, and testing shall be in compliance with the latest revisions of the following standards, unless otherwise noted in the Contract Documents.
 - 1. ASTM International (ASTM) Standards:

ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft ³ (600 kN-m/m ³))
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

- B. Any other testing required by these specifications and not specifically referenced to a standard shall be performed under ASTM or other appropriate standards as designated by the Engineer.

1.05 DELIVERY AND STORAGE

- A. Deposit material to be used for backfill in storage piles at points convenient for handling of the material during the backfilling operations and as required to prevent contamination with other materials.

1.06 JOB CONDITIONS

- A. Review subsurface investigations. A limited subsurface investigation has been performed by Tolunay-Wong Engineers inc. A geotechnical report] from that investigation is available at the Engineer's office for information purposes only. The precise profile of soil and rock strata beneath this Site is not known.
- B. Review the Site and determine the conditions which may affect the structural excavation, prior to the commencement of the excavation.

2.00 PRODUCTS

2.01 BACKFILL MATERIALS

- A. Select Fill: Select fill shall be Class 4 Earth Fill as specified in Section 31 05 13 "Soils for Earthwork.
- B. Mud Slab: Lean concrete in accordance with Section 03 30 00 "Cast-In-Place Concrete."
- C. Levelling Course For Slab-On-Grade:
 - 1. Provide a 3-inch layer of compacted Fine-Graded Granular Material.

2.02 COMPACTION EQUIPMENT

- A. Compaction equipment shall conform to the following requirements.
 - 1. Heavy Compaction Equipment:
 - a. Tamping Compactor: Steel wheels with rectangular face, tapered pads that prevent fluffing the soil. Compactor shall be equipped with cleaning fingers to remove soil accumulation from between pads.
 - 1). Operating Weight, Minimum: 30,000 pounds.
 - 2). Wheels or Drum Size, Minimum: 4 feet diameter.
 - 3). Travel Speed, Maximum: 10 mph.
 - b. Pneumatic Rollers: Minimum eight-tire, pneumatic roller with a modular ballast system and flexible operating weight, and which will equally distribute load between tires to provide compaction uniformity.
 - 1). Operating Weight Range: As required for specified compaction, 36,000 to 50,000 pounds.
 - 2). Tire Pressure Range: 80 psi to 100 psi.
 - 3). Travel Speed, Maximum: 10 mph.
 - 4). Distance Between Edges of Adjacent Tires: Less than 50 percent of tire width.

- c. Vibratory Rollers: Smooth drum roller with 90 percent of the static weight transmitted through a single drum.
 - 1). Static Weight, Minimum: 20,000 pounds
 - 2). Centrifugal Force Per Drum, Minimum: 40,000 pounds
 - 3). Frequency: 1400 v/min
 - 4). Drum Size: Diameter 5 feet, +/- 1 foot; width between 6 and 9 feet.
 - 5). Travel Speed: 5 mph for self-propelled; 2 mph for towed.
 - 6). No backing up of the vibratory roller will be allowed on an embankment unless the vibrating mechanism is capable of being reversed.
- 2. Hand-Directed Compaction Equipment: Use power tampers and vibratory plate compactors in areas where it is impracticable or unacceptable to use heavy compaction equipment.

3.00 EXECUTION

3.01 PREPARATION

- A. Clear and grub the area to be excavated prior to the start of excavation. Remove the surficial vegetation, waste and soils to a minimum depth of 24 inches. Depth of removal shall not be less than that required to remove trees, shrubs, stumps, roots, and other organic material above and below ground from within the area to be excavated. Ensure below grade organic material is removed to a minimum depth of 18 inches below bottom of footing/structure.

3.02 EXCAVATION FOR FOUNDATIONS

- A. General: Excavate subgrade to the depth indicated on Drawings, +/- 0.1 feet tolerance. Extend limits of the excavation beyond the perimeter of the foundations as indicated on the Drawings.
 - 1. Exposed subgrade surfaces shall be level and of sound, stable material; free of mud, frost, snow, or ice. Testing agency or Owner's representative shall confirm exposed subgrade is a suitable bearing material based on the Construction Documents.
 - 2. Proof roll the exposed subgrade in accordance with TxDOT Item 216. Do not proof roll wet or saturated subgrades.
 - 3. Where unsound or unstable material is uncovered, notify Owner's representative. Remove objectionable material and replace after approval is received from Owner's representative. Replacement material shall be as indicated here unless otherwise indicated on Drawings:
 - a. Soil subgrade replacement material: Compacted structural earth fill.
- B. Mud Slab: Where indicated, install mud slab on exposed foundation subgrade surface within 8 hours of subgrade exposure. Confirm subgrade is free of loose, unsound, and/or deleterious material before placement of mud slab.
- C. Excavation Safety: All excavations shall be in accordance with OSHA requirements.

3.03 WATER IN FOUNDATION EXCAVATIONS

A. General:

1. Prevent water infiltration into foundation excavations. Remove standing water from excavation prior to placing concrete. If removal of standing water is not possible due to continuous water infiltration, then contact Owner's representative for additional direction regarding placing concrete underwater.
2. Do not dewater a foundation excavation while placing concrete or for a period of at least 24 hours after concrete placement.

B. Rock Foundation Subgrade: If rock material becomes weathered due to water infiltration, then remove weathered material and provide rock replacement material to restore foundation subgrade elevation.

C. Soil Foundation Subgrade: If foundation subgrade becomes saturated do not disturb the subgrade. Wait for water to evacuate the subgrade and subgrade surface to adequately stiffen prior to placing concrete. If subgrade is disturbed, then wait until subgrade has dried out, excavate disturbed subgrade and provide replacement material as indicated above.

3.04 COMPACTED BACKFILL

A. General: Backfill excavated spaces and areas not occupied by the permanent structure.

1. Backfill behind a retaining wall or basement-type wall shall not be placed until the concrete has reached its 28-day compressive strength or 7 days, whichever is longer.
2. Unless otherwise indicated on Drawings, structures with a top slab shall not backfilled until the top slab has been in place at least 4 days.
3. Structures with soil on opposing (opposite) sides shall be backfilled to prevent uneven loading of the structure – evenly raise backfill on opposing sides of the structure. The maximum differential backfill height between opposing sides is 1 foot.
4. Do not permit rollers to operate within 3 feet of structures.
5. Maximum Loose Lift Height:
 - a. Heavy Compaction Equipment: 8 inches.
 - b. Hand-Directed Compaction Equipment: 4 inches.
6. Previous Compacted Layer: If backfill placement occurs over a period of time greater than 24 hours, then scarify and recompact the previous day's final compacted layer.
 - a. Scarify and Recompact: 6-inch depth; adjust the moisture content; recompact.
 - b. Saturated subgrades shall not be worked on until sufficiently dry and harden so as not to be rutted with compaction equipment. Scarify and recompact layers damaged by weather or construction equipment.

B. Moisture: Prior to compacting backfill, mix and aerate or water the loose lift backfill material as necessary to adjust the moisture content and evenly distribute throughout. The material shall contain moisture within the limits specified below.

1. In accordance with ASTM D6938, determine the optimum moisture content for the maximum dry density.
 2. Backfill moisture content shall be as indicated in Table 1, "Compacted Fill."
 3. Aggregate fill: Completely cohesionless materials, shall be at a moisture content which will allow use of the specified compaction equipment and consistent achievement of the specified density.
- C. Compaction: As required to achieve the specified density, increase the number of passes above the minimum specified and/or modify the weight of the equipment.
1. Determine the maximum dry density in accordance with ASTM D698 for cohesive soils and ASTM D4253 for cohesionless soils.
 2. Minimum number of passes for all compacted fill types: 8.
 3. Cohesive Soils: A tamping compactor or tamping compactor followed by a pneumatic roller shall be used.
 4. Cohesionless or low cohesive soils: A vibratory roller or vibratory plate compactors shall be required if the material is cohesionless or with less than 15 percent passing the No. 200 sieve. Confirm applicability of vibratory compaction equipment in the field.
 5. Overlap passes a minimum of 1 feet for heavy compaction equipment and 50 percent of the baseplate width for hand-directed equipment.
 6. Backfill density shall be as indicated in Table 1, "Compacted Fill."

Table 1: Compacted Fill			
Backfill Type	Density^{1,2}	Moisture Content^{3,4}	Comments
Classes 1 & 2	95%	-0% to +5%	N/A
Classes 3, 4, & 5	95%	-2% to +3%	N/A
Fine Graded Granular Material	98%	See Note 4	N/A

¹ The percentage indicated is the minimum required percentage of the maximum dry density as determined by the applicable ASTM.

² Below Vehicular Pavement: Scarify to a depth of 8, moisture condition, and recompact to not less than 100 percent of the maximum dry density.

³ Range indicated is the acceptable tolerance with respect to the optimum moisture content.

⁴ Completely cohesionless materials, shall be at a moisture content which will allow use of the specified compaction equipment and result in consistent achievement of the specified density.

3.05 FIELD QUALITY CONTROL

- A. Contractor is responsible for the costs involved in providing an approved testing agency to perform quality control testing of backfill operations and verification of subgrade bearing material. The testing laboratory shall make tests of in-place density and moisture in accordance with ASTM Standards previously mentioned in this Section. The testing agency shall monitor backfill operations continuously or at intervals acceptable to the Owner's

representative. It shall be the responsibility of the Contractor to notify the testing agency a minimum of 2 business days before backfill operations begin.

1. Unless noted otherwise, in-place density tests shall be conducted at a rate of one test per 3000 square feet for every lift.

END OF SECTION

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1.00 GENERAL

1.01 WORK INCLUDED

- A. Furnish labor, materials, equipment and incidentals necessary to perform operations in connection with the construction of hot mix asphaltic concrete (HMAC) base course, leveling-up course and surface course or any other combination of these courses. Construct the pavement on the previously completed and approved subgrade, base, or existing pavement.

1.02 QUALITY ASSURANCE

- A. Design Criteria: Use the services of an independent testing laboratory to prepare a mix design to comply with Texas Department of Transportation, Standard Specification Item 340 or may use a previously prepared mix design meeting the specification requirements with satisfactory substantiation of experience with the mix.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00 "Document Management" and shall include:
 - 1. Mix design as record data.

1.04 STANDARDS

- A. Hot mix asphaltic concrete (HMAC) pavement shall conform to the requirements of the current Texas Department of Transportation (TXDOT), Standard Specification for "Dense-Graded Hot Mix Asphaltic ", Item 340.
- B. Asphaltic material shall comply with Texas Department of Transportation (TXDOT) Standard Specification Item 300.

1.05 DELIVERY AND STORAGE

- A. Haul the asphaltic mixture to the job site in tight vehicles previously cleaned of foreign materials. Arrange the dispatching of vehicles so that all material delivered shall be placed and all rolling shall be completed during daylight hours. In cool weather, or for long hauls, canvas covers may be required. The inside of the truck body may be given a light coating of oil, if necessary, to prevent the asphaltic mixture from adhering to the body.

1.06 JOB CONDITIONS

- A. Do not apply prime coat when the air temperature is below 50 F and falling, but may be applied when the air temperature is above 40 F and rising, the air temperature being taken in the shade and away from artificial heat. Do not place asphaltic material when general weather conditions, in the opinion of the Owner's Representative are not suitable.
- B. The asphaltic mixture shall be at a temperature between 225 and 350 F when dumped from the mixer. The Owner's Representative shall determine the temperature, within the above

limitations. The mixture when dumped from the mixer shall not vary from the selected temperature more than 30 F.

2.00 PRODUCTS

2.01 MATERIALS

A. Aggregate: Conform to TXDOT Standard Specification Item 340. The Type “B” mixtures and at least three bins when producing Type “D” mixture. These bins shall contain the following sizes of aggregate, in percentages by weight or by volume, as applicable.

1. Gradation for base course or leveling-up course shall comply with Type B listed as follows:

a. Type “B” (Fine Graded Base Course):

Sieve Size	Percent Passing by Weight or Volume
1”	98-100
3/4”	84-98
5/8”	75-95
3/8”	60-80
No. 4	40-60
No. 8	29-43
No. 30	13-28
No. 50	6-20
No. 200	2-7
VMA percent minimum	12
The asphaltic material shall form from 3.5 to 7 percent of the mixture by weight unless specified otherwise on the plans.	

2. Gradation for surface course shall comply with Type D listed as follows:

a. Type “D” (Fine-Graded Surface Course):

Sieve Size	Percent Passing by Weight or Volume
1/2”	98-100
3/8”	85-100
No. 4	50-70
No. 8	35-46
No. 30	15-29
No. 50	7-20
No. 200	2-7

Sieve Size	Percent Passing by Weight or Volume
VMA percent minimum	14
The asphaltic material shall form from 4 to 8 percent of the mixture by weight unless specified otherwise on the plans.	

- B. Asphaltic Materials: Comply with TXDOT Standard Specification Item 300. In general, the grade of asphalt shall be AC-10. Other grades of asphalt shall be considered if weather conditions or mix design appear to warrant a change. Prime coat shall comply with TXDOT Standard Specification Item 300, Grade MC-30. Tack coat shall meet the requirements of cutback asphalt RC-250.

2.02 EQUIPMENT

- A. The equipment necessary for the construction of the hot mix asphaltic concrete pavement shall be on the project site and shall be approved by the Owner’s Representative as to condition before the Contractor shall be permitted to begin construction operations on which the equipment is to be used. Equipment shall be maintained in good repair and operating condition.
- B. Spreading and Finishing Machines:
 - 1. The spreading and finishing machine shall be of a type approved by the Owner’s Representative and capable of producing a surface that shall meet the requirements of the typical cross section and surface test.
 - 2. Rollers:
 - a. Pneumatic Tire Roller: The roller shall consist of not less than seven pneumatic tire wheels, running on axles in such a manner that the rear group of tires shall cover the entire gap between adjacent tires of forward group; mounted in a rigid frame; and provided with a loading platform or body suitable for ballast loading. The front axle shall be attached to the frame in such a manner that the roller may be turned within a minimum circle. The tire shall afford surface contact pressures up to 90 pounds per square inch or more. The roller shall be so constructed as to operate in both forward and a reverse direction with suitable provisions for moistening the surface of the tires while operating; and shall be approved by the Owner’s Representative.
 - b. Two-Axle Tandem Roller: The roller shall be an acceptable power-driven, steel-wheel tandem roller weighing not less than 8 tons. The roller must operate in forward and reverse directions; contain provisions for moistening the surface of the wheels while in motion; and shall be approved by the Owner’s Representative.
 - c. Three-Wheel Roller: The roller shall be an acceptable power-driven, all steel three wheel roller weighing not less than 10 tons. The roller must operate in forward and reverse directions; contain provisions for moistening the surface of the wheels while in motion; and shall be approved by the Owner’s Representative.
 - d. Vibratory Steel Wheel Roller: If approved for use by the Owner’s Representative, this roller shall have a minimum weight of 6 tons. The compactor shall be equipped

with amplitude and frequency controls and shall be specifically designed to compact the material on which it is used. The roller shall be operated in accordance with the Manufacturer's recommendations.

3. Straightedges: The Contractor shall provide acceptable straightedges for the surface testing. Satisfactory templates shall be provided as required by the Owner's Representative.

3.00 EXECUTION

3.01 PREPARATION

- A. Prime Coat: Apply a uniform coat of prime coat asphaltic material to the surface of the prepared subgrade, sub-base, or base, applied at a rate of not less than 0.30 gallons per square yard of surface. Apply a thin uniform coat of the prime coat material to contact surfaces of gutters, manholes, and other structures.
- B. Tack Coat: Thoroughly clean the surface of the asphalt base course and apply a uniform coat of tack material meeting the requirements for cutback asphalt RC-250. Apply a tack coat when the surface to be paved is Portland cement concrete, brick, or asphaltic pavement. Apply the tack coat using sprayer at a rate not exceeding 0.05 gallons per square yard surface. Paint contact surfaces of curbs, gutters, vertical faces, and other structures in actual contact with asphaltic mixes with asphaltic material to provide a closely bonded, water-tight joint.
- C. Compacted Thickness of Asphaltic Concrete Surface Courses and Base Courses:
 1. Surface Course: The compacted thickness or depth of the asphaltic concrete surface shall be as indicated on the plans. Where the plans indicate a depth or thickness of the surface course greater than 2 inches compacted depth, same shall be placed in multiple courses of equal depth, each which shall not exceed 2 inches compacted depth. A tack coat is required between any of the multiple courses, and applied at the rate specified.
 2. Base Course: The compacted thickness or depth of each base shall be as indicated. Where the plans indicate a depth or thickness of the course greater than 4 inches, same shall be accomplished by constructing multiple lifts of approximately equal depth, each of which shall not exceed these maximum compacted depths. An additional tack coat is required between any of the multiple lifts and must be applied at the rate specified.

3.02 PLACEMENT

- A. Place the asphaltic mixture on an approved base course with the previously specified spreading and finishing machine in such a manner that, when properly compacted, the finished course shall comply with the maximum thickness requirements, shall be smooth, of uniform density and meet the requirements of the typical cross-sections and the surface test. During the placing and spreading of the asphaltic material, take care to prevent the spilling of the material onto adjacent pavement, gutters, or structures.
- B. In small areas, which are inaccessible to the spreading and finishing machine, hand spreading may be authorized by the Owner's Representative, provided an acceptable surface can be obtained.

3.03 COMPACTION

- A. Rolling with the three-wheel and tandem rollers shall start longitudinally at the sides and proceed toward the center of the surface course, overlapping on successive trips by at least half the width of the rear wheels. Alternate trips of the roller shall be slightly different in length. Rolling with the pneumatic tire roller shall be done as directed by the Owner's Representative. Rolling shall continue until no further compression can be obtained and all roller marks are eliminated. The motion of the rollers shall be slow enough at all times to avoid displacement of the asphaltic surface material. If displacement should occur, correct the situation at once by the use of rakes and fresh asphaltic mixtures. The roller shall not be allowed to stand on the surface course when it has not been fully compacted and allowed to cool. To prevent adhesion of the surface to the roller, the wheels shall be kept thoroughly moistened with water, but an excess of water shall not be permitted. Rollers must be in good mechanical condition. Take the necessary precautions to prevent the dripping of gasoline, oil, grease, or other foreign matter on the surface course while the rollers are in motion or when standing. In areas where surface course cannot be compacted with the roller, hand tamps, lightly oiled, shall be used to secure the required compaction.
- B. With approval by the Owner's Representative, the vibratory steel wheel roller may be substituted for the three-wheel roller and tandem roller. Each course, after final compaction, shall contain from 5 to 9 percent air voids determined by TXDOT Test Method TEX207-F and TEX-227-F.

3.04 FIELD QUALITY CONTROL

- A. Surface Tests: The finished surface of the pavement after compression shall be smooth and true to the established line, grade, and cross-section. When tested with a 16-foot straightedge placed parallel to the centerline of the roadway, the finished surface shall have no deviation in excess of 1/16 inch per foot from the nearest point of contact. The maximum ordinate measured from the face of the straightedge shall not exceed 1/4 inch at any point. Any point in the pavement surface not meeting these requirements shall be immediately corrected.
- B. Pavement Thickness Test: Upon completion of the work and before final acceptance and final payment shall be made, pavement thickness test shall be made by the Owner or his authorized representative unless otherwise specified in the special provisions or in the plans. The number and location of tests shall be at the discretion of the Owner's Representative. The cost for the initial pavement thickness test shall be at the expense of the Owner. In the event a deficiency in the thickness of the pavement is revealed during normal testing operations, subsequent tests necessary to isolate the deficiency shall be at the Contractor's expense. The cost for the additional coring test shall be at the same rate charged by commercial laboratories.

END OF SECTION

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