CAMERON COUNTY PARKS Olmito Park Improvements <u>RFP # 240201</u>

ARCHITECTS Gomez Mendez Saenz, Inc. Ambiotec Civil Engineering Group Green Rubiano & Associates Ethos Engineering



Roan G. Gomez, AIA



Set No.



CAMERON COUNTY PURCHASING DEPARTMENT REQUEST FOR PROPOSALS

RFP NUMBER: # 240201

RFP TITLE: OLMITO NATURE PARK – PHASE 1

DATE DUE: JANUARY 24, 2024

DUE NO LATER THAN 3:00 P.M.

RFP's will be opened at the Cameron County Courthouse, 1100 East Monroe Street, Brownsville, Texas in the Purchasing Department -3^{rd} Floor - Room # 345 at 3:01 p.m. (as per Purchasing Dept. time clock) on deadline due date.

Please return RFP <u>ORIGINAL (marked "ORIGINAL") AND ONE (1) COPY (marked "COPY")</u> sets and an electronic (PDF format file only) of your RFP submittal for review by evaluation committee in a sealed envelope. Be sure that return envelope shows the RFP Number, Description and is marked "SEALED RFP".

RETURN RFP TO:

by U.S. mail or delivered to the office of Purchasing Dept., County Courthouse (Dancy Bldg.) 1100 E. Monroe St, 3rd Floor, Room 345, Brownsville, Texas 78520.

PRE-PROPOSAL MEETINGS SCHEDULE: <u>Wednesday, January 10, 2024 at 3:00 P.M.</u> PRE-PROPOSAL MEETING LOCATION: 835 East Levee Building,2nd floor, conference room, Brownsville, Texas 78520

CONTACT PERSON: Danny Villarreal, Construction Manager 956-454-1378

Proposal questions/clarifications must be submitted by: Friday, January 12, 2024 before 5:00P.M. (e-mail to <u>purchasing@co.cameron.tx.us</u> or fax 956-550-7219 attention, Roberto C. Luna, Interim Purchasing Agent)

For additional information or to request addendum email: <u>Roberto C. Luna and/or Dalia Loera at</u> roberto.luna@co.cameron.tx.us or <u>dalia.loera@co.cameron.tx.us</u>

<u>YOU MUST SIGN BELOW IN INK. FAILUFE TO SIGN WILL DISQUALIFY THE OFFER</u>.

Company Name:			
Company Address:			
City, State, Zip Code:			
Historically Underutilized Business (State of	of Texas) Certification V	/ID Number:	
Telephone No.	Fax No	e-	mail
SIGNATURE:		Print Name:	
How did you find out about this RFP?			_(ex: Newspaper, Web, and Mail)
Is Bidder's principal place of Business w	ithin Cameron County	'? □ Yes □ No	

If yes what City:

Your signature attests to your offer to provide the goods and/or services in this RFQ according to the published provision of this RFP. When an award letter is issued, this RFP becomes the contract. If an RFP required specific Contract is to be utilized in addition to this RFP, this signed RFP will become part of that contract. When an additional Contract is required a RFP award does not constitute a contract award and RFP / Contract is not valid until contract is awarded by Commissioners Court (when applicable) signed by County Judge) and Purchase Order is issued.

Bidders must sign each bid page to ensure you have read each page's information, terms, conditions and/or required forms. Failure to sign or initial each bid page will disqualify the BID/PROPOSAL offer.

ACKNOWLEDGMENT OF RECEIPT

RFP # 240201 OLMITO NATURE PARK – PHASE1

Please submit this page upon receipt

For any clarifications, please contact Mr. Roberto C. Luna, Purchasing Agent and/or Dalia Loera, Bids & Proposals Coordinator at the Cameron County Purchasing Department office at: (956) 544-0871 or e-mail at: purchasing@co.cameron.tx.us

Please fax or e-mail this page upon receipt of RFP package no later than <u>Friday, January 12, 2024 before 3:00 p.m. CST</u>. All questions regarding this RFP should also be submitted no later than the stated date and time on RFP cover page.

Fax: (956) 550-7219 or E-mail: purchasing@co.cameron.tx.us

If you are unable to respond on this RFP solicitation, kindly indicate your reason for <u>"Not Responding/No-Participation"</u> below and fax or e-mail back to Cameron County Purchasing Department. This will insure you remain active on our vendor list.

(____) Yes, I will be able to submit an RFP submittal.

Date:

____) No, I will not be able to submit an RFP submittal for the following reason:

		·
Company Name:		
Company Representative Name:		
Company Address:		
Phone #:	Fax #"	
E-mail Address:		



CAMERON COUNTY

INVITATION

Cameron County is requesting bids/proposals/qualifications for the following, which should BE REFERENCED ON ENVELOPE, "ATTN: COMMISSIONERS COURT - SEALED BID/PROPOSAL: DEADLINE – **3:00 P.M.**

01/24/24 **RFP# 240201** OLMITO NATURE PARK IMPROVEMENTS PHASE 1

The RFP# 240201 is particularly interested in Proposers' ability to meet the funding eligibility requirements set for in the American Rescue Plan Act of 2021 (ARPA) <u>Please see Appendix A "FHWA 1273" & Appendix B "Super Circular-Procurement Standards</u> <u>2 CFR Parts 200.317 – 200.327"</u>

A = Annual Q = Quarterly B = Bid RFP = Proposal RFQ = Qualifications

Detailed specifications are available from Dalia Loera at <u>956/544-0871</u> of the County Purchasing Department or web site – Bids & Specs. Tab <u>https://www.cameroncountytx.gov/purchasing-bids-rfpq-addms-tabs/</u>

Your sealed submittals should contain the REFERENCE "ATTN: COMMISSIONERS COURT – SEALED BID/PROPOSAL/REQUEST FOR QUALIFICATIONS ON THE OUTSIDE OF YOUR RETURN ENVELOPE and addressed and sent to the County Purchasing Department - **Cameron County Courthouse**, **(Dancy Building) 1100 E. Monroe St., 3rd Floor, Room # 345, Brownsville, Tx. 78520.** Properly referenced and returned Bids/ RFP's / RFQ's will be opened at the Cameron County Courthouse, 1100 East Monroe Street, Brownsville, Texas in the Purchasing Department – 3rd Floor – Room # 345 at 3:00 p.m. (as per Purchasing Dept. time clock) on deadline date. Bidders are invited to attend. Cameron County is an Equal Employment Opportunity Employer and expressly reserves the right to accept or reject any and all submittals and may waive formalities.

TO APPEAR: December 23, 2023 & December 30, 2023

Brownsville Herald - P.O. #

CHECK LIST

Proposers are asked to review the package to be sure that all applicable parts are included. If any portion of the package is missing, notify the Purchasing Department immediately. It is the Proposer's responsibility to be familiar with all the Requirements and Specifications. Be sure you understand the following before you return your RFP packet.

 X
 Cover Sheet

 Your company name, address and your signature (IN INK) should appear on this page.

 X
 Instructions to Proposers

 You should be familiar with all of the Instructions to Proposers.

 X
 Special Requirements

 This section provides information you must know in order to make an offer properly.

 X
 Specifications / Scope of Work

 This section contains the detailed description of the product/service sought by the County.

Attachments

- _X__ Attachments A, B, C, D, E, F, G, H & I APPENDIX A & B Be sure to complete these forms and return with packet.
- __X_ Minimum Insurance Requirements Included when applicable
- __X_ Worker's Compensation Insurance Coverage Rule 110.110 This requirement is applicable for a building or construction contract. Financial Statement
 - When this information is required, you must use this form.

Other - Final reminders to double check before submitting RFP

- _____ Is your RFP sealed with RFP #, title, Proposer's Name, & return address, on outside?
- ____ Did you complete, sign and submit page 1?
- Did you provide the number of copies as required on the cover page?
- Did you visit our website for any addendums?

https://www.cameroncounty.us/purchasing-bids-rfpq-addms-tabs/

If not interested in responding please let us know why e-mail to: <u>Purchasing@co.cameron.tx.us</u>

INSTRUCTIONS FOR SUBMITTING RFP'S

These General Instructions apply to all offers made to Cameron County, Texas (herein after referred to as "County") by all prospective vendors (herein after referred to as "Proposers") on behalf of Solicitations including, but not limited to, Invitations to RFP and Requests for Quotes.

Carefully read all instructions, requirements and specifications. Fill out all forms properly and completely. Submit your RFP with all appropriate supplements and/or samples. Prior to returning your sealed RFP response / submittal, all Addendums - if issued - should be reviewed and downloaded by entering the County Purchasing web <u>https://www.cameroncounty.us/purchasing-bids-rfpq-addms-tabs/</u>

Addendums Column (updated Addendums). These Addendums must be signed and returned with your RFP in order to avoid disqualification. All Tabulations can also be viewed and downloaded at this site. Annual RFP award information can be accessed at: https://www.cameroncounty.us/purchasing-bids-rfpq-addms-tabs/

Review this document in its entirety. Be sure your RFP is complete, and double check your RFP for accuracy.

Cameron County is an Equal Employment Opportunity Employer. Review this document in its entirety. Be sure your RFP is complete, and double check your RFP for accuracy.

GOVERNING FORMS: In the event of any conflict between the terms and provisions of these requirements and the specifications, the specifications shall govern. In the event of any conflict of interpretation of any part of this overall document, Cameron County's interpretation shall govern. Where substitutions are used, they must be of equivalent value or service, and specified by the Proposer as such, in the columns to the right on the "Minimum Specifications' Forms". The County's specifications may be exceeded and should be noted by the Vendor as such. Any RFP NOT MEETING the Minimum Requirements specified will be rejected.

GOVERNING LAW: This invitation to RFP is governed by the competitive RFP requirements of the County Purchasing Act, Texas Local Government Code, $\delta 262.021$ et seq., as amended. Offerors shall comply with all applicable federal, state and local laws and regulations. Offeror is further advised that these requirements shall be fully governed by the laws of the State of Texas and that Cameron County may request and rely on advice, decisions and opinions of the Attorney General of Texas and the County Attorney concerning any portion of these requirements.

Questions requiring only clarification of instructions or specifications will be handled verbally. If any questions results in a change or addition to this RFP, the Change(s) and addition(s) will be forwarded to all vendors involved as quickly as possible in the form of a written addendum only.

Verbal changes to RFP's must be backed-up by written addendum or written Q/A clarifications which would be posted on County Purchasing Web site. Without written Addendum or written Q / A clarification, verbal changes to RFP will not apply.

Sign the Vendor's Affidavit Notice, complete answers to Attachments A,B, C, D, E, F, G, H, I and return all with your RFP.

The RFP is particularly interested in Proposers' ability to meet the funding eligibility requirements set for in the American Rescue Plan Act of 2021 (ARPA) <u>Please see Appendix A "FHWA 1273" & Appendix B "Super Circular-</u> <u>Procurement Standards 2 CFR Parts 200.317 – 200.327"</u>

CONFLICT OF INTEREST QUESTIONNAIRE:

For vendor or other person doing business with local governmental entity

This questionnaire must be filed in accordance with chapter §176 of the Local Government Code by a person doing business with the governmental entity.

By law this questionnaire must be filed with the records administrator (County Clerk's Office) of the local government not later than the 7th business day after the date the person becomes aware of facts that require the statement to be filed. See Section §176.006, Local Government Code. A person commits an offense if the person violates Section §176.006, Local Government Code. An offense under this section is a Class C misdemeanor.

The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than September 1 of the year for which an activity described in Section §176.006(a), Local Government Code, is pending and not later than the 7th business day after the date the originally filed questionnaire becomes incomplete or inaccurate.

Please review this entire document, if for any reason there is any information to disclose, relative to any questions in this Conflict of Interest form, you must file with County Clerk's Office subject to above instructions.

can be downloaded at the following web site:

https://www.cameroncounty.us/wp-content/uploads/Purchasing/docs/Conflict_of_Interest_Questionnaire_New_2015_.pdf

DISCLOSURE OF INTERESTS:

This questionnaire must be filed with the records administrator (County Clerk's Office) of the local government and no later than the 7th business day after the person becomes aware of facts that require this statement to be filed. Cameron County, Texas requires all persons or firms seeking to do business with the County to **provide the following information if the person becomes aware of facts that require this statement to be filed**. Every question must be answered. If the question is not applicable, answer with "N/A."

Please review this entire document, if for any reason there is any information to disclose, relative to any questions in this disclosure of interest form, you must file with County Clerk's Office subject to above instructions.

can be downloaded at the following web site: https://www.cameroncounty.us/wp-content/uploads/Purchasing/CIS.pdf

TEXAS ETHICS COMMISSION FORM 1295

All RFPs prior to award or award of Contract by Commissioner's Court will require that the Texas Ethics Commission (TEC) Form 1295 Electronic (on line) Vendor filing procedure be completed by Vendor.

All Vendors being recommended to Commissioners Court for award or renewal of award on Agenda must register and obtain a TEC Certification for the specific award. This Certification Form 1295 must be electronically submitted and printed form must be emailed or delivered to County Purchasing Department making the request for form. This process must be completed prior to Commissioners Court Agenda for approval consideration of RFP award. There is no charge for this TEC online process.

Texas Ethics Commission (TEC) Form 1295 must be completed (by firm - on line "New Form 1295 Certificate of Interested Parties Electronic Filing Application" Site at: <u>https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm</u>)

If any Vendors have questions as to TEC Form 1295 visit the County Purchasing Web site left column tab "<u>Vendor – TEC Form 1295</u>" for more information. TEC Web site links can be found at this location including Question / Answers and Video instructions. tab Link: <u>https://www.cameroncounty.us/vendors-tec-form-1295/</u>

PROPOSER SHALL SUBMIT RFP ON THE FORM PROVIDED, SIGN THE VENDOR AFFIDAVIT, AND RETURN ENTIRE RFP PACKET. In the event of inclement weather and County Offices are officially closed on a Proposal deadline day, RFP's will be received unit 2:00 p.m. of the next business day. Proposals will be opened at the Cameron County Courthouse, 1100 East Monroe Street, Brownsville, Texas in the Purchasing Department -3^{rd} Floor - Room # 345 (as per Purchasing Dept. time clock.

RFP's SUBMITTED AFTER THE SUBMISSION DEADLINE SHALL BE RETURNED UNOPENED AND WILL BE CONSIDERED VOID AND UNACCEPTABLE.

PRESENTATIONS SEQUENCE TO EVALUATION COMMITTEE. Presentations to Evaluation Committee will be sequenced (in order) as determined by the utilization of RANDOM.ORG. Process will be conducted in the Purchasing Dept. with Auditor's designee present.

SUCCESSFUL PROPOSERS WILL BE NOTIFIED BY MAIL. All responding vendors will receive written notification regarding outcome of award.

PROPOSERS MAY ATTEND PUBLICLY HELD COMM COURT MEETING FOR AWARD OF THIS SOLICITATION. All responding proposers are welcome to attend the publicly held Commissioners Court meeting relative to the outcome / award of this solicitation. Court Meeting agenda date and times may be obtained at the following web site: https://www.cameroncountytx.gov/commissioners-court-agendas/

OPEN RECORDS ACCESS TO ALL INFORMATION SUBMITTED. All information included will be open to the public, other proposers, media as per the Open Records Act and not be confidential in nature. If you deem any information as confidential, it <u>should not</u> be made part of your RFP package.

PLEASE NOTE CAREFULLY

THIS IS THE <u>ONLY APPROVED INSTRUCTION</u> FOR USE ON SUMBITTING YOUR REPONSE. ITEMS BELOW APPLY TO AND BECOME A PART OF TERMS AND CONDITIONS OF RFP. <u>ANY EXCEPTIONS THERETO MUST BE IN WRITING.</u>

- 1. ORIGINAL (marked "ORIGINAL") AND ONE (1) COPY (marked "COPY") sets and an electronic (PDF format file only) <u>MUST BE SUBMITTED</u>. Each RFP shall be placed in a separate envelope completely and properly identified with the name and number of the bid. Proposals must be in the Purchasing Department <u>BEFORE</u> the hour and date specified.
- 2. Proposals MUST give full firm name and address of the proposer. <u>Failure to manually sign RFP will disqualify it.</u> Person signing RFP should show TITLE or AUTHORITY TO BIND THE FIRM IN A CONTRACT.
- 3. Proposals CANNOT be altered or amended after deadline time. Any alterations made before deadline time must be initiated by Proposer or his authorized agent. No RFP can be withdrawn after opening time without approval by the Commissioners Court based on a written acceptable reason.
- 4. Written and verbal inquires pertaining to bids must give RFP Number and Company.

- 5. NO changes or cancellations permitted without written approval of Purchasing Agent. The County reserves the right to accept or reject all or any part of any RFP and waive minor technicalities.
- 6. This is a RFP inquiry only and implies no obligation on the part of Cameron County.
- 7. Partial RFP's will not be accepted unless awarded by <u>complete</u> RFP.
- 8. It is expected that the Proposer will meet all state and federal safety standards and laws in effect on the date of the RFP, for the item(s) being specified, and the particular use for which they are meant.
- 9. It is the responsibility of the Proposer to ask any and all questions the Proposer feels to be pertinent to the proposal. Cameron County shall not be required to attempt to anticipate such questions for proposers. Cameron County will endeavor or respond promptly to all questions asked.
- 10. If <u>PROPOSER</u> takes exception to specifications or reference data, he will be required to <u>provide</u> details etc. as specified.
- 11. A proposal may not be withdrawn or canceled by the proposer without the written acknowledgment of the County for a period of sixty (60) days following the date designated for the receipt of proposal, and proposer so agrees upon submittal of the proposal.
- 12. If a Bid Bond is required in this Proposal it must be included in Proposers Sealed RFP package.
- 13. The County reserves the right to accept or reject all or any part of any RFP, waiver minor technicalities. The County of Cameron reserves the right to award by item category or by total RFP. Prices should be itemized. County also reserves the right to award either with or without trade-in, if applicable. Cameron County reserves the right to award if only one (1) RFP was received. Cameron County retains the option to re-solicit at any time if in its best interest and is not automatically bound to renewal or resolicitation. The County reserves the right to hold all RFPs for 60 days from the due date of receipt without actions. The County reserves the right to add additional County Departments (at a later time during this RFP award) as the need arises. The County also reserves the right to consider utilizing CO-OP Interlocal Agreements / pricing if determined to be more advantageous to the County.
- 14. All property of Cameron County must remain (at all times) within the United States without exception unless prior Agenda approval has been given by Commissioners Court.
- 15. The County is exempt from State Sales Tax and Federal Excise Tax. DO NOT INCLUDE TAX IN RFP. Cameron County claims exemption from all sales and/or use taxes under Texas Tax Code δ151.309, as amended. Texas Limited Sales Tax Exemption Certificates will be furnished upon written request to the Cameron County Purchasing Agent.
- 16. Proposals are scheduled to be opened and publicly acknowledged at the Cameron County Commissioners Courtroom, on the scheduled date and time specified on cover sheet of this RFP package. Proposers, their representatives and interested persons may be present. The proposals shall be opened and acknowledged only so as to avoid disclosure of the contents to competing proposers and shall remain confidential during negotiations. However, all proposals shall be opened for public review after the concession lease agreement is approved, except for trade secrets and confidential information contained in the proposal and identified by proposers as such.
- 17. No oral statement of any person shall modify or otherwise change, or affect the terms, conditions or specifications stated in the resulting concession agreement. All change orders to this RFP will be made in writing by the Cameron County Purchasing Department. Award of proposal does not constitute a concession agreement. A binding concession agreement will be negotiated by the Cameron County Property Manager and approved by the Commissioners Court after the proposal has been awarded.
- 18. No public official shall have interest in this RFP except in accordance with Vernon's Texas Codes Annotated, Local Government Code Title 5. Subtitle C, Chapter §171.
- 19. The proposer shall not offer or accept gifts or anything of value nor enter into any business arrangement with any employee, official or agent of Cameron County.
- 20. All proposals meeting the intent of this RFP will be considered for a possible negotiation.
- 21. Any interpretations, corrections or changes to this RFP will be made by addenda. Sole issuing authority of addenda shall be vested in Cameron County Purchasing Department. Addenda will be mailed to all who are known to have received a copy of this RFP. Proposers shall acknowledge receipt of all addenda in writing.
- 22. Proposals must comply with all federal and state laws, County policy and local regulations.
- 23. Cameron County may request a presentation and additional information to determine proposer's ability to sufficiently meet these minimum responsible standards listed above.
- 24. Cameron County requests proposer to supply, with this RFP, a list of at least three (3) references. Include full name and title, address, telephone number, fax number and name(s) of contact person.

- 25. Successful proposer shall defend, indemnify and save harmless Cameron County and all its officers, agents and employees from all suits, actions, or other claims of any person, persons, or property on account of negligent act or fault of the successful offered, or of any agent, employee, subcontractor or supplier in the execution of or performance under any contract which may result from proposal award. Successful proposer shall pay any judgment including costs, which may be obtained against Cameron County developing out of such injury or damages.
- 26. Any notice provided by this proposal or required by Law to be given to the successful proposer by Cameron County shall be conclusively deemed to have been given and received on the next day after such written notice has been deposited in the mail in Brownsville, Texas by Registered or Certified mail with sufficient postage affixed thereto, addressed to the successful proposer at the address so provided; this shall not prevent the giving of actual notice in any other manner.
- 27. It is the responsibility of the bidder or proposer to ask any and all questions the bidder or proposer feels to be pertinent to the bid or proposal. Cameron County shall not be required to attempt to anticipate such questions for bidders or proposers. Cameron County will endeavor to respond promptly to all questions asked.
- 28. AWARD OF CONTRACT Award(s), if made, will be made to the responsive and responsible Offeror(s) whose proposal is most advantageous to Cameron County, taking into consideration price and the other factors set forth in the Request for Proposals "R.F.P. . Contract will be negotiated with the offeror whose proposal is determined to be most advantageous to County. The County reserves the right and option to reject any and all proposals and to waive any formality in proposals received, to accept or reject any or all of the items in the proposal, and award the contract in whole or in part, if it is deemed in the best interest of the County. Proposals should be submitted initially on the most favorable terms, from both price and technical standpoints. The County further reserves the right to award without discussion after proposals are received to request written "BEST AND FINAL OFFERS" from respondents judged to be responsive to the minimum technical requirements.

PURCHASE ORDER AND DELIVERY: The successful PROPOSER shall not deliver products or provide services without a <u>contract approved by the Cameron County Commissioners Court</u> and a Cameron County Purchase Order signed by an authorized agent of the Cameron County Purchasing Department.

This shall be understood to include bringing merchandise to the appropriate room or place designated by the using department. Every tender or delivery of goods must fully comply with all provisions of these requirements and the specifications including time, delivery and quality. Nonconformance shall constitute a breach which must be rectified prior to expiration of the time for performance. Failure to rectify within the performance period will be considered cause to reject future deliveries and cancellation of the contract by Cameron County without prejudice to other remedies provided by law. Where delivery times are critical, Cameron County reserves the right to award accordingly.

NO PLACEMENT OF DEFECTIVE TENDER: Every tender or delivery of goods must fully comply with all provisions of this contract as to time of delivery, quality and the like. If a tender is made which does not fully conform, this shall constitute a breach and Seller shall not have the right to substitute a conforming tender provided, where the time for performance has not yet expired, the Seller may seasonably notify Buyer of their intention to cure and may then make a conforming tender within the contract time but not afterward.

PLACE OF DELIVERY: The place of delivery shall be that set forth on the purchase order. Any change thereto shall be affected by modification as provided for in clause 20, "Modifications", hereof. The terms of this agreement are "no arrival, no sale".

DELIVERY TERMS AND TRANSPORTATION CHARGES: RFP must show number of days required to place material in receiving agency's designated location under normal conditions. Failure to state delivery time obligates Proposer to complete delivery in 24 hours. A five-day difference in delivery promise may break a tie. Unrealistically short or long delivery promises may cause RFP to be disregarded. Consistent failure to meet delivery promises without valid reason may cause removal from Proposer list.

An accurate delivery date must be quoted on the "RFP Form". When there are various items, a delivery date must be included with each item quoted. Freight and shipping charges to Cameron County must be included in the RFP price. Final location will be supplied to the vendor on award of RFP, F.O.B. destination. Delivery locations will be: Various County Building locations. Delivery days after receipt of order (ARO). Specify all (various) dates by categories or item if different.

If delay is foreseen, contractor shall give written notice to Director of Purchasing. The County has the right to extend delivery date if reasons appear valid. Contractor must keep County advised at all times of status of order. Default in promised delivery (without accepted reasons) or failure to meet specifications, authorized the County to purchase supplies elsewhere and charge full increase in cost and handling to defaulting contractor.

Delivery shall be made during normal working hours only, 8:00 a.m. to 5:00 p.m. unless otherwise noted in RFP. **VARIATON IN QUANTITY:** The County assumes no liability for commodities produced, processed or shipped in excess of the amount specified herein.

SELLER TO PACKAGE GOODS: Seller will package goods in accordance with good commercial practice. Each shipping container shall be clearly and permanently packed as follows: (a) Seller's name and address; (b) Consignee's name, address and purchase order or purchase release number and the supply agreement number if applicable; (c) Container number and total number of containers, e.g. box 1 of 4 boxes; and (d) the number of the container bearing the packing slip. Seller shall bear cost of packaging unless otherwise provided. Goods shall be suitably packed to secure lowest transportation costs and to conform with requirements of common carriers and any applicable specifications. Buyer's count or weight shall be final and conclusive on shipments not accompanied by packing lists.

SHIPMENT UNDER RESERVATION PROHIBITED: Seller is not authorized to ship the goods under reservation, and no tender of a bill of lading will operate as a tender of goods.

TITLE AND RISK OF LOSS: The title and risk of loss of the goods shall not pass to Buyer until Buyer actually receives and takes possession of the goods at the point or points of delivery.

INSPECTION: Upon receiving item(s), they will be inspected for compliance with the RFP Specifications. If the item(s) do not pass inspection, the vendor will be required to pick up the rejected item(s) at the delivery point, provide the necessary replacement, and return the item(s) to the original point of delivery.

All items proposed shall be new, in first class condition, including containers suitable for shipment and storage (Cameron County prefers recycled packaging whenever possible), unless otherwise indicated in RFP. Verbal agreements to the contrary will not be recognized. All materials and services shall be subject to Purchaser's approval. Unsatisfactory material will be returned at Seller's expense. Cameron County reserves the right to inspect any item(s) or service location for compliance with specifications and requirements and needs of the using department. If an offeror cannot furnish a sample of a RFP item, where applicable, for review, or fails to satisfactorily show an ability to perform, the County can reject the RFP as inadequate.

TESTING: Cameron County reserves the right to test equipment, supplies, material and goods Proposed for quality, compliance with specifications and ability to meet the needs of the user. Demonstration units must be available for review. Should the goods or services fail to meet requirements and/or be unavailable for evaluation, the RFP is subject to rejection. <u>County user Dept.(s) reserves the right to make the final determination as to equivalents.</u>

SPECIAL TOOLS AND TEST EQUIPMENT: If the price stated on the face hereof includes the cost of any special tooling or special test equipment fabricated or required by Seller for the purpose of filling this order, such special tooling equipment and any process sheets related thereto shall become the property of the Buyer and to the extent feasible shall be identified by the Seller as such.

INVOICES AND PAYMENTS: (a) Vendor_shall submit separate invoices, in duplicate, on each purchase order after each delivery. Invoices shall indicate the purchase order number, shall be itemized and transportation charges, if any, shall be listed separately. A copy of the bill of lading and the freight weigh bill when applicable, should be attached to the invoice. Mail to: Cameron County, ATTN: Auditor's Office, 1100 East Monroe St., Brownsville, Texas 78520. Payment shall not be due until the above instruments are submitted after delivery. Vendors must keep the Auditor_advised of any changes in your remittance addresses. (b) County's only_obligation to pay Vendor is to pay from funds budgeted and available for the purpose of the purchase. Lack of funds shall render this contract null and void to the-extent funds are not available and any delivered but unpaid for goods will be returned to Vendor by the County. (c) Do not include Federal Excise, State or City Sales Tax. County shall furnish tax exemption certificate if required.

Any invoice, which cannot be verified by the contract price and/or is otherwise incorrect, will be returned to the Vendor for correction. Under term contracts, when multiple deliveries and/or services are required, the Vendor may invoice following each delivery and the County will pay on invoice. Contracts providing for a monthly charge will be billed and paid on a monthly basis only. Prior to any and all payments made for good and/or services provided under this contract, the Vendor should provide his Taxpayer Identification Number or social security number as applicable. This information must be on file with the Cameron County Auditor's office. Failure to provide this information may result in a delay in payment and/or back-up withholding as required by the Internal Revenue Services.

Vendor shall submit two (2) copies of an itemized invoice showing RFP number and purchase order number to:

CAMERON COUNTY AUDITOR ACCOUNTS PAYABLE 1100 EAST MONROE ST., BROWNSVILLE, TEXAS 78520

Please note that any payment due under this RFP award will be applied towards any debt, including but not limited to delinquent taxes that is owed to Cameron County.

PAYMENT DISCOUNT: Indicate the payment discount (s) available depending on the when invoices are paid. For example, 1/30 means a 1% discount if paid within 30 days, 2/15 means a 2% discount if paid within 15 days, etc. Payment in full will be made within thirty (30) days of delivery, inspection, and receipt of invoice.

All costs quotations must include all the various features needed to satisfy the requirements. Note: No amounts will be paid for the items in this RFP in excess of the amounts quoted.

CAMERON COUNTY REQUEST FOR PROPOSAL (RFP)

RFP # 240201 OLMITO NATURE PARK – PHASE 1

INSTRUCTIONS

PART I – GENERAL REQUIREMENTS

1.0 By order of the Commissioners' Court of Cameron County, Texas, sealed proposals will be received for:

OLMITO NATURE PARK – PHASE 1

SEE (DIVISION 1 – GENERAL REQUIREMENTS) WHICH FURTHER DESCRIBES THE SCOPE OF WORK/SERVICES AS SPECIFIED ON TECHNICAL SPECIFICATIONS AND CONSTRUCTION DRAWINGS PROVIDED BY ARCHITECTURAL FIRM.

It is the responsibility of the bidder to provide and install new emergency generator equipment which best complies with the specifications listed in RFP package.

It is the Responder's responsibility to provide a Payment and Performance Bond, and proof of insurance. Responder's shall fill out the form which follows, which details basic equipment and construction and installation requirements. Failure to fill out the form, leaving items blank, or referencing other manufacturer documents instead of filling out the form, will be considered non-responsive and could disqualify proposal.

- 2.0 INCURRED EXPENSES: There is expressed or implied obligation for Cameron County to reimburse for any expense incurred in preparing proposals in response to this request, and Cameron County will not reimburse anyone for these expenses. Cameron County will consider all RFP's from all responsible proposers.
- 3.0 CASHIER'S CHECK AND FORFEITURE: Each RFP shall be accompanied by a Cashier's Check, Certified Check, or acceptable Proposer's Bond payable to Cameron County, in the amount of not less than 5% of the larges possible total for the proposal submitted, must accompany each proposal. Proposal guarantee bond as a guarantee that if the Proposer receives an award, the Proposer will enter into a contract for services and submit proof of any required insurance. Checks of unsuccessful Proposers will be returned. If the successful Proposer fails to satisfy all pre-work requirements or commence work after award, that Proposer shall forfeit this security deposit. Cameron County shall retain it as liquidated damages.
- 4.0 GENERAL CONDITIONS: Proposers shall thoroughly examine the specific requirements, schedules, instructions and all other contract documents. RFP must set forth accurate and complete information as required by this RFP (including attachments). No plea of ignorance by the Proposer of conditions that exist or that may hereafter exist as a result of failure or omission on the part of the Proposer to make the necessary examinations and investigations, or failure to fulfill in every detail the requirements of the contract documents, will be accepted as a basis for varying the requirements of Cameron County.
- 5.0. SITE INSPECTION: Before submitting a Proposal, Proposers are encouraged to visit the site and make all investigations and examinations necessary to ascertain site and/or local physical conditions and requirements affecting the full performance of the construction Agreement and to verify any representations made by Cameron County, Texas, upon which the Proposer will rely. If the Proposer receives an award because of its RFP submission, failure to have made such investigations and examinations will in no way relieve the Proposer from its obligations to comply in every detail with all

provisions and requirements of the Concession Agreement, nor will a plea of ignorance of such conditions and requirements be accepted as a basis for any claim by the Proposer for additional compensation or relief. Failure to do so will not relieve the successful Proposer from performing the contract in accordance with all terms and conditions as set forth.

Each Proposer attests, by signing this RFP that he/she has acquainted themselves with the job site and fully understands there will be no recourse for negligence or oversight for not doing so.

- 6.0 ASSIGNMENT: The awarded Proposer shall not assign, transfer, convey, sublet, or otherwise dispose of any award or of any of its rights, title, or interests therein, without the prior written consent of the County Commissioners Court.
- 7.0 CONTRACT PERIOD: .
 - a. Contact Danny Villarreal, Cameron County Construction Manager at: phone (956) 454-1378 for questions and to make arrangement to inspect site at Cameron County Juvenile Justice Center
- 8.0 RFP PRICE:

PROPOSER hereby certifies that this RFP is made without prior understanding, agreement or connection with any corporation, firm or person submitting a RFP for the same materials, supplies, services or equipment and is in all respects fair and without collusion or fraud. Further, the PROPOSER hereby agrees to abide by all terms and conditions of this RFP and certifies that the person executing the RFP form is authorized to sign this RFP for the PROPOSER.

9.0 <u>PRE-AWARD SURVEY</u>: After RFP opening and prior to award, County reserves the right to make a preaward survey of proposer's facilities and its operation to be used in the services and performance of this work. Proposer agrees to allow all reasonable requests for inspection of such facilities or operations with two (2) working days advance notice. Failure to allow an inspection is cause for rejection of a RFP as non-responsive. County reserves the right to reject facilities or equipment as unacceptable for performance as a result of the pre-award survey.

10.0 MINIMUM REQUIREMENTS FOR RESPONSIBLE PROPOSAL:

A proposer must affirmatively demonstrate proposer's responsibility. At a minimum, a prospective proposal must contain in the order presented here an outlined response to the following criteria:

11.0 <u>RFP EVALUATION AND AWARD</u>:

EVALUATION AND SELECTION CRITERIA

WEIGHTED QUANTITATIVE SCORING:

Each Vendor will be assigned a score of 0 - 4 by each evaluator for each criteria

- 4 = Very good / Exceeds expectations
- 3 = Above expectations
- 2 = Meets expectations
- 1 =Does not meet expectations
- 0 =non-responsive

Evaluators score by category will be multiplied by the assigned weight for each criteria by vendor then totaled.

Scoring for price will be a ratio and based on a pro rata factor of the best price submitted.

Once RFPs are reviewed and scored, a short list will be compiled. Interviews may be conducted with Proposers determined by total score rankings. Additional information may be required at that time.

Negotiations will begin with the Proposer selected for the project. Commissioners Court will make the final selection and possible approval of the contract.

An Evaluation Committee will review each proposal. Committee will be comprised of, but not limited to, County Staff. Proposer may be requested to appear before the Committee to answer questions or give additional information regarding the project or for a formal presentation.

Proposals will be evaluated as to the proposal, which offers the best overall project and is deemed to be the most advantageous and yield the greatest benefit to the County. Some specific elements the Committee will be evaluating are as follows:

- 1. Commercial Quality. (40 points) Satisfactory response to terms and conditions. Experience with similar programs. Proposal quality and customer references and satisfaction of existing customers.
- 2. Cost Factor. (**30 points**) Total cost and additional cost.
- 3. Customer Service. (20 points) Warranties and engineering value options.
- 4. Functional & Technical. (**10 points**) A clearly demonstrated understanding of the work to be performed and completeness and reasonableness of the proposing firm's plan for accomplishing the requested services.

TOTAL 100 points

At the discretion of the Committee, some or all proposals may be ranked in order of meeting the overall requirements of the highest and best use of concession project. The County reserves the right to negotiate with any, one, or all the ranked proposers. The Evaluation Committee will make a recommendation for award by the Cameron County Commissioners' Court.

12.0 <u>REJECTION OF RFP:</u>

County expressly reserves the right to:

- 1) waive any defect, irregularity or informality in any proposal;
- 2) reject or cancel any RFP or parts of any proposal;
- 3) accept proposals from one or more proposers; or
- 4) procure the services in whole or in part by other means.

PART II - REQUIRED DOCUMENTATION

RFP # 231001

Please note this Section may not address all documentation required by the RFP. The Proposer is cautioned to read the entire RFP to determine all requirements. CAMERON COUNTY RESERVES THE RIGHT TO REJECT ANY RFP WHICH DOES NOT CONTAIN ALL INFORMATION REQUIRED BY THIS RFP.

Proposals shall include all of the information solicited in this RFP, and any additional data that the Proposer deems pertinent to the understanding and evaluation of the Proposal. The Proposer should not withhold any information from the written response in anticipation of presenting the information orally or in a demonstration, since oral presentations or demonstrations may not be solicited.

Submittal of a RFP shall constitute the Proposer's agreement and intent to follow and adhere to all statements, offerings and monetary incentives contained within this Proposal.

In conjunction with other material and information requested in the RFP, all Proposers responding to this solicitation shall provide one (1) original (marked "Original") and seven (7) copies and all attachments of the following in $8 \frac{1}{2}$ " by 11" format, clearly legible, tabbed and in a binder. To achieve a uniform review process and to obtain a maximum degree of comparability, Cameron County requires that RFP information be submitted in the following order:

Table of Contents

List title of each tabbed section and title of any additional information included in this Proposal.

Tab 1 - Transmittal Cover

(Format and Content: Please included in your RFP's / RFQ's as part of your cover).

Executive Summary (2 pages max.)

Submit a signed letter (Executive Summary) briefly addressing the services to be provided by Proposer.

Introduction (2 pages max.)

Proposals must include confirm that the firm will comply with all of the provisions in this RFP. If exceptions will be taken it should be so noted. Proposals must be signed by a company officer empowered to bind the company. A proposer's failure to include these items in their proposals may cause their proposal to be determined to be non-responsive and the proposal may be rejected. Include the following: *Firms Name, Address, Phone #, Contact Name, Phone #, Email address.*

Understanding of the Project (1 pages max.)

Proposers must provide a comprehensive narrative statement that illustrates their understanding of the project as proposed and detail schedule (timeline).

Methodology Used for the Project (1 page max.)

Proposers must provide a comprehensive narrative statement that sets out the methodology they intend to employ and that illustrates how their methodology will serve to accomplish the work and meet project schedule.

Management Plan for the Project (1 page max.)

Proposers must provide a comprehensive narrative statement that sets out the management plan they intend to follow and illustrates how their plan will serve to accomplish the work and meet project schedule.

Provide list specific to the personnel assigned to accomplish the work called for in this RFP; illustrate the lines of authority; designate the individual responsible and accountable for the completion of the proposed project.

Provide a narrative description of the organization of the project team.

Provide a personnel roster that identifies each person who will actually work on the contract and provide the following information about each person listed and Title;

RFP MAG Guarantee per Proposal (1 page max.)

Proposer's MAG Guarantee associated with this offer.

Tab 2 - Proposed General Contractor Information

- a. Name of owner/operator
- b. Address of GE owner/operator
- c. Telephone & Fax number
- d. Identification by name and address of principal financial investors/supporters committed to the project, specifying estimated proportionate levels of involvement for each in the total project.
- e. Include the name and telephone numbers of the designated individual(s), who will answer technical and contractual questions with respect to the proposal.

Tab 3 - Authorization to Do Business in Texas and Management / Organization

Evidence of authorization and <u>if incorporated</u>: certificate of good standing issued by the Secretary of State of Texas indicating Proposer is authorized to conduct business within the State of Texas.

<u>If Business is an individual</u>: proof of registration with Cameron County doing business under assumed name (d/b/a).

<u> Tab 4 - RFP Bond</u>

Each RFP shall be accompanied by a <u>Cashier's Check</u> made payable to Cameron County in the amount of five (5) percent (%) of the total cost proposal as a guarantee that if the Proposer receives an award, the Proposer will enter into a contract for services and submit proof of any required insurance. Checks of unsuccessful proposers will be returned. If the successful Proposer fails to satisfy all pre-work requirements or commence work after award, that Proposer shall forfeit this security deposit. Cameron County shall retain it as liquidated damages.

Tab 5 – Price Proposal

Proposer shall provide a detailed breakdown of the total project cost.

Tab 6 - Security (Performance Bond)

The selected Proposer, within 30 days of the time of the execution of the Construction Agreement, shall furnish the County with a valid security (performance) deposit for the amounts detailed in Construction Agreement.

Tab 7 - Time Frame

Describe the time frame for proposed replacement of existing smoke evacuation system and environmental air exhaust system at detention 1 and 2 at the Juvenile Justice Center located in Cameron County. Project commencement date (number of months after contract is approved by the Cameron County Commissioners Court.) Project completion date (smoke evacuation system and air exhaust system in working/running conditions).

Tab 8 – Changes / Deviations

Requested changes to Construction Agreement

List any requested changes to the draft construction Agreement. Each requested change shall reference the lease article and page number. All terms and conditions in the Draft Construction Agreement are final unless any requested changes are approved and agreed upon. The County has the right to negotiate the terms and conditions with the selected Proposer.

Deviations to terms, conditions and specifications

Any deviations from the terms, conditions and technical specifications and/or schematic drawings listed herein must be clearly indicated; otherwise, it will be considered that the RFP offered is in strict compliance with these specifications and the successful Proposer will be held responsible.

Tab 9 - References - <u>Mandatory</u>

Complete & include Attachment A three (3) references page. References to include (3) three business/Commercial references and one (1) creditor or bank.

Tab 10 - All other information required by this RFP

(Please note if applicable: All design documents must be reviewed and approved by Cameron County prior to any construction. It is the responsibility of the selected Proposer to obtain and comply with all permits, licenses and authorizations as may be applicable from all governing agencies having jurisdiction over the construction site/building).

Proposer must submit the following documents after contract award:

Insurance documentation within ten (10) days from execution of the contract. Payment and Performance Bonds. Permits. All other information required in this RFP

Tab 11 - Acknowledgment of compliance with the American Rescue Plan Act of 2021 (ARPA)

<u>Please see Appendix A " FHWA 1273" & Appendix B "Super Circular- Procurement Standards 2 CFR Parts 200.317 – 200.327"</u>

Deviations

All Proposals must clearly and with specific detail, note all deviations to the <u>exact</u> requirements imposed upon the Proposer by the specifications. Such deviations must be stated upon the RFP Form; otherwise Cameron County will consider the subject Proposals as being made in strict compliance with said specifications to Proposers, the Proposer being held therefore accountable and responsible. Proposers are hereby advised that Cameron County will only consider Proposals that meet the exact requirements imposed by the specifications; except, however, said Proposals may not be subject to such rejection where, at the sole discretion of Cameron County, the stated deviation is considered to be equal or better than the imposed requirement and where said deviation does not destroy the competitive character of the RFP process by affecting the amount of the RFP such that an advantage or benefit is gained to the detriment of the other Proposers.

Records & Right to Audit

The Proposer shall maintain such financial records and other records as may be prescribed by the County or by applicable federal and state laws, rules, and regulations. The Proposer shall retain these records for a period of three (3) years after final payment, or until they are audited by the County, whichever event occurs first. These records shall be made available during the term of the Concession Agreement and the subsequent three-year period for examination, transcription, and audit by the County, its designees, or other authorized entities.

Modifications Due to Public Welfare or Change in Law

The County shall have the power to make changes in the Concession Agreement as the result of changes in law and/or Ordinances of Cameron County to impose new rules and regulations on the Proposer under the Concession Agreement relative to the scope and methods of providing services as shall from time-to-time be necessary and desirable for the public welfare. The County shall give the Proposer notice of any proposed change and an opportunity to be heard concerning those matters. The scope and method of providing services as referenced herein shall also be liberally construed to include, but is not limited to, the manner, procedures, operations and obligations, financial or otherwise, of the Proposer. In the event any future change in Federal, State or County law or the RFP # 240201 Page 14 of 77 Responder's signature/Initials

Ordinances of Cameron County materially alters the obligations of the Proposer, or the benefits to the County, then the Concession Agreement shall be amended consistent therewith. Should these amendments materially alter the obligations of the Proposer, then the Proposer or the County shall be entitled to an adjustment in the rates and charges established under the Concession Agreement. Nothing contained in the Concession Agreement shall require any party to perform any act or function contrary to law. The County and Proposer agree to enter into good faith negotiations regarding modifications to the lease which may be required in order to implement changes in the interest of the public welfare or due to change in law. When such modifications are made to the Concession Agreement, the County and the Proposer shall negotiate in good faith, a reasonable and appropriate adjustment for any changes in services or other obligations required of the Proposer directly and demonstrably due to any modification in the lease under this clause.

Right to Require Performance

- a. The failure of the County at any time to require performance by the Proposer of any provision hereof shall in no way affect the right of the County thereafter to enforce same. Nor shall waiver by the County of any breach of any provision hereof be taken or held to be a waiver of any succeeding breach of such provision or as a waiver of any provision itself.
- a. In the event of failure of the Proposer to deliver services in accordance with the lease terms and conditions, the County, after due written notice, may procure the services from other sources and hold the Proposer responsible for any resulting additional purchase and administrative costs. This remedy shall be in addition to any other remedies that the County may have.

NON-PERFORMANCE

- a. Time is of the essence in this contract and failure to deliver the services specified shall be considered a default.
- b. In case of default, the County may procure the services from other sources and hold the Proposer responsible for all costs occasioned there by and may immediately cancel the contract.

SPECIAL PROVISIONS

- a. <u>PUBLIC ENTITY CRIMES</u> Any person submitting a RFP or RFP in response to this invitation certifies that they are aware of, and in compliance with, all requirements under Section 287.133, Texas Statutes, on Public Entity Crimes. Prior to RFP award, the recommended Proposer may be required to submit a sworn statement attesting to compliance with said statute.
- b. <u>PERMITS AND LICENSES</u> The Proposer agrees to secure all necessary licenses and permits prior to award and agrees to comply with all Federal and State laws, and

Minor Irregularities

The County reserves the right to waive minor irregularities in RFP's, providing such action is in the best interest of the County. Minor irregularities are defined as those that have no adverse effect on the County's best interests, and will not affect the outcome of the selection process by giving the Proposer an advantage or benefit not enjoyed by other Proposers.

Governing Laws

Except to the extent Federal law is applicable, the laws and regulations of the State of Texas, and the County of Cameron, Texas, shall govern the interpretation, effect, and validity of any contract(s) resulting from this RFP. Venue of any court action shall be in Cameron County. In the event that a suit is brought for the enforcement of any term of the contract, or any right arising there from, the parties expressly waive their respective rights to have such action tried by jury trial and hereby consent to the use of non-jury trial for the adjudication of such suit.

INSURANCE AND LIABILITY

During the period of this Contract, contractor shall maintain at his expense, insurance with limits not less than those prescribed below. With respect to required insurance, Contractor shall:

- a. Name County as additional insured, as its interests may appear,
- b. Provide County a waiver of subrogation,
- c. Provide County with a thirty (30) calendar days advance written notice of cancellation or material change to said insurance,
- d. Provide the County Purchasing Agent at the address shown on Page 1 of this contract, a Certificate of Insurance evidencing required coverage within ten (10) calendar days after receipt of Notice of Award. Also, please assure your certificate contains the contract number as indicated on the Contract Award form when issued by Cameron County. All insurance policies shall be issued by insurers licensed to do business in the State of Texas and any insuring company is required to have a minimum rating of B, Class VIII in the "Best Key Rating Guide" published by A.M. Best & Company, Inc.,
- e. Loss Deductible Clause: The County shall be exempt from, and in no way liable for, any sums of money, which may represent a deductible in any insurance policy. The payment of such deductible shall be the sole responsibility of the Proposer and/or subcontractor providing such insurance, and
- f. Submit an original certificate of insurance reflecting coverage as follows:

Automobile Liability:

Bodily Injury (Each person)	\$250,000.00
Bodily Injury (Each accident)	\$500,000.00
Property Damage	\$500,000.00

General Liability (Including Contractual Liability):

Bodily Injury (Per occurrence)	\$5,000,000.00
Bodily injury Aggregate	\$10,000,000.00
Property Damage (Per occurrence)	\$5,000,000.00
Property Damage Aggregate	\$10,000,000.00
Fire Damage	\$5,000,000.00
Medical Expense (Anyone (1) person)	\$5,000,000.00

Excess Liability:

Umbrella Form Not Required

Worker's Compensation: Statutory

g. <u>INDEMNITY</u>

The Proposer covenants and agrees that it will indemnify and hold harmless the COUNTY and all of the County's officers, agents, and employees from any claim, loss, damage, cost, charge, attorney's fees and costs, or any other expense arising out of any act, action, neglect, or omission by Proposer during the performance of the contract, whether direct or indirect, and whether to any person or property to which the COUNTY or said parties may be subject, except that neither the Proposer nor any of its subcontractors, or assignees, will be liable under this section for damages arising out of injury or damage to persons or property directly caused or resulting from the sole negligence of the COUNTY or any of its officers, agents, or employees.

d. PROTECTION OF PERSONS AND PROPERTY

- 1) The Proposer will take all reasonable precautions for, and will be responsible for initiating, maintaining and supervising all programs relating to the safety of all persons and property affected by, or involved in, the performance of his operations under this contract.
- 2) The Proposer will take all reasonable precautions to prevent damage, injury or loss to: (a) all persons who may be affected by the performance of his operations, including employees; (b) all materials and equipment; and (c) all property at or surrounding the work site. In an emergency affecting the safety of persons or property, the Proposer will act, with reasonable care and discretion, to prevent any threatened damage, injury or loss.
- i. Companies issuing the insurance policy, or policies, shall have no recourse against the County for payment of premiums or assessments for any deductibles which all are the sole
- j. PROPOSERS may, at the COUNTY'S request, be required to provide proof that their firm meets the preceding insurance requirements, by submission of Certificates of Insurance Coverage(s), prior to award of the Contract.

RFP	Title

Proposer's Name

Date: _____

REFERENCES

Please list (3) three references - (1) should be a concessionaire customer who can verify the quality of service your company provides. The County prefers customers of similar size and scope of work to this RFP.

	REFERENCE ONE	
Government/Company Name:		-
Address:		-
Contact Person and Title:		_
Phone:	e-mail address:	-
Contract Period:	Scope of Work	-
	REFERENCE TWO	
Government/Company Name:		
Address:		
Contact Person and Title:		
Phone:	e-mail address:	-
Contract Period:	Scope of Work	_
r		
	REFERENCE THREE	
Government/Company Name:		
Address:		
Contact Person and Title:		
Phone:	e-mail address:	
Contract Period:	Scope of Work	
THIS FORM	MUST BE RETURNED WITH YOUR RFP.	

BANK OR CREDITOR REFERENCES

	REFERENCE		
Government/Company Name:			
Address:			
Contact Person and Title:			
Phone:	e-mail address:		
Contract Period:	Scope of Work		

STATE OF TEXAS COUNTY OF CAMERON

AFFIDAVIT

The undersigned certifies that the RFP prices contained in this RFP have been carefully checked and are submitted as correct and final and if RFP is accepted (within 60 days), agrees to furnish any and/or all items upon which prices are offered, at the price(s) and upon the conditions contained in the Specifications.

BEFORE ME, the undersigned authority, A Notary Public in and for the State of ______, on this day personally appeared ______

who, after having first been duly sworn, upon oath did depose and say;

That the foregoing RFP submitted by

hereinafter called "Proposer" is the duly authorized agent of said company and that the person signing said RFP has been duly authorized to execute the same. Proposer affirms that they are duly authorized to execute this contract, that this company, corporation, firm, partnership or individual has not prepared this RFP in collusion with any other Proposer. The Proposer is not a member of any trust, pool, or combination to control the price of products or services RFP on, or to influence any person to RFP or not to RFP thereon. I further affirm that the Proposer has not given, offered to give, nor intends to give, at any time hereafter, any economic opportunity, future employment, gift, loan, gratuity, special discounts, trip, favor, or service to a public servant in connection with the submitted RFP. The contents of this RFP as to prices, terms or conditions of said RFP have not been communicated by the undersigned nor by any employee or agent to any other person engaged in this type of business prior to the official opening of this RFP.

Name and Address of Proposer:

Telephone number	Fax number		-
Signature			
Name:	Title:		
SWORN TO AND SUBSCRIBE B	EFORE ME THIS	day of	20
	Notary Public in and fo	or County	State
THIS EADM	MICT DE DETIDNE	NUTII VAUD DI	σ

RESIDENCE CERTIFICATION

Pursuant to Texas Government Code $\delta 2252.001 \ et \ seq.$, as amended, Cameron County requests Residence Certification. $\delta 2252.001 \ et \ seq.$ of the Government Code provides some restrictions on the awarding of governmental contracts; pertinent provisions of $\delta 2252.001$ are stated below:

"Nonresident Proposer" refers to a person who is not a resident.

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

I certify that is a Resident		is a Resident
	(Company Name)	
Proposer of Texas as defined in Gover	mment Code δ2252.001.	
□ I certify that		is a Nonresident
	(Company Name)	
Proposer as defined in Governmen	nt Code $\delta 2252.001$ and our	principal place of business is
(City and S	State)	
Print Name:	Signature:	

STATEMENT OF NON-COLLUSION

CAMERON COUNTY EXPRESSLY REQUESTS THAT PROPOSERS NOT DISCUSS THIS ENGAGEMENT OR THIS PROPOSER'S PLANS, EXPERIENCE OR CREDENTIALS WITH OTHER PROPOSER'S OR ANY MEMBER OF COMMISSIONERS' COURT, ANY COUNTY OFFICIAL, OR ANY EVALUATION COMMITTEE MEMBER APPOINTED BY COMMISSIONERS COURT. EXCLUDED ARE PRE-RFP OR PRE-RFP CONFERENCES, EVALUATION COMMITTEE SCHEDULED PROPOSER PRESENTATIONS OR PROPOSER INTERVIEWS, OR EVALUATION COMMITTEE SCHEDULED EQUIPMENT OR SERVICES DEMONSTRATIONS. YOU MAY CONTACT THE PURCHASING AGENT / PURCHASING DEPARTMENT AT ANY TIME.

FROM RFP OPENING DATE THROUGH COMMISSIONERS COURT MEETING FOR SELECTION, VENDORS WILL NOT APPROACH THE COUNTY JUDGE OR COMMISSIONERS TO DISCUSS MATTERS PERTAINING TO THIS BID.

01. Has any individual with the firm submitting this RFP response made any contact with any member of Commissioners Court, any County Official, or an Evaluation Committee member concerning this Proposal, other than questions to the Purchasing Agent?

02. Has any individual with the firm submitting this RFP response made any contact with any other proposer concerning this RFP?

Signature of person doing business with the governmental entity

Date

ORDER NO. 2007O2005

THE STATE OF TEXAS § COUNTY OF CAMERON §

ORDER ADOPTING CONTRACTING RULES FOR PERSONS INDEBTED TO COUNTY

WHEREAS, pursuant to V.T.C.A., Local Government Code, Section 262.0276, a commissioner's court is authorized to adopt rules permitting a county to refuse to enter into a contract or other transaction with a person indebted to the county;

WHEREAS, the Commissioners Court of Cameron County finds it is in the best interest of Cameron County to adopt such rules;

NOW THEREFORE, BE IT ORDERED by the Commissioners Court of Cameron County, that the following rules be adopted regarding Cameron County and persons interested in doing business with Cameron County:

- 1. Cameron County may refuse to enter into a contract or other transaction with a person with a past due debt to Cameron County, including delinquent ad valorem taxes, even if the person is the lowest or successful Proposer; and
- 2. For purposes of this Order, a debt is past due if it is not received in the County Treasurer's Office by the due date in a written agreement or notice, and ad valorem taxes are past due if not received in the County Tax Assessor/Collector's Office by February 1st following the January 1st on which the ad valorem taxes are due.
- 3. For purposes of this Order, a person includes an individual, sole proprietorship, corporation, nonprofit corporation, partnership, joint venture, limited liability Company, and any other entity that proposes or otherwise seeks to enter into a contract or other transaction with Cameron County requiring approval by the Commissioners Court.

ADOPTED this <u>13</u> day of March, 2007.

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

Cameron County Acct #'s: Real Estate _____ Personal Property_____

01. Is the person or the firm submitting this RFP current with all local and State taxes?

Yes No

Signature of person submitting this Bid

Date

Certification Regarding Debarment & Suspension Ineligibility

As is required by the Federal Regulations Implementing Executive Order 12549, Debarment and Suspension, 45 CFR Part 76, Government-wide Debarment and Suspension, in the applicant certifies, to the best of his or her knowledge and belief, that both it and its principals:

- a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department or agency;
- b. Have not within a three-year period preceding this bid and/or application been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state or local) transaction or contract under a public transaction, violation of federal or state antitrust statutes or commission of embezzlement, theft, theory, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- c. Are not presently indicted for or otherwise criminally or civilly charged by a government entity with commission of any of the offenses enumerated herein; and
- d. Have not within a three-year period preceding this bid had one or more public transactions terminated for cause or because of default.

Company Name:	
Signature:	
Print Name:	
Title:	<u> </u>
Telephone Number:	
Date:	_

If the Bidder is unable to certify to all of the statements in this Certification, such Bidder should attach an explanation to this Bid.

SWORN STATEMENT ON DEBARMENT

This SWORN state	ement is submitted with pro	ject number	
By:			
(PR	IINT INDIVIDUALS NAW	ie and iiile)	
For:	NAME OF ENTITY SUBM	AITTING SWOPN	(STATEMENT)
	NAME OF ENTITY SODW		STATEMENT)
whose business ad	dress is:		
CITY	STATE	ZIP	VOICE PHONE
and if app	licable its Federal Employe	ee Identification Nu	umber (FEIN) is:
Neither the entity shareholders, emp of the entity has b	(INDICATE WHI submitting this SWORN st bloyees, members or agents een charged with and conve	CH STATEMENT atement, nor any o who are active in t icted of a public en	S APPLY) f its officers, directors, executives, partners, the management of the entity, nor any affiliate atity crime.
The entity submitt shareholders, emp the entity HAS B	ting this SWORN statement ployees, members, or agents EEN CHARGED WITH A	t, or one or more of s who are active in AND CONVICTE	the management of the entity, or an affiliate of CD OF A PUBLIC ENTITY CRIME.
The entity submit been debarred fro	ting this SWORN statement om any other type of contra-	at is not present on cting.	any Federal list of debarred contractors, nor
AUTHORIZED SIG	NATURE		
(Printed Name)	(Title)		
Sworn to and subscrib	bed before me this o	lay of	,
Personally known	OR Produced i	dentification	
Notary Public State of _	, County of	My commiss	sion expires
PRINTED/TYPED/ OR	STAMPED COMMISSIONF	D NAME OF NOT	ARY PUBLIC)
			·

THIS FORM MUST BE RETURNED WITH YOUR RFP

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CONFLICT OF INTEREST QUESTIONNAIRE For vendor doing business with local governmental entity	FORM CIQ			
This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.	OFFICE USE ONLY			
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).	Date Received			
By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the vendor becomes aware of facts that require the statement to be filed. See Section 176.006(a-1), Local Government Code.				
A vendor commits an offense if the vendor knowingly violates Section 176.006, Local Government Code. An offense under this section is a misdemeanor.				
1 Name of vendor who has a business relationship with local governmental entity.				
2 Check this box if you are filing an update to a previously filed questionnaire. (The law re- completed questionnaire with the appropriate filing authority not later than the 7th business you became aware that the originally filed questionnaire was incomplete or inaccurate.)	quires that you file an updated s day after the date on which			
3 Name of local government officer about whom the information is being disclosed.				
Name of Officer				
<u>4</u> Describe each employment or other business relationship with the local government officer, or a family member of the officer, as described by Section 176.003(a)(2)(A). Also describe any family relationship with the local government officer. Complete subparts A and B for each employment or business relationship described. Attach additional pages to this Form CIQ as necessary.				
A. Is the local government officer or a family member of the officer receiving or likely to receive taxable income, other than investment income, from the vendor?				
Yes No				
B. Is the vendor receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer or a family member of the officer AND the taxable income is not received from the local governmental entity?				
Yes No				
5 Describe each employment or business relationship that the vendor named in Section 1 maintains with a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership interest of one percent or more.				
6 Check this box if the vendor has given the local government officer or a family member of the officer one or more gifts as described in Section 176.003(a)(2)(B), excluding gifts described in Section 176.003(a-1).				
7				
Signature of vendor doing business with the governmental entity	Date			
Form provided by Texas Ethics Commission <u>www.ethics,state.tx.us</u>	Revised 1/1/2021			

CONFLICT OF INTEREST QUESTIONNAIRE

For vendor doing business with local governmental entity

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

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

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

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

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

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

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

(2) the vendor:

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

- (i) a contract between the local governmental entity and vendor has been executed; or
 - r
- (ii) the local governmental entity is considering entering into a contract with the vendor;

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

- $(i)\,$ a contract between the local governmental entity and vendor has been executed; or
- (ii) the local governmental entity is considering entering into a contract with the vendor.

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

- (a) A vendor shall file a completed conflict of interest questionnaire if the vendor has a business relationship with a local governmental entity and:
 - (1) has an employment or other business relationship with a local government officer of that local governmental entity, or a family member of the officer, described by Section 176.003(a)(2)(A);
 - (2) has given a local government officer of that local governmental entity, or a family member of the officer, one or more gifts with the aggregate value specified by Section 176.003(a)(2)(B), excluding any gift described by Section 176.003(a-1); or
 - (3) has a family relationship with a local government officer of that local governmental entity.

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

(1) the date that the vendor:

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

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

(2) the date the vendor becomes aware:

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

- (B) that the vendor has given one or more gifts described by Subsection (a); or
- (C) of a family relationship with a local government officer.

Form provided by Texas Ethics Commission

w.ethics,state.tx.us

Revised 1/1/2021

NEPOTISM CHART

AFFINITY KINSHIP Relationship by Marriage

for

The chart below shows

• Affinity Kinship (relationship by marriage)

CONSANGUINITY KINSHIP Relationship by Blood

• **Consanguinity Kinship** (relationship by blood) purposes of interpreting nepotism as defined in VTCA Government Code, Chapter 573, §§573.021 - .025





DISCLOSURE OF INTERESTS

<u>MUST BE FILLED OUT AND SUBMITTED WITH THE BID/RFP/RFQ</u> <u>IF DISCLOSING: BIDDER / PROPOSER MUST ALSO FILE WITH THE COUNTY CLERK'S OFFICE</u> <u>THE PURCHASING DEPT. WILL NOT BE FILING ON THE BIDDER'S BEHALF</u>

Cameron County, Texas requires all persons or firms seeking to do business with the County to provide the following information. Every question must be answered. If the question is not applicable, answer with "N/A." By law this questionnaire must be filed with the records administrator (County Clerk's Office) of the local government.

Date			
FIRM NAME:ADDRESS:			
FIRM is: 1. Corporation () 4. Association () 5	2. Partnership () . Other ()	3. Sole Owner ()	_
	<u> </u>		-

DISCLOSURE QUESTIONS

If additional space is necessary, please use the reverse side of this page or attach separate sheet.

- 1. State the names of each "employee, elected official, or member of Commissioners Court" of Cameron County having <u>Substantial Interest in Business Entity</u> Local Govt. Code §171.002 (use box below)
- a) For purpose of this chapter, a person has a substantial interest in a business entity if :
 - (1) the person owns 10 percent or more of the voting stock or shares of the business entity or owns either 10 percent or more or \$15,000 or more of the fair market value of the business entity; or
 - (2) funds received by the person from the business entity exceeds 10 percent of the person's gross income for the previous year.
- b) A person has a substantial interest in real property if the interest is an equitable or legal ownership with a fair market value of \$2,500 or more.
- c) A local public official is considered to have a substantial interest under this section if a person related to the official in the first degree by consanguinity or affinity, as determined under Chapter 573, Government Code, has a substantial interest under this section.

Name	Title	Department

CERTIFICATE

I certify that all information provided is true and correct as of the date of this statement, that I have not knowingly withheld disclosure of any information requested; and that supplemental statements will be promptly submitted to the Cameron County as changes occur.

Certifying Person:	_Title:	(Type or Print)
Signature of Certifying Person:	Date:	

THIS FORM MUST BE RETURNED WITH YOUR RFP

Attachment I



HOUSE BILL 89 VERIFICATION (REVISED)

I, _____[Person Name]

the undersigned representative of _______ [Company or Business Name]

(hereafter referred to as Company) being an adult over the age of eighteen (18) years of age, does hereby depose and verify that the Company named above, under the provisions of Subtitle F, Title 10, Texas Government Code Chapter 2270:

- 1. Does not currently boycott the country of Israel; and
- 2. Will not boycott the country of Israel during the term of the contract with Cameron County, Texas.

Signature: _____

Date: _____

Pursuant to Section 2270.001, Texas Government Code:

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

GENERAL TERMS & CONDITIONS (Requests for proposals (RFP))

RFP # 240201

ADDENDA: If RFP specifications, terms or conditions are revised, the Cameron County Purchasing Department will issue an addendum addressing the nature of the changes and notify interested potential Proposers. Proposers must acknowledge receipt and consideration of any such changes by signing the addendum and including it in the RFP package containing the Proposer's submittal.

ADVERTISING: Unless otherwise required by law, Proposers to County RFPs shall not publish and shall keep confidential their intentions and actions respecting any response to the RFP.

AWARD: Cameron County may hold RFP responses for a period of sixty (60) days. Cameron County reserves the right to reject any or all responses to RFPs. Cameron County reserves the right to award a contract, if any, based on the Proposer's response when compared to the EVALUATION CRITERIA (AS STATED IN THE RFP) and, in accordance with the laws of the State of Texas, reserves the right to waive any formality or irregularity, to make awards to more than one proposer. Commissioners Court reserves the right to determine the method and procedures for the final award of all RFPs at any time they may choose, regardless of the Point System used by the Evaluation Committee.

BONDS: If the contract that may be entered into with the County will likely require a performance guarantee or bond, the Purchasing Department will attach a separate page to the RFP explaining those requirements.

CANCELLATION AND TERMINATION: In any contract resulting from the RFP, the County shall have the right to cancel all or any part of the undelivered portion of the contract if (1) Proposer breaches any of the terms hereof, including, but not limited to, applicable warranties, and/or (2) Proposer becomes insolvent or files for bankruptcy. Such right of cancellation is in addition to, and not in lieu of, any other remedies which the County may have in law or equity. Cancellation of work hereunder shall be affected by the delivery to the Proposer of a "Notice of Cancellation of Undelivered Work" specifying the extent to which performance of work, including all goods and services, under the contract is cancelled and the date upon which such cancellation becomes effective.

The performance of work under any resulting contract may be terminated in whole, or in part, by the County in accordance with this provision. The County shall have the right to terminate all or any part of the contract if (1) the Proposer breaches any of the terms hereof, including, but not limited to, applicable warranties, and/or (2) Proposer becomes insolvent or files for bankruptcy. Such right of termination is in addition to, and not in lieu of, any other remedies which the County may have in law or equity. Termination of work hereunder shall be affected by the delivery to the Proposer of a "Notice of Termination" specifying the extent to which performance of work, including all goods and services, under the contract is terminated and the date upon which such termination becomes effective.

CHANGE ORDERS: 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 by mutual consent of the Proposer and the County.

CONTRACT RENEWALS: Contract Renewals must receive Commissioners Court approval. For contract renewal status and information, please contact Elisa Cisneros at 956-982-5405 e-mail: <u>Elisa.Cisneros2@co.cameron.tx.us</u> Cameron County Purchasing Dept. or Dylbia Jeffries 956-550-1340 <u>djefferies@co.cameron.tx.us</u> at the Cameron County Civil Legal Division. Any price escalations are limited to those stated by the original contract terms. All contracts with a one (1) year renewal option require that the Proposer must notify Cameron County of any anticipated price increases in writing at least three months (90 calendar days) prior to the annual renewal award date unless otherwise specified within the specific provisions of the contract up for renewal. This allows the County sufficient time to find an alternative vendor if possible. If Proposer fails to notify the County within time noted it shall be assumed that there will be no price increase for the following year's award period if renewed. This procedure does not apply to any contract which allows for Open Market Price increases or Cost allowance increases.

DISCRIMINATION: In order to encourage fair employment practices, the Proposer agrees as follows: 1.) Proposer will not discriminate against any employee or applicant for employment because of race, sex, color, age, religion, handicap, or national origin; 2) in all solicitations or advertisements for employees, the Proposer will state that all qualified applicants will receive consideration

without regard to race, color, sex, age, religion, handicap or national origin; 3) the Proposer will furnish such relevant information and reports as requested by the County for the purpose of determining compliance with these regulations; and 4) failure of the Proposer to comply with these laws will be deemed a breach of contract and it may be cancelled, terminated or suspended in whole or in part as a result thereof.

DISQUALIFICATION OF PROPOSER: Upon submitting a response to this RFP, Proposer certifies that the Proposer has not violated the antitrust laws of this state codified in Texas Business and Commerce Code 15.01, *et seq.*, as amended, or the federal antitrust laws, and has not communicated directly or indirectly its RFP considerations, plan or response to any competitor or any other person engaged in such line of business. Any and all responses may be rejected if the County believes that collusion exists among the Proposers. If multiples are submitted by a Proposer and after all responses to the RFPs are opened one or more of the responses are withdrawn, the result will be that all of the responses submitted by that Proposer will be withdrawn; however, nothing herein prohibits a Proposer from submitting multiples for different products or services.

EVALUATION: All responses will be evaluated in accordance with law and reviewed to assure they are in the best interest of Cameron County. Evaluations shall be based on criteria bearing on price and performance of the items or services in the user environment. Any specific criteria section or sections identified elsewhere in this RFP may be evaluated by one or more evaluators once the basis and details of this process have been approved by the Purchasing Officer and acknowledged by the Evaluation Committee. Detailed information pertaining to this selective evaluation process is available to Proposers and the Commissioners Court upon request. Evaluation sheets and any summary of all responses are subject to review by the Cameron County Purchasing Department and Evaluation Committee's recommendation to Cameron County Commissioners Court. Compliance with all RFP requirements, delivery terms and needs of the using department are considerations in evaluating responses. Pricing is NOT the only criterion for making a recommendation (see criteria and relative importance of price and other evaluation factors, if any, specified elsewhere in this RFP). The Cameron County Purchasing Department reserves the right to contact any Proposer, at any time, to clarify, verify or request information with regard to that Proposer's response. The Cameron County Purchasing Department further reserves the right to hold negotiation discussions with any responsible Proposer determined to be reasonably susceptible of being selected for award in accordance with law.

PROTEST PROCEDURES: Procedure - This protest procedure is available to Proposers responding to this RFP and requesting a debriefing conference.

<u>Debriefing Conference</u> – A debriefing conference must be requested in writing to the Purchasing Department within five (5) business days from the date of the RFP award by the Cameron County Commissioners' Court. Debriefing questions must be submitted in writing to the Purchasing Department no later than two (2) business days before the scheduled date for the Debriefing Conference. These questions will be answered at the debriefing conference. Follow- up questions must be submitted (in writing) no later than one (1) business day after the date of the Debriefing Conference and answered no later than two (2) business days after the date of the Debriefing Conference. Follow-up answers will be sent via e-mail or fax (if e-mail not available). For RFPs, Proposers are given the opportunity to ask questions of the Evaluation Committee relative to their responses and the Committee's scores.

<u>Protests are made</u>: 1. To the Purchasing Department after the debriefing conference. Proposer protests shall be received, in writing, by the Purchasing Department within five (5) business days after the debriefing conference. 2. To the Protest Committee, only after the protest to the Purchasing Department was not satisfactorily resolved. Protests to the Protest Committee shall be made within five (5) business days after the County Purchasing Department of its decision.

Grounds for protest

1. Errors were made in computing the score.

2. The County failed to follow procedures established in the RFP, the Purchasing policy on acquisitions or applicable state or federal laws or regulations.

3. Bias, discrimination or conflict of interest on the part of an evaluator. Protests not based on these criteria shall not be considered.

<u>Format and Content</u> - Protesting Proposers shall include, in their written protest to the Cameron County Purchasing Department, all facts and arguments upon which they rely. Proposers shall, at a minimum, provide:

1. Information about the protesting Proposer; name of firm, mailing address, phone number and name of individual responsible for submission of the protest.

2. Information about the acquisition and the acquisition method.

3. Specific and complete statement of the County's action(s) being protested. 4. Specific reference to the grounds for the protest.

5. Description of the relief or corrective action requested.

6. For protests to the Protest Committee, a copy of the Purchasing Department's written decision on the protest.

Review Process:

1. Upon receipt of a Proposer's protest, the Purchasing Department shall postpone further steps in the acquisition process until the Proposer protest has been resolved.

2. The Department's internal protest review procedures consist of the following:

a) The Purchasing Department shall perform an objective review of the protest by individuals not involved in the acquisition protested. The review shall be based on the written protest material submitted by the Proposer.

b) A written decision will be delivered to the Proposer within five business days after receipt of the protest, unless more time is needed. The protesting Proposer shall be notified if additional time is necessary.

Final Determination:

The final determination shall:

1. Find the protest lacking in merit and uphold the agency's action; or

2. Find only technical or harmless errors in the agency's acquisition process, determine the agency to be in substantial compliance, and reject the protest; or 3. Find merit in the protest and provide the agency options which may include recommendations to a) correct its errors and reevaluate all proposals, and/or b) reissue the Proposer solicitation document; or c) make other findings and determine other courses of action as appropriate.

Protest Committee Review Process:

Protests to the Protest Committee may be made only for Protest Committee approved acquisitions, and only after review by County Purchasing Department. Protests of the decisions of County Purchasing Department shall be made by letter to the Protest Committee, who may establish procedures to resolve the protest. Protests shall be received by the Protest Committee within five business days after the decision of Purchasing Department in order to be considered. The Committee's decision is final, with no further administrative appeal available.

FISCAL FUNDING: A multi-year lease or lease/purchase arrangement (if requested by the Special Requirements/Instructions), or any contract continuing as a result of an extension option, must include "fiscal funding out" clause. If, for any reason, funds are not appropriated to continue the lease or contract, said lease or contract shall become null and void on the last day of the current appropriation of funds. After expiration of the lease, leased equipment shall be removed by the Proposer from the using department without penalty of any kind or form to Cameron County. All charges and physical activity related to delivery, installation, removal and redelivery shall be the responsibility of the Proposer.

GRATUITIES AND PROHIBITION AGAINST PERSONAL INTEREST IN CONTRACTS: Any elected or appointed official who has any substantial interest, either direct or indirect, in any business entity seeking to contract with the County, shall, before any vote or decision on any matter involving the business entity, file an affidavit stating the nature and extent of interest and shall abstain from any participation in the matter. This is not required if the vote or decision will not have any special effect on the entity other than its effect on the public. However, if a majority of the governing body is also required to file, and do file similar affidavits, then the member is not required to abstain from further participation. Attached and included in this RFP is a disclosure of all of this Company's business or pecuniary financial relationships with officers or employees of Cameron County or County entities (if any

such relationships exist) which must be filled out, attached and included with the RFP response. The County may, by written notice to the Proposer, cancel this contract without liability to Proposer if it is determined by County that gratuities, in the form of entertainment, gifts, or otherwise, were offered or given by the Proposer, or any agent, or representative of the Proposer, to any officer or employee of Cameron County with a view toward securing a contract or securing favorable treatment with respect to the awarding or amending or the making or any determinations with respect to the performance of such a contract. In the event this contract is cancelled by County pursuant to this provision, County shall be entitled, in addition to any other rights and remedies, to recover or withhold the amount of the costs incurred by Proposer in providing such gratuities. Proposer guarantees that he has not retained a person to solicit or secure any contract upon an agreement or understanding for a commission, percentage, brokerage or contingent fee, except for retention of bona fide employees or bona fide established commercial selling agencies maintained by the Proposer for the purpose of securing business.

HISTORICALLY UNDERUTILIZED BUSINESS (HUB) CERTIFICATION: If Proposer is a Certified Historically Underutilized Business (HUB), please include a copy of your HUB Certificate with your response. This information will assist Cameron County in the percentage tracking of HUB utilization.

INSURANCE: The Proposer shall secure and maintain, throughout the duration of the Contract, insurance of such types and in such amounts as may be necessary to protect the Proposer and the interests of the County against all hazards or risks of loss as hereinafter specified. The form and limits of such insurance, together with the insurer, shall be acceptable to the County. It shall be the responsibility of the Proposer to maintain adequate insurance coverage at all times. Failure of the Proposer to maintain adequate coverage shall not relieve the Proposer of any contractual responsibility or obligation.

MAINTENANCE: Maintenance required for equipment requested in RFPs should be available in Cameron County by a manufacturer authorized maintenance facility. Costs for this service shall be shown on the Pricing/Delivery Information form. If Cameron 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.

MATERIAL SAFETY DATA SHEETS: Under the "Hazardous Communication Act", commonly known as the "Texas Right To Know Act", a Proposer must provide to the County with each delivery, material safety data sheets which are applicable to hazardous substances defined in the Act. Failure of the Proposer to furnish this documentation will be cause to reject any RFP applying thereto.

NAME BRANDS: Specifications may reference name brands and model numbers. It is not the intent of Cameron County to restrict responses to RFPs in such cases, but to establish a desired quality level of merchandise or to meet a pre-established standard common to similar existing items. Proposers may offer items of equal stature and standard, but the burden of proof of such stature and standard rests with Proposers. Cameron County shall act as sole judge in determining equality and acceptability of products offered.

PRICING: Prices for all goods and/or services shall be firm for the duration of the contract and shall be stated on the Pricing/Delivery Information form. Prices shall be all inclusive: No price changes, additions, or subsequent qualifications will be honored during the term of the contract. All prices must be written in ink or typewritten. Pricing on all transportation, freight, drayage and other charges are to be prepaid by the Proposer and included in the price. If there are any additional charges of any kind, other than those mentioned above, specified or unspecified, Proposer MUST indicate the items required and attendant costs or forfeit the right to payment for such items. Where unit pricing and extended pricing differ, unit pricing prevails.

RECYCLED MATERIALS: Cameron County encourages the use of products made of recycled materials and shall give preference in purchasing to products made of recycled materials if the products meet applicable specifications as to quantity and quality. County will be the sole judge in determining product preference application.

SCANNED RE-TYPED RESPONSE: If in its RFP response, Proposer either electronically scans, re-types, or in some way reproduces the County's published RFP package, then in event of any conflict between the terms and provisions of the County's published RFP specifications, or any portion thereof, and the terms and provisions of the RFP response made by Proposer, the County's RFP specifications as published shall control. Furthermore, if an alteration of any kind to the County's published RFP specifications is only discovered after the contract is executed and is or is not being performed, the contract is subject to immediate cancellation.
SILENCE OF SPECIFICATIONS: The apparent silence of specifications as to any detail, or the apparent omission from it of a detailed description concerning any point, shall be regarded as meaning that only the best commercial practices are to prevail and that only material and workmanship of the finest quality are to be used. All interpretations of specifications shall be made on the basis of this statement. The items furnished under this contract shall be new, unused of the latest product in production to commercial trade and shall be of the highest quality as to materials used and workmanship. The manufacturer furnishing these items shall be experienced in design and construction of such items and shall be an established supplier of the item needed in the RFP. Substitute items will not be accepted unless approved (in advance).

SUPPLEMENTAL MATERIALS: Proposers are responsible for including all pertinent product data in the returned RFP package. Literature, brochures, data sheets, specification information, completed forms requested as part of the RFP package and any other facts which may affect the evaluation and subsequent contract award should be included. Materials such as legal documents and contractual agreements, which the Proposer wishes to include as a condition of the RFP response must also be in the returned RFP response package. Failure to include all necessary and proper supplemental materials may be cause to reject the Proposer's entire RFP.

TITLE TRANSFER: Title and Risk of Loss of goods shall not pass to Cameron County until Cameron County actually receives and takes possession of the goods at the point or points of delivery. Receiving times may vary with the using department. Generally, deliveries may be made between 8:30 a.m. and 4:00 p.m., Monday through Friday. Proposers are advised to consult the using department for instructions. The place of delivery shall be shown under the "Special Requirements/Instructions" section of this RFP package and/or on the Purchase Order as a "Deliver To:" with the address.

USAGE REPORTS: Cameron 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 RFP. The reports must be furnished no later than five (5) working days after written request and itemize all purchases to date by

Cameron County department with a description, of each item purchased, including the manufacturer, quantity of each item purchased, the per unit and extended price of each item purchased, and the total amount and price of all items purchased.

WARRANTY PRICE: (a) The price to be paid by the County shall be that contained in Proposer's response to the RFP which Proposer warrants to be no higher than Proposer's current prices on orders by others for products of the kind and specification covered by this agreement for similar quantities under similar or like conditions and methods of purchase. In the event Proposer breaches this warranty, the prices of the items shall be reduced to the Proposer's current prices on orders by others, or in the alternative, County may cancel this contract without liability to Proposer for breach or Proposer's actual expense.

(b) The Proposer warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for commission, percentage, brokerage, or contingent fee excepting bona fide employees of bona fide established commercial or selling agencies maintained by the Proposer for the purpose of securing business. For breach or violation of this warranty, the County shall have the right in addition to any other right or rights to cancel this contract without liability and to deduct from the contract price, or otherwise recover the full amount of such commission, percentage, brokerage or contingent fee.

Proposers shall furnish all data pertinent to warranties or guarantees which may apply to items in the RFP.

Proposers may not limit or exclude any implied warranties.

Proposer warrants that products sold and services provided to the County shall conform to the highest commercial and/or professional standards in the industry and laws established by the U.S. Department of Labor, U.S. Department of Homeland Security, Occupational Safety and Health Administration and O.S.H.A. Act of 1970. In the event any product does not conform to OSHA Standards, where applicable, Cameron County may return the product for correction or replacement at the Proposer's expense. If Proposer fails to make the appropriate correction within a reasonable time, Cameron County may correct at the Proposer's expense.

-WARRANTY ITEMS/PRODUCTS: Proposer warrants that products sold and services provided to the County shall conform to the highest commercial and/or professional standards in the industry_and laws established by the U.S. Department of Labor, U.S. Department of Homeland Security, Occupational Safety and Health Administration and O.S.H.A. Act of 1970. In the event product RFP # 240201 Page **35** of **77** Responder's signature/Initials______

does not conform to OSHA Standards, where applicable, Cameron County may return the product for correction or replacement at the Proposer's expense. If Proposer fails to make the appropriate correction within a reasonable time, Cameron County may correct at the Proposer's expense.

Proposer shall not limit or exclude any implied warranties and any attempt to do so shall render this contract voidable at the option of the County.

Proposer warrants that the goods furnished will conform to the specifications, drawings and descriptions listed in the RFP invitation and to the sample(s) furnished by Proposer, if any. In the event of a conflict between the specifications, drawings and descriptions, the specifications shall govern. All items must be new, in first class condition, unless otherwise specified. The design, strength, and quality of materials must conform to the highest standards of manufacturing practice.

Items supplied under this contract shall be subject to the County's approval. Successful Proposer shall warrant that all items/services 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. Any items found defective or not meeting specifications shall be picked up and promptly replaced by the successful Proposer at no expense to the County.

SAFETY WARRANTY: As noted above, Proposer warrants that the products sold to County shall conform to the standards promulgated by the U.S. Department of Labor under the Occupational Safety and Health Act of 1970. In the event the product does not conform to OSHA standards, County may return the product for correction or replacement at the Proposer's expense. In the event Proposer fails to make the appropriate correction within a reasonable time, correction made by County will be at Proposer's expense. Have you attached the required warranty information to the RFP (if applicable)? "Yes" or "No"

APPLICABLE LAW

To the extent it is applicable, this agreement shall be governed by the Uniform Commercial Code. Wherever the term "Uniform Commercial Code" is used, it shall be construed as meaning "the Uniform Commercial Code" as adopted in the State of Texas as effective and in force on the date of this agreement. Otherwise, Texas state and federal law shall apply.

ASSIGNMENT DELEGATION: No right, obligation or interest in this contract shall be assigned or delegated to another by Proposer without the written permission of the County. Any attempted assignment or delegation by Proposer shall be wholly void and totally ineffective for all purposes unless made in conformity with this paragraph.

CONTRACT OBLIGATION: Cameron County Commissioners Court must award any resulting contract and the County Judge or other person authorized by the Cameron County Commissioners Court must sign the contract before it becomes binding on Cameron County or the Proposer. Department Heads are NOT authorized to sign agreements for Cameron County. Binding agreements shall remain in effect until all products and/or services covered by this RFP - have been delivered and accepted and all contract requirements have been satisfied.

ERRORS AND OMISSIONS: Errors and Omissions in the RFP or any provision herein described will not be construed as to relieve the Proposer of any responsibility or obligation requisite to the complete and satisfactory implementation, operation, and support of all obligations under any resulting contract.

FORCE MAJEURE: If, by reason of Force Majeure, either party hereto shall be rendered unable wholly, or in part, to carry out its obligations under this RFP and any resulting contract, then such party shall give notice and full particulars of Force Majeure in writing to the other party within a reasonable time after occurrence of the event or cause relied upon, and the obligation of the party giving such notice, so far as it is affected by such Force Majeure, shall be suspended during the continuance of the inability then claimed, except as hereinafter provided, but for no longer period, and such party shall endeavor to remove or overcome such inability with all reasonable dispatch. The term "Force Majeure" as employed herein, shall mean acts of God, strikes, lockouts, or other industrial disturbances, act of public enemy, orders of any kind of government of the United States or the State of Texas or any civil or military authority, insurrections, riots, epidemics, landslides, lightening, earthquakes, fires, hurricanes, storms, floods, washouts, droughts, arrests, restraint of government and people, civil disturbances, explosions, breakage or accidents to machinery, pipelines or canals,

or other causes not reasonably within the control of the party claiming such inability. It is understood and agreed that the settlement of strikes and lockouts shall be entirely with the discretion of the party having the difficulty, and that the above requirement that any Force Majeure shall be remedied with all reasonable dispatch shall not require the settlement of strikes and lockouts by acceding to the demands of the opposing party or parties when such settlement is unfavorable in the judgment of the party having the difficulty.

HOLD HARMLESS AGREEMENT: The successful Proposer shall indemnify and hold Cameron County harmless from all claims for personal injury, death and/or property damage resulting directly or indirectly from Proposer's performance. Proposer shall procure and maintain, with respect to the subject matter of this RFP, appropriate insurance coverage including, as a minimum, public liability and property damage with adequate limits to cover Proposer's liability as may arise directly or indirectly from work performed and goods or services sold under the terms of this RFP. Certification of such coverage must be provided to the County upon request.

INFRINGEMENTS: There will be no warranty by County against infringements. As part of this contract for sales, Proposer agrees to ascertain whether goods manufactured in accordance with the specifications attached to this agreement will give rise to the rightful claim of any third person by way of infringement or the like. County makes no warranty that the production of goods according to the specification will not give rise to such a claim, and in no event shall County be liable to Proposer for indemnification in the event that Proposer gets sued on the grounds of infringement or the like. If Proposer is of the opinion that an infringement or the like will result, Proposer shall notify County to that effect in writing within two (2) weeks after the signing of this agreement. If County does not receive notice and is subsequently held liable for the infringement or the like, Proposer will hold County harmless. If Proposer in good faith ascertains that production of the goods in accordance with the specifications will result in infringement or the like, this contract shall be null and void, except that County will pay Proposer the reasonable cost of Proposer's search as to infringement. The Proposer agrees to protect the County from claims involving infringement of patents or copyrights.

INTERPRETATION PAROLE EVIDENCE: Unless a separate contract or addendum hereof is prepared and entered into following the award of this RFP to a successful Proposer, this writing is intended by the parties as a final expression of the terms of this RFP and the general terms of any resulting contract. No course of prior dealings between the parties and no usage of the trade shall be relevant to supplement or explain any term. Acceptance or acquiescence in a course of performance rendered under this RFP and any resulting contract shall not be relevant to determine meaning even though the accepting or acquiescing party has knowledge of the performance and opportunity for objection. Whenever a term defined by the Uniform Commercial Code is used in this agreement, the definition contained in the Code is to Control, if applicable.

LATE RESPONSES: RFP responses must be received by the County before the hour and date specified. Responses received after the time and date specified will be disqualified and may be returned to sender. The County is not responsible for lateness or non-delivery of mail, delivered to wrong office, carrier, etc.

MODIFICATIONS: This contract can be modified or rescinded only by a writing signed by both of the parties or their duly authorized agents.

O.S.H.A: Proposer must meet all Federal and State OSHA requirements.

REMEDIES: The successful Proposer and County agree that both parties have all rights, duties, defenses and remedies available under law.

RIGHT TO ASSURANCE: During the RFP process and any resulting contract, whenever a Proposer or County in good faith has reason to question the other's intent to perform, demand may be made that the other party give written assurance of intent. In the event that a demand is made, and no assurance is given within five (5) days, such failure may be treated as an anticipatory repudiation of the RFP and any resulting contract.

SEVERABILITY: If any section, subsection, paragraph, sentence, clause, phrase or word of these requirements or the specifications shall be held invalid, such holding shall not affect the remaining portions of these requirements and the specifications and it is hereby declared that such remaining portions would have been included in these requirements and the specifications as though the invalid portion had been omitted.

VENUE: Both parties agree that venue for any litigation arising from this contract shall lie in Cameron County, Texas.

PROPOSER SHALL CONFIRM ACCEPTANCE OF RFB TERMS: The Proposer shall specifically state acceptance of these terms and conditions as a basis for providing the County with a response to this RFP.

THESE TERMS INCORPORATED: These General Terms and Conditions shall be incorporated in the response to the RFP and any resulting contract to this RFP. The Proposer shall specifically state acceptance of these terms and conditions as a basis for providing the County with a response to this RFP.

OTHER TERMS: The Proposer shall state any exceptions desired to these terms and conditions and may suggest alternate wording that addresses the intent of the term or condition. The County may accept or reject any suggestions in accordance with law.

REQUIRED CONTRACT CLAUSES FOR CONTRACTS UNDER FEDERAL AWARD

2 C.F.R. § 200.327 & 2 C.F.R. PART 200, APPENDIX II, REQUIRED CONTRACT CLAUSES FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS

The United States Office of Management and Budget (OMB) issued in 2 C.F.R. 200: Uniform Administrative Requirements, Cost Principals and Audit Requirements for Federal Awards (Uniform Guidance). Subpart D: Post Federal Award Requirements: <u>2 CFR §§200.317-200.327</u> of the Uniform Guidance contain provisions applicable to procurements made with federal grant funding. [Except as otherwise provided, updated Post Federal Award Requirements (i.e.: 2 CFR §§200.317-200.327) apply to declarations and awards issued on or after November 12, 2020]. https://www.ecfr.gov/current/title-2/subtitle-A/chapter-II/part-200#subject-group-ECFR45ddd4419ad436d See Appendix "B"

As a non-Federal entity, the County of Cameron's ("County") contracts must contain the applicable contract clauses described in Appendix II to the Uniform Guidance (Contract Provisions for non-Federal Entity Contracts Under Federal Awards), which are set forth below. (2 C.F.R. §200.327). If applicable, the following clauses shall supersede any existing, similar clauses stated within the bid document, contract, and/or Terms and Conditions. *The term "Contractor" used herein refers to the proposer, bidder or other entity/individual responding to the applicable procurement packet*.

If applicable, the regulations in 2 CFR, Part 200 and Appendix II to the Uniform Guidance, as it may be amended from time to time, and the contract clauses below, are incorporated by reference as part of this procurement packet and any resulting agreement.

To procure goods and services using funds under a federal grant or contract, specific federal laws, regulations, and requirements may apply in addition to those under state law. The following provisions are required and apply when federal funds are expended by the County of Cameron for any contract resulting from this procurement process.

1. Remedies.

- a. <u>Applicability</u>. This requirement applies to all Federal grant and cooperative agreement programs.
- b. <u>Standard.</u> Contracts for more than the simplified acquisition threshold currently set at \$150,000, 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. <u>See 2 C.F.R.</u> <u>Part 200, Appendix II, A</u>.
- c. <u>Statement</u>. Pursuant to Federal Rule (A) above, when federal funds are expended by the County, the County reserves all rights and privileges under the applicable laws and regulations with respect to this procurement in the event of breach of contract by either party. Contractor shall

comply with all applicable Federal, State of Texas, and local laws, rules, and regulations and shall obtain all applicable licenses and permits for the conduct of its business and the performance of the services, and any provision of equipment and material ("Applicable Law"). All transactions related to any of the Contract Documents shall be governed by the laws of the State of Texas, and trial of any action brought in connection with the bid or the Contract Documents shall be held exclusively in a state court in the County of Cameron, Texas.

2. Termination for Cause and Convenience.

- a. <u>Applicability</u>. This requirement applies to all Federal grant and cooperative agreement programs.
 - b. <u>Standard.</u> All contracts in excess of \$10,000 shall 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 as follows. <u>See 2 C.F.R. Part 200, Appendix II, B</u>.
 - c. <u>Statement</u>. *Termination*. County may terminate this Agreement for any reason upon ten (10) days written notice to the other party. County may terminate this Agreement immediately upon written notice if Contractor breaches this Agreement. In the event of any termination, Contractor shall promptly deliver to the County any and all Work Materials prepared for the County prior to the effective date of such termination, all of which shall become County's sole property. After receipt of the Work Materials, County will pay Contractor for the services which the County determines were satisfactorily performed as of the effective date of the termination.

Excuses for Non-Performance. Either party shall be absolved from its obligations under this contract when and to the extent that performance is delayed or prevented (and in the County of Cameron's case when and to the extent that its need for the articles, materials or work to be supplied hereunder is reduced or eliminated) by reason of acts of God, fire explosion, war riots, strikes, labor disputes, or governmental laws, orders or regulations.

Default. If Contractor or Subcontractor shall breach any provision hereof or shall become insolvent, enter voluntary or involuntary bankruptcy or receivership proceedings or make an assignment to the benefit of creditors, County of Cameron shall have the right (without limiting any other rights or remedies which it may have hereunder or by operation of law) to terminate this contract by written notice to Contractor whereupon County shall be relieved of all further obligation hereunder except the obligation to pay the reasonable value of Contractor's prior performance (at not exceeding the contract rate), and Contractor shall be liable to County for all costs incurred by County in completing or procuring the completion of performance in excess of the contract price herein specified. The County's right to require strict performance of any obligation hereunder shall not be affected by any previous waiver, forbearance of course of dealing. Time is of the essence thereof.

3. Equal Employment Opportunity.

- a. <u>Applicability</u>: This requirement applies to all Federal grant and cooperative agreement programs.
- b. <u>Standard</u>. Except as otherwise provided under 41 C.F.R. Part 60, all contracts that meet the definition of *"federally assisted construction contract"* in 41 C.F.R. § 60-1.3 must include the

equal opportunity clause provided under 41 C.F.R. § 60- 1.4(b), in accordance with Executive Order 11246, *Equal Employment Opportunity* (30 Fed. Reg. 12319, 12935, 3 C.F.R. 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 C.F.R. Part 60 (Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor). See 2 C.F.R. Part 200, Appendix II, C.

c. Key Definitions:

- (1) Federally Assisted Construction Contract. The regulation at 41 C.F.R. § 60-1.3 defines a "federally assisted construction contract" as any agreement or modification thereof between any applicant and a person for construction work which is paid for in whole or in part with funds obtained from the Government or borrowed on the credit of the Government pursuant to any Federal program involving a grant, contract, loan, insurance, or guarantee, or undertaken pursuant to any Federal program involving such grant, contract, loan, insurance, or guarantee, or guarantee, or any application or modification thereof approved by the Government for a grant, contract, loan, insurance, or guarantee under which the applicant itself participates in the construction work.
- (2) *Construction Work*. The regulation at 41 C.F.R. § 60-1.3 defines "construction work" as the construction, rehabilitation, alteration, conversion, extension, demolition or repair of buildings, highways, or other changes or improvements to real property, including facilities providing utility services. The term also includes the supervision, inspection, and other onsite functions incidental to the actual construction
- d. <u>Statement</u>: Contractor will comply with the Nondiscrimination Civil Rights Act of 1964, as amended and all Federal regulations relative to nondiscrimination in Federally assisted programs. <u>The regulation at 41 C.F.R. Part 60-1.4(b) requires the insertion of the following contract clause</u>:

"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, 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, 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 considerations for employment without regard to race, color, religion, sex, or national origin.
- (3) 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.

- (4) 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.
- (5) 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.
- (6) 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 as 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.
- (7) The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) 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: 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."

4. Davis Bacon Act and Copeland Anti-Kickback Act.

- a. <u>Applicability of Davis-Bacon Act</u>. The Davis-Bacon Act only applies to the emergency Management Preparedness Grant Program, Homeland Security Grant Program, Nonprofit Security Grant Program, Tribal Homeland Security Grant Program, Port Security Grant Program, and Transit Security Grant Program. <u>It does not apply to other Federal grant and</u> <u>cooperative agreement programs, including the Public Assistance Program</u>.
- <u>Standard</u>. 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 at 29 C.F.R. Part 5 (Labor Standards Provisions 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.

In contracts subject to the Davis-Bacon Act, 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 at 29 C.F.R. 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 Copeland Anti-Kickback 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 FEMA or applicable Federal entity. <u>See 2 C.F.R. Part 200, Appendix II, ¶ D</u>.

c. <u>Statement</u>. The regulation at 29 C.F.R. § 5.5(a) does provide the required contract clause that applies to compliance with both the Davis-Bacon and Copeland Acts. However, as discussed in the previous subsection, the Davis-Bacon Act does not apply to Public Assistance recipients and subrecipients. In situations where the Davis-Bacon Act does not apply, neither does the Copeland "Anti-Kickback Act." However, for purposes of grant programs where both clauses do apply, FEMA or applicable Federal entity requires the following contract clause:

"<u>Compliance with the Copeland "Anti-Kickback" Act</u>.

- (1) *Contractor*. The contractor shall comply with 18 U.S.C. § 874, 40 U.S.C. § 3145, and the requirements of 29 C.F.R. pt. 3 as may be applicable, which are incorporated by reference into this contract.
- (2) *Subcontracts.* The contractor or subcontractor shall insert in any subcontracts the clause above and such other clauses as Federal requirements may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all of these contract clauses.
- (3) *Breach*. A breach of the contract clauses above may be grounds for termination of the contract, and for debarment as a contractor and subcontractor as provided in 29 C.F.R. § 5.12."

5. Contract Work Hours and Safety Standards Act.

- a. <u>Applicability</u>: This requirement applies to all Federal grant and cooperative agreement programs.
- b. <u>Standard</u>. Where applicable (see 40 U.S.C. § 3701), 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 at 29 C.F.R. Part 5.

Under 40 U.S.C. § 3702, 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. See 2 C.F.R. Part 200, Appendix II, <u>E.</u>

The regulation at 29 C.F.R. § 5.5(b) provides the required contract clause concerning compliance with the Contract Work Hours and Safety Standards Act:

c. <u>Statement</u>.

"Compliance with the Contract Work Hours and Safety Standards Act.

- (1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
- (2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this section.

- (3) Withholding for unpaid wages and liquidated damages. The County of Cameron shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this section.
- (4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this section."

6. Rights to Inventions Made Under a Contract or Agreement.

- <u>Applicability</u>: <u>Stafford Act Disaster Grants</u>. This requirement <u>does not apply to the Public</u> <u>Assistance</u>, Hazard Mitigation Grant Program, Fire Management Assistance Grant Program, Crisis Counseling Assistance and Training Grant Program, Disaster Case Management Grant Program, and Federal Assistance to Individuals and Households – Other Needs Assistance Grant Program, as FEMA or Federal awards under these programs do not meet the definition of "funding agreement."
- b. <u>Standard</u>. If the FEMA or Federal award meets the definition of "funding agreement" under 37 C.F.R. § 401.2(a) and the non-Federal entity 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 non-Federal entity must comply with the requirements of 37 C.F.R. 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 FEMA or applicable awarding agency. <u>See 2 C.F.R. Part 200, Appendix II, F</u>.
- c. <u>Key Definition</u>: The regulation at 37 C.F.R. § 401.2(a) currently defines "funding agreement" as any contract, grant, or cooperative agreement entered into between any Federal agency, other than the County of Cameron, and any contractor for the performance of experimental, developmental, or research work funded in whole or in part by the Federal government. This term also includes any assignment, substitution of parties, or subcontract of any type entered into for the performance of experimental, developmental, or research work under a funding agreement as defined in the first sentence of this paragraph.

7. Clean Air Act and the Federal Water Pollution Control Act.

a. <u>Applicability and Standard</u>: Contracts of amounts in excess of \$150,000 must contain a provision that requires the contractor 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. <u>See 2 C.F.R. Part 200, Appendix II, G.</u>

b. Statement: Included in contracts as provided in section "7a" above.

- (1) The contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401 et seq. and the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq.
- (2) The contractor agrees to report each violation to the Federal awarding agency (e.g. Federal Emergency Management Agency-FEMA) and the Regional Office of the Environmental Protection Agency. Contractor understands and agrees that each violation reported to the County of Cameron will, in turn, be reported as required to assure notification to the Federal awarding agency and the appropriate Environmental Protection Agency Regional Office.
- (3) The contractor agrees to include these requirements in each subcontract exceeding \$150,000 financed in whole or in part with Federal assistance provided by the applicable Federal awarding agency (e.g. FEMA).

8. Debarment and Suspension.

- a. <u>Applicability</u>: This requirement applies to all Federal grant and cooperative agreement programs.
- b. <u>Standard</u>. 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 (Non-procurement Debarment and Suspension).

These regulations restrict awards, subawards, and contracts with certain parties that are debarred, suspended, or otherwise excluded from or ineligible for participation in Federal assistance programs and activities. <u>See 2 C.F.R. Part 200, Appendix II, H</u>; and Chapter IV, 6.d and Appendix C, 2. A contract award must not be made to parties listed in the SAM Exclusions. SAM Exclusions is the list maintained by the General.

Services Administration that 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. SAM exclusions can be accessed at <u>www.sam.gov</u> See 2 C.F.R. § 180.530; Chapter IV, 6.d and Appendix C, 2.

In general, an "excluded" party cannot receive a Federal grant award or a contract within the meaning of a "covered transaction," to include subawards and subcontracts. This includes parties that receive Federal funding indirectly, such as contractors to recipients and subrecipients. The key to the exclusion is whether there is a "covered transaction," which is any non-procurement transaction (unless excepted) at either a "primary" or "secondary" tier. Although "covered transactions" do not include contracts awarded by the Federal Government for purposes of the non-procurement common rule and DHS's implementing regulations, it does include some contracts awarded by recipients and subrecipient.

Specifically, a covered transaction includes the following contracts for goods or services:

- (1) The contract is awarded by a recipient or subrecipient in the amount of at least \$25,000.
- (2) The contract requires the approval of FEMA or applicable Federal entity, regardless of amount.
- (3) The contract is for Federally-required audit services.
- (4) A subcontract is also a covered transaction if it is awarded by the contractor of a recipient or subrecipient and requires either the approval of FEMA or applicable Federal entity or is in excess of \$25,000.
- c. <u>Statement</u>. <u>The following provides a debarment and suspension clause. It incorporates a</u> <u>method of verifying that contractors are not excluded or disqualified</u>:

For maximum protection, provide a print or electronic document for every prime and subcontractor, from <u>www.sam.gov</u> in order to ensure that they are not debarred, suspended, or otherwise excluded from or ineligible for participation in Federal assistance programs and activities.

This contract is a covered transaction for purposes of 2 C.F.R. pt. 180 and 2 C.F.R. pt. 3000. As such the contractor is required to verify that none of the contractor, its principals (defined at 2 C.F.R. §180.995), or its affiliates (defined at 2 C.F.R. § 180.905) are excluded (defined at 2 C.F.R. 180.940) or disqualified (defined at 2 C.F.R. § 180.935).

The contractor must comply with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C and must include a requirement to comply with these regulations in any lower tier covered transaction it enters into.

This certification is a material representation of fact relied upon by (insert name of subrecipient). If it is later determined that the contractor did not comply with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C, in addition to remedies available to (name of state City serving as recipient and name of subrecipient), the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment.

The bidder or proposer agrees to comply with the requirements of 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C while this offer is valid and throughout the period of any contract that may arise from this offer. The bidder or proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions."

9. Byrd Anti-Lobbying Amendment.

- a. <u>Applicability</u>: This requirement applies to all Federal grant and cooperative agreement programs.
- b. <u>Standard</u>. Contractors that apply or bid for an award of \$100,000 or more must file the required certification. See 2 C.F.R. Part 200, Appendix II, I; 44 C.F.R. Part 18; Chapter IV, 6.c; Appendix C, 4. 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 City, 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. See Chapter IV, 6.c and Appendix C, 4.

c. <u>Statement</u>. <u>The following statement in bold provides a Byrd Anti-Lobbying contract clause</u>:

(IF APPLICABLE, PLEASE FILL IN BLANKS AND SIGN)

"Byrd Anti-Lobbying Amendment, 31 U.S.C. § 1352 (as amended)

Contractors who apply or bid for an award of \$100,000 or more shall 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 shall 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 recipient."

APPENDIX A, 44 C.F.R. PART 18 – CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

(To be submitted with each bid or offer exceeding \$100,000)

The undersigned Contractor, ______ certifies, to the best of his or her knowledge, 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 31, U.S.C. § 1352 (as amended by the Lobbying

Disclosure Act of 1995). 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. § 3801 *et seq.*, apply to this certification and disclosure, if any.

Signature of Contractor's Authorized Official

Name and Title of Contractor's Authorized Official

Date

10. Procurement of Recovered Materials.

- a. <u>Applicability</u>: This requirement applies to all Federal grant and cooperative agreement programs.
- b. <u>Standard</u>. 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, Pub. L. No. 89-272 (1965) (codified as amended by the Resource Conservation and Recovery Act at 42 U.S.C. § 6962). See 2 C.F.R. Part 200, Appendix II, ¶ J; 2 C.F.R. § 200.323; PDAT Supplement, Chapter V, 7.

The requirements of Section 6002 include procuring only items designated in guidelines of the EPA at 40 C.F.R. 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 by 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.

- c. <u>Statement</u>. <u>The following provides the clause that a state agency or agency of a political</u> <u>subdivision of a state and its contractors can include in contracts meeting the above contract</u> <u>thresholds</u>:
 - (1) In the performance of this contract, the Contractor shall make maximum use of products containing recovered materials that are EPA- designated items unless the product cannot be acquired—
 - (i) Competitively within a timeframe providing for compliance with the contract performance schedule;
 - (ii) Meeting contract performance requirements; or
 - (iii) At a reasonable price.
 - (2) Information about this requirement, along with the list of EPA-designate items, is available at EPA's Comprehensive Procurement Guidelines web site, <u>https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program</u>.
 - (3) The Contractor also agrees to comply with all other applicable requirements of Section 6002 of the Solid Waste Disposal Act."

11. <u>Prohibition on Contracting for Covered Telecommunications Equipment or Services – 2 CFR §</u> 200.216 (FEMA Interim Policy #405-143-1 effective August 13, 2020).

- a. <u>Applicability</u>: This requirement applies to all Federal grant and cooperative agreement programs and/or as provided below, and is effective August 13, 2020.
- b. <u>Standard</u>. A non-Federal entity is prohibited against using federal funds to purchase telecommunications and video surveillance equipment and services (such as but not limited to mobile phones, land lines, internet, video surveillance, and cloud servers) from certain companies/entities in covered foreign countries for national security reasons. This regulation is

being incorporated into federal grants and contracts received by the County through 2 CFR 200.216 and/or Federal Acquisition Regulations (FAR) clause 52.204-25; as well as guidance provided through Federal Emergency Management Agency (FEMA) Policy #405-143-1. See 2 C.F.R. Part 200, Appendix II, ¶ K

Currently, applicable federal provisions provide that Covered Foreign country means the People's Republic of China and covered telecommunications equipment or services means –

- i. Telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation, (or any subsidiary or affiliate of such entities);
- ii. 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);
- iii. Telecommunications or video surveillance services provided by such entities or using such equipment; or
- iv. Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of 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.

The definition of "Affiliate" can be found in FAR 2.101. Listing of subsidiaries and affiliates can be found in Supplement Number 4 to 15 CFR Part 744.

c. <u>Statement</u>. Federal awards recipients and subrecipients, as well as their contractors and subcontractors, include the following required contract clause in applicable new, extended, or renewed contracts and subcontracts as per the provisions discussed above.

PROHIBITION ON CONTRACTING FOR COVERED TELECOMMUNICATIONS EQUIPMENT OR SERVICES

- (a) Definitions. As used in this clause, the terms backhaul; covered foreign country; covered telecommunications equipment or services; interconnection arrangements; roaming; substantial or essential component; and telecommunications equipment or services have the meaning as defined in FEMA Policy, #405-143-1 Prohibitions on Expending FEMA Award Funds for Covered Telecommunications Equipment or Services As used in this clause
- (b) Prohibitions.
- (1) Section 889(b) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019, Pub. L. No. 115-232, and 2 C.F.R. § 200.216 prohibit the head of an executive agency on or after Aug.13, 2020, from obligating or expending grant, cooperative agreement, loan, or loan

guarantee funds on certain telecommunications products or from certain entities for national security reasons.

- (2) Unless an exception in paragraph (c) of this clause applies, the contractor and its subcontractors may not use grant, cooperative agreement, loan, or loan guarantee funds from the Federal Emergency Management Agency to:
- Procure or obtain any equipment, system, or service that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology of any system;
- (ii) Enter into, extend, or renew a contract to procure or obtain any equipment, system, or service that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology of any system;
- (iii) Enter into, extend, or renew contracts with entities that use covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system; or
- (iv) Provide, as part of its performance of this contract, subcontract, or other contractual instrument, any equipment, system, or service that uses covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system.
- (c) Exceptions.
 - (1) This clause does not prohibit contractors from providing—
 - a. A service that connects to the facilities of a third-party, such as backhaul, roaming, or interconnection arrangements; or
 - b. Telecommunications equipment that cannot route or redirect user data traffic or permit visibility into any user data or packets that such equipment transmits or otherwise handles.
 - (2) By necessary implication and regulation, the prohibitions also do not apply to:
- a. Covered telecommunications equipment or services that:
 - i. Are not used as a substantial or essential component of any system; and
 - ii. Are not used as critical technology of any system.
- b. Other telecommunications equipment or services that are not considered covered telecommunications equipment or services.
 - (d) Reporting requirement.
 - (1) In the event the contractor identifies covered telecommunications equipment or services used as a substantial or essential component of any system, or as critical technology as part of any system, during contract performance, or the contractor is notified of such by a subcontractor at any tier or by any other source, the contractor shall report the information in paragraph

(d)(2) of this clause to the recipient or subrecipient, unless elsewhere in this contract are established procedures for reporting the information.

- (2) The Contractor shall report the following information pursuant to paragraph (d)(1) of this clause:
- (i) Within one business day from the date of such identification or notification: The contract number; the order number(s), if applicable; supplier name; supplier unique entity identifier (if known); supplier Commercial and Government Entity (CAGE) code (if known); brand; model number (original equipment manufacturer number, manufacturer part number, or wholesaler number); item description; and any readily available information about mitigation actions undertaken or recommended.
- (ii) Within 10 business days of submitting the information in paragraph (d)(2)(i) of this clause: Any further available information about mitigation actions undertaken or recommended. In addition, the contractor shall describe the efforts it undertook to prevent use or submission of covered telecommunications equipment or services, and any additional efforts that will be incorporated to prevent future use or submission of covered telecommunications equipment or services.
- (e) Subcontracts. The Contractor shall insert the substance of this clause, including this paragraph (e), in all subcontracts and other contractual instruments.

12. Domestic Preferences for Procurements

- a. <u>Applicability</u>: This requirement of this section must be included in all subawards including all contracts and purchase orders for work or products under Federal award applies to all contracts and purchase orders for work or products using federal funds.
- b. <u>Standard</u>. As appropriate, and to the extent consistent with law, Non-Federal Entities 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. This includes, but is not limited to, iron, aluminum, steel, cement, and other manufactured products. <u>See 2 C.F.R. Part</u> <u>200.322 and2 C.F.R. Part 200, Appendix II, L</u>
- c. <u>Statement</u>. <u>The following provides the required Domestic Preferences for Procurements contracts</u> <u>clause that is incorporated herein by reference.</u>

"Domestic Preference for Procurements

As appropriate, and to the extent consistent with law, the contractor should, to the greatest extent practicable, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States. This includes, but is not limited to iron, aluminum, steel, cement, and other manufactured products.

For purposes of this clause:

• *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. • *Manufactured products* mean 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."

ADDITIONAL REQUIRED CONTRACT CLAUSES FOR NON-FEDERAL ENTITY CONTRACTS UNDER FEDERAL AWARDS WITH THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

Additional FEMA or applicable Federal Requirements. In addition to the requirements above, non-Federal entity contracts under Federal award subject to financial assistance from FEMA are required to contain the following additional contract clauses. The Uniform Guidance authorizes FEMA to require additional provisions for non-Federal entity contracts. FEMA, pursuant to this authority, requires or recommends the following:

These clauses are incorporated by reference as part of this procurement packet and any resulting agreement.

1. Changes.

- a. <u>Standard</u>. To be eligible for FEMA assistance under the non-Federal entity's Federal grant or cooperative agreement, the cost of the change, modification, change order, or constructive change must be allowable, allocable, within the scope of its grant or cooperative agreement, and reasonable for the completion of project scope. FEMA or applicable Federal entity recommends, therefore, that a non-Federal entity include a changes clause in its contract that describes how, if at all, changes can be made by either party to alter the method, price, or schedule of the work without breaching the contract. The language of the clause may differ depending on the nature of the contract and the end-item procured.
- b. <u>Statement</u>. <u>The following provides a contract clause regarding access to records</u>:

"The contractor shall secure written authorization before proceeding with any additional work, whether requested by the County or required to complete the contract. The cost for any changes to the contract price, whether requested by the County or the Contractor will be approved only after submitting the contractor's true costs for the work and related equipment costs and site expenses."

2. Access to Records.

- a. <u>Standard</u>. All non-Federal entities must place into their contracts a provision that all contractors and their successors, transferees, assignees, and subcontractors acknowledge and agree to comply with applicable provisions governing Department and FEMA or applicable Federal entity access to records, accounts, documents, information, facilities, and staff. See DHS Standard Terms and Conditions, v 3.0, XXVI (2013).
- b. Statement. The following provides a contract clause regarding access to records:

"Access to Records. The following access to records requirements applies to this contract:

(1) The contractor agrees to provide the City of Concord, the FEMA or applicable Federal Administrator, the Comptroller General of the United States, or any of their authorized representatives access to any books, documents, papers, and records of the Contractor

which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts, and transcriptions.

- (2) The Contractor agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.
- (3) The contractor agrees to provide the FEMA or applicable Federal Administrator or his authorized representatives access to construction or other work sites pertaining to the work being completed under the contract."

3. DHS Seal, Logo, and Flags.

- a. <u>Standard</u>. All non-Federal entities must place in their contracts a provision that a contractor shall not use the DHS seal(s), logos, crests, or reproductions of flags or likenesses of DHS City officials without specific FEMA or applicable Federal entity pre-approval. See DHS Standard Terms and Conditions, v3.0, XXV (2013).
- b. <u>Statement. The following provides a contract clause regarding DHS Seal, Logo, and Flags:</u>

"The contractor shall not use the DHS seal(s), logos, crests, or reproductions of flags or likenesses of DHS City officials without specific FEMA or applicable Federal entity preapproval."

4. Compliance with Federal Law, Regulations, and Executive Orders.

- a. <u>Standard</u>. All non-Federal entities must place into their contracts an acknowledgement that FEMA or applicable Federal financial assistance will be used to fund the contract along with the requirement that the contractor will comply with all applicable Federal law, regulations, executive orders, and FEMA or applicable Federal policies, procedures, and directives.
- b. <u>Statement. The following provides a contract clause regarding Compliance with Federal</u> <u>Law, Regulations and Executive Orders</u>:

"This is an acknowledgement that Federal financial assistance will be used to fund the contract only. The contractor will comply will all applicable Federal law, regulations, executive orders, FEMA or applicable Federal policies, procedures, and directives."

5. No Obligation by Federal Government.

- a. <u>Standard</u>. The non-Federal entity must include a provision in its contract that states that the Federal Government is not a party to the contract and is not subject to any obligations or liabilities to the non-Federal entity, contractor, or any other party pertaining to any matter resulting from the contract.
- b. <u>Statement</u>. <u>The following provides a contract clause regarding no obligation by the</u> <u>Federal Government</u>:

"The Federal Government is not a party to this contract and is not subject to any obligations or liabilities to the non-Federal entity, contractor, or any other party pertaining to any matter resulting from the contract."

6. Program Fraud and False or Fraudulent Statements or Related Acts.

- a. <u>Standard</u>. The non-Federal entity must include a provision in its contract that the contractor acknowledges that 31 U.S.C. Chap. 38 (Administrative Remedies for False Claims and Statements) applies to its actions pertaining to the contract.
- b. <u>Statement</u>. <u>The following provides a contract clause regarding Fraud and False or</u> <u>Fraudulent Related Acts</u>:

"The contractor acknowledges that 31 U.S.C. Chap. 38 (Administrative Remedies for False Claims and Statements) applies to the contractor's actions pertaining to this contract."

7. <u>FEMA Contract requirement regarding Prohibition on Contracting for Covered</u> <u>Telecommunications Equipment or Services – 2 CFR § 200.216 (FEMA Interim Policy #405-143-1</u> <u>effective August 13, 2020)</u>.

FEMA recipients and subrecipients and their contractors and subcontractors are required per 2 C.F.R. Part 200, Appendix II K to include a contract provision in all FEMA-funded contracts and subcontracts, including any purchase orders. To satisfy this requirement, the contract provision found in Number 11 above is incorporated by reference by the County of Cameron in all new, extended, or renewed contracts and subcontracts. Applicable County contractors and subcontractors shall also comply with the applicable law and requirements. (*See* Number 11 above).

8. FEMA Contract requirement regarding Domestic Preferences for Procurements

For purchases in support of FEMA declarations and awards issued on or after November 12, 2020, all FEMA recipients and subrecipients are required per 2 C.F.R. Part 200, Appendix II ¶ L to include in all contracts and purchase orders for work or products the contract provision included in number 12 above encouraging domestic preference for procurements.

Contractor agrees to comply with all federal, state and local laws, rules, regulations and ordinances, as applicable. It is further acknowledged that the Contractor read and understands all provisions, laws, acts, regulations, etc. as specifically noted above and certifies compliance with the same.

Vendor's Name/Company Name:

Printed Name and Title of Authorized Representative:

Signature of Authorized Representative:

Date:

Appendix A FHWA 1273

I. General

II. Nondiscrimination III. No segregated Facilities FHWA-1273 -- Revised May 1, 2012

REQUIRED CONTRACT PROVISIONS FEDERAL-AID CONSTRUCTION CONTRACTS

A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final

IV. Davis-Bacon and Related Act Provisions

V. Contract Work Hours and Safety Standards Act Provisions

VI. Subletting or Assigning the Contract

VII. Safety: Accident Prevention

VIII. False Statements Concerning Highway Projects IX. Implementation of Clean Air Act and Federal Water Pollution Control Act

X. Compliance with Governmentwide Suspension and Debarment Requirements

XI. Certification Regarding Use of Contract Funds for Lobbying

ATTACHMENTS

A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under Title 23 (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services).

The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Form FHWA-1273 must be included in all Federal-aid design build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services). The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.

Contracting agencies may reference Form FHWA-1273 in bid proposal or request for proposal documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract).

2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.

payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.

4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors.

II. NONDISCRIMINATION

The provisions of this section related to 23 CFR Part 230 are applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR 60, 29 CFR 1625-1627, Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60- 1.4(b) and, for all construction contracts exceeding \$10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60- 4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR 60, and 29 CFR 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), and Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR 230, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. Equal Employment Opportunity: Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:

a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract.

b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: 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, pre-apprenticeship, and/or on-the job training."

- 2. EEO Officer: The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.
- 3. Dissemination of Policy: All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:
 - a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.
 - b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.
 - c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.
 - d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.
 - e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.
- 4. Recruitment: When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.
 - a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.
 - b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.
 - c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.
- 5. Personnel Actions: Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:

- a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.
- b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.
- c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.
- d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.

6. Training and Promotion:

- a. he contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.
- b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).
- c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.
- d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.

7. Unions:

If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:

- a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.
- b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.
- c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.
- d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.

8. Reasonable Accommodation for Applicants / Employees with Disabilities: The contractor must be familiar

with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established there under. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.

- 9. Selection of Subcontractors, Procurement of Materials and Leasing of Equipment: The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.
 - a. The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.
 - b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.

10. Assurance Required by 49 CFR 26.13(b):

a. The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.

b. The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract.

The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the contracting agency deems appropriate.

- **11. Records and Reports:** The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.
 - a. The records kept by the contractor shall document the following:
 - (1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;
 - (2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and
 - (3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women;
 - b. The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on <u>Form FHWA-1391</u>. The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more.

The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding \$2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size). The requirements apply to all projects located within the right-of way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 "Contract provisions and related matters" with minor revisions to conform to the FHWA 1273 format and FHWA program requirements.

1. Minimum wages

a. All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.d. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH–1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

- b. (1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:
 - (i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
 - (ii) The classification is utilized in the area by the construction industry; and
 - (iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(2) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(3) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. The Wage and Hour Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or

Appendix B

Super Circular – Procurement Standards 2 CFR Parts 200.317 – 200.327

Procurement Standards https://www.ecfr.gov/current/title-2/subtitle-A/chapter-II/part-200#subject-group-ECFR45ddd4419ad436d

§ 200.317 Procurements by states.

When procuring property and services under a Federal award, a State must follow the same policies and procedures it uses for procurements from its non-Federal funds. The State will comply with <u>§§ 200.321</u>, <u>200.322</u>, and <u>200.323</u> and ensure that every purchase order or other contract includes any clauses required by <u>§ 200.327</u>. All other non-Federal entities, including subrecipients of a State, must follow the procurement standards in <u>§§ 200.318</u> through <u>200.327</u>.

§ 200.318 General procurement standards.

(a) The non-Federal entity must have and use documented procurement procedures, consistent with State, local, and tribal laws and regulations and the standards of this section, for the acquisition of property or services required under a Federal award or subaward. The non-Federal entity's documented procurement procedures must conform to the procurement standards identified in <u>§§ 200.317</u> through <u>200.327</u>.

(b) Non-Federal entities must maintain oversight to ensure that contractors perform in accordance with the terms, conditions, and specifications of their contracts or purchase orders.

(c)

(1) The non-Federal entity must maintain written standards of conduct covering conflicts of interest and governing the actions of its employees engaged in the selection, award and administration of contracts. No employee, officer, or agent may participate in the selection, award, or administration of a contract supported by a Federal award if he or she has a real or apparent conflict of interest. Such a conflict of interest would arise when the employee, officer, or agent, any member of his or her immediate family, his or her partner, or an organization which employs or is about to employ any of the parties indicated herein, has a financial or other interest in or a tangible personal benefit from a firm considered for a contract. The officers, employees, and agents of the non-Federal entity may neither solicit nor accept gratuities, favors, or anything of monetary value from contractors or parties to subcontracts. However, non-Federal entities may set standards for situations in which the financial interest is not substantial or the gift is an unsolicited item of nominal value. The standards of conduct must provide for disciplinary actions to be applied for violations of such standards by officers, employees, or agents of the non-Federal entity.

(2) If the non-Federal entity has a parent, affiliate, or subsidiary organization that is not a State, local government, or Indian tribe, the non-Federal entity must also maintain written standards of conduct covering organizational conflicts of interest. Organizational conflicts of interest means that because of relationships with a parent company, affiliate, or subsidiary organization, the non-Federal entity is unable or appears to be unable to be impartial in conducting a procurement action involving a related organization.

(d) The non-Federal entity's procedures must avoid acquisition of unnecessary or duplicative items. Consideration should be given to consolidating or breaking out procurements to obtain a more economical purchase. Where appropriate, an analysis will be made of lease versus purchase alternatives, and any other appropriate analysis to determine the most economical approach.

(e) To foster greater economy and efficiency, and in accordance with efforts to promote cost-effective use of shared services across the Federal Government, the non-Federal entity is encouraged to enter into state and local intergovernmental agreements or interentity agreements where appropriate for procurement or use of common or shared goods and services. Competition requirements will be met with documented procurement actions using strategic sourcing, shared services, and other similar procurement arrangements.

(f) The non-Federal entity is encouraged to use Federal excess and surplus property in lieu of purchasing new equipment and property whenever such use is feasible and reduces project costs.

(g) The non-Federal entity is encouraged to use value engineering clauses in contracts for construction projects of sufficient size to offer reasonable opportunities for cost reductions. Value engineering is a systematic and creative analysis of each contract item or task to ensure that its essential function is provided at the overall lower cost.

(h) The non-Federal entity must award contracts only to responsible contractors possessing the ability to perform successfully under the terms and conditions of a proposed procurement. Consideration will be given to such matters as contractor integrity, compliance with public policy, record of past performance, and financial and technical resources. See also $\frac{\$ 200.214}{1000}$.

(i) The non-Federal entity must maintain records sufficient to detail the history of procurement. These records will include, but are not necessarily limited to, the following: Rationale for the method of procurement, selection of contract type, contractor selection or rejection, and the basis for the contract price.

(j)

(1) The non-Federal entity may use a time-and-materials type contract only after a determination that no other contract is suitable and if the contract includes a ceiling price that the contractor exceeds at its own risk. Time-and-materials type contract means a contract whose cost to a non-Federal entity is the sum of:

(i) The actual cost of materials; and

(ii) Direct labor hours charged at fixed hourly rates that reflect wages, general and administrative expenses, and profit.

(2) Since this formula generates an open-ended contract price, a time-and-materials contract provides no positive profit incentive to the contractor for cost control or labor efficiency. Therefore, each contract must set a ceiling price that the contractor exceeds at its own risk. Further, the non-Federal entity awarding such a contract must assert a high degree of oversight in order to obtain reasonable assurance that the contractor is using efficient methods and effective cost controls.

(k) The non-Federal entity alone must be responsible, in accordance with good administrative practice and sound business judgment, for the settlement of all contractual and administrative issues arising out of procurements. These issues include, but are not limited to, source evaluation, protests, disputes, and claims. These standards do not relieve the non-Federal entity of any contractual responsibilities under its contracts. The Federal awarding agency will not substitute its judgment for that of the non-Federal entity unless the matter is primarily a Federal concern. Violations of law will be referred to the local, state, or Federal authority having proper jurisdiction.

[85 FR 49543, Aug. 13, 2020, as amended at 86 FR 10440, Feb. 22, 2021]

§ 200.319 Competition.

(a) All procurement transactions for the acquisition of property or services required under a Federal award must be conducted in a manner providing full and open competition consistent with the standards of this section and $\frac{\& 200.320}{\&}$.

(b) In order to ensure objective contractor performance and eliminate unfair competitive advantage, contractors that develop or draft specifications, requirements, statements of work, or invitations for bids or requests for proposals must be excluded from competing for such procurements. Some of the situations considered to be restrictive of competition include but are not limited to:

- (1) Placing unreasonable requirements on firms in order for them to qualify to do business;
- (2) Requiring unnecessary experience and excessive bonding;
- (3) Noncompetitive pricing practices between firms or between affiliated companies;
- (4) Noncompetitive contracts to consultants that are on retainer contracts;
- (5) Organizational conflicts of interest;

(6) Specifying only a "brand name" product instead of allowing "an equal" product to be offered and describing the performance or other relevant requirements of the procurement; and

(7) Any arbitrary action in the procurement process.

(c) The non-Federal entity must conduct procurements in a manner that prohibits the use of statutorily or administratively imposed state, local, or tribal geographical preferences in the evaluation of bids or proposals, except in those cases where applicable Federal statutes expressly mandate or encourage geographic preference. Nothing in this section preempts state licensing laws. When contracting for architectural and engineering (A/E) services, geographic location may be a selection criterion provided its application leaves an appropriate number of qualified firms, given the nature and size of the project, to compete for the contract.

(d) The non-Federal entity must have written procedures for procurement transactions. These procedures must ensure that all solicitations:

(1) Incorporate a clear and accurate description of the technical requirements for the material, product, or service to be procured. Such description must not, in competitive procurements, contain features which unduly restrict competition. The description may include a statement of the qualitative nature of the material, product or service to be procured and, when necessary, must set forth those minimum essential characteristics and standards to which it must conform if it is to satisfy its intended use. Detailed product specifications should be avoided if at all possible. When it is impractical or uneconomical to make a clear and accurate description of the technical requirements, a "brand name or equivalent" description may be used as a means to define the performance or other salient requirements of procurement. The specific features of the named brand which must be met by offers must be clearly stated; and

(2) Identify all requirements which the offerors must fulfill and all other factors to be used in evaluating bids or proposals.

(e) The non-Federal entity must ensure that all prequalified lists of persons, firms, or products which are used in acquiring goods and services are current and include enough qualified sources to ensure maximum open and free competition. Also, the non-Federal entity must not preclude potential bidders from qualifying during the solicitation period.

(f) Noncompetitive procurements can only be awarded in accordance with <u>§ 200.320(c)</u>.

§ 200.320 Methods of procurement to be followed.

The non-Federal entity must have and use documented procurement procedures, consistent with the standards of this section and $\underline{\$\$}$ 200.317, 200.318, and 200.319 for any of the following methods of procurement used for the acquisition of property or services required under a Federal award or sub-award.

(a) *Informal procurement methods.* When the value of the procurement for property or services under a Federal award does not exceed the *simplified acquisition threshold (SAT)*, as defined in § 200.1, or a lower threshold established by a non-Federal entity, formal procurement methods are not required. The non-Federal entity may use informal procurement methods to expedite the completion of its transactions and minimize the associated administrative burden and cost. The informal methods used for procurement of property or services at or below the SAT include:

(1) Micro-purchases -

(i) *Distribution.* The acquisition of supplies or services, the aggregate dollar amount of which does not exceed the micro-purchase threshold (See the definition of *micro-purchase* in § 200.1). To the maximum extent practicable, the non-Federal entity should distribute micro-purchases equitably among qualified suppliers.

(ii) *Micro-purchase awards.* Micro-purchases may be awarded without soliciting competitive price or rate quotations if the non-Federal entity considers the price to be reasonable based on research, experience, purchase history or other information and documents it files accordingly. Purchase cards can be used for micro-purchases if procedures are documented and approved by the non-Federal entity.

(iii) *Micro-purchase thresholds.* The non-Federal entity is responsible for determining and documenting an appropriate micropurchase threshold based on internal controls, an evaluation of risk, and its documented procurement procedures. The micropurchase threshold used by the non-Federal entity must be authorized or not prohibited under State, local, or tribal laws or regulations. Non-Federal entities may establish a threshold higher than the Federal threshold established in the Federal Acquisition Regulations (FAR) in accordance with paragraphs (a)(1)(iv) and (v) of this section.

(iv) Non-Federal entity increase to the micro-purchase threshold up to \$50,000. Non-Federal entities may establish a threshold higher than the micro-purchase threshold identified in the FAR in accordance with the requirements of this section. The non-Federal entity may self-certify a threshold up to \$50,000 on an annual basis and must maintain documentation to be made available to the Federal awarding agency and auditors in accordance with $\S 200.334$. The self-certification must include a justification, clear identification of the threshold, and supporting documentation of any of the following:

(A) A qualification as a low-risk auditee, in accordance with the criteria in <u>§ 200.520</u> for the most recent audit;

- (B) An annual internal institutional risk assessment to identify, mitigate, and manage financial risks; or,
- (C) For public institutions, a higher threshold consistent with State law.

(v) Non-Federal entity increase to the micro-purchase threshold over \$50,000. Micro-purchase thresholds higher than \$50,000 must be approved by the cognizant agency for indirect costs. The non-federal entity must submit a request with the requirements included in paragraph (a)(1)(iv) of this section. The increased threshold is valid until there is a change in status in which the justification was approved.

(2) Small purchases -

(i) *Small purchase procedures.* The acquisition of property or services, the aggregate dollar amount of which is higher than the micro-purchase threshold but does not exceed the simplified acquisition threshold. If small purchase procedures are used, price or rate quotations must be obtained from an adequate number of qualified sources as determined appropriate by the non-Federal entity.

(ii) *Simplified acquisition thresholds.* The non-Federal entity is responsible for determining an appropriate simplified acquisition threshold based on internal controls, an evaluation of risk and its documented procurement procedures which must not exceed the threshold established in the FAR. When applicable, a lower simplified acquisition threshold used by the non-Federal entity must be authorized or not prohibited under State, local, or tribal laws or regulations.

(b) *Formal procurement methods.* When the value of the procurement for property or services under a Federal financial assistance award exceeds the SAT, or a lower threshold established by a non-Federal entity, formal procurement methods are required. Formal procurement methods require following documented procedures. Formal procurement methods also require public advertising unless a non-competitive procurement can be used in accordance with § 200.319 or paragraph (c) of this section. The following formal methods of procurement are used for procurement of property or services above the simplified acquisition threshold the non-Federal entity determines to be appropriate:

(1) *Sealed bids.* A procurement method in which bids are publicly solicited and a firm fixed-price contract (lump sum or unit price) is awarded to the responsible bidder whose bid, conforming with all the material terms and conditions of the invitation for bids, is the lowest in price. The sealed bids method is the preferred method for procuring construction, if the conditions.

(i) In order for sealed bidding to be feasible, the following conditions should be present:

(A) A complete, adequate, and realistic specification or purchase description is available;

(B) Two or more responsible bidders are willing and able to compete effectively for the business; and

(C) The procurement lends itself to a firm fixed price contract and the selection of the successful bidder can be made principally on the basis of price.

(ii) If sealed bids are used, the following requirements apply:

(A) Bids must be solicited from an adequate number of qualified sources, providing them sufficient response time prior to the date set for opening the bids, for local, and tribal governments, the invitation for bids must be publicly advertised;

(B) The invitation for bids, which will include any specifications and pertinent attachments, must define the items or services in order for the bidder to properly respond;

(C) All bids will be opened at the time and place prescribed in the invitation for bids, and for local and tribal governments, the bids must be opened publicly;

(D) A firm fixed price contract award will be made in writing to the lowest responsive and responsible bidder. Where specified in bidding documents, factors such as discounts, transportation cost, and life cycle costs must be considered in determining which bid is lowest. Payment discounts will only be used to determine the low bid when prior experience indicates that such discounts are usually taken advantage of; and

(E) Any or all bids may be rejected if there is a sound documented reason.

(2) *Proposals.* A procurement method in which either a fixed price or cost-reimbursement type contract is awarded. Proposals are generally used when conditions are not appropriate for the use of sealed bids. They are awarded in accordance with the following requirements:

(i) Requests for proposals must be publicized and identify all evaluation factors and their relative importance. Proposals must be solicited from an adequate number of qualified offerors. Any response to publicized requests for proposals must be considered to the maximum extent practical;

(ii) The non-Federal entity must have a written method for conducting technical evaluations of the proposals received and making selections;

(iii) Contracts must be awarded to the responsible offeror whose proposal is most advantageous to the non-Federal entity, with price and other factors considered; and

(iv) The non-Federal entity may use competitive proposal procedures for qualifications-based procurement of architectural/engineering (A/E) professional services whereby offeror's qualifications are evaluated and the most qualified offeror is selected, subject to negotiation of fair and reasonable compensation. The method, where price is not used as a selection factor, can only be used in procurement of A/E professional services. It cannot be used to purchase other types of services though A/E firms that are a potential source to perform the proposed effort.

(c) *Noncompetitive procurement.* There are specific circumstances in which noncompetitive procurement can be used. Noncompetitive procurement can only be awarded if one or more of the following circumstances apply:

(1) The acquisition of property or services, the aggregate dollar amount of which does not exceed the micro-purchase threshold (see <u>paragraph (a)(1)</u> of this section);

(2) The item is available only from a single source;

(3) The public exigency or emergency for the requirement will not permit a delay resulting from publicizing a competitive solicitation;

(4) The Federal awarding agency or pass-through entity expressly authorizes a noncompetitive procurement in response to a written request from the non-Federal entity; or

(5) After solicitation of a number of sources, competition is determined inadequate.

§ 200.321 Contracting with small and minority businesses, women's business enterprises, and labor surplus area firms.

(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.

(b) Affirmative steps must include:

(1) Placing qualified small and minority businesses and women's business enterprises on solicitation lists;

(2) Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;

(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;

(4) Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises;

(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

(6) Requiring the prime contractor, if subcontracts are to be let, to take the affirmative steps listed in <u>paragraphs (b)(1)</u> through (5) of this section.

§ 200.322 Domestic preferences for procurements.

(a) 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.

(b) For purposes of this section:

(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.

(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.

§ 200.323 Procurement of recovered materials.

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 <u>40 CFR part 247</u> 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.

§ 200.324 Contract cost and price.

(a) The non-Federal entity must perform a cost or price analysis in connection with every procurement action in excess of the Simplified Acquisition Threshold including contract modifications. The method and degree of analysis is dependent on the facts surrounding the particular procurement situation, but as a starting point, the non-Federal entity must make independent estimates before receiving bids or proposals.

(b) The non-Federal entity must negotiate profit as a separate element of the price for each contract in which there is no price competition and in all cases where cost analysis is performed. To establish a fair and reasonable profit, consideration must be given to the complexity of the work to be performed, the risk borne by the contractor, the contractor's investment, the amount of subcontracting, the quality of its record of past performance, and industry profit rates in the surrounding geographical area for similar work.

(c) Costs or prices based on estimated costs for contracts under the Federal award are allowable only to the extent that costs incurred or cost estimates included in negotiated prices would be allowable for the non-Federal entity under <u>subpart E of this part</u>. The non-Federal entity may reference its own cost principles that comply with the Federal cost principles.

(d) The cost plus a percentage of cost and percentage of construction cost methods of contracting must not be used.

§ 200.325 Federal awarding agency or pass-through entity review.

(a) The non-Federal entity must make available, upon request of the Federal awarding agency or pass-through entity, technical specifications on proposed procurements where the Federal awarding agency or pass-through entity believes such review is needed to ensure that the item or service specified is the one being proposed for acquisition. This review generally will take place prior to the time the specification is incorporated into a solicitation document. However, if the non-Federal entity desires to have the review accomplished after a solicitation has been developed, the Federal awarding agency or pass-through entity may still review the specifications, with such review usually limited to the technical aspects of the proposed purchase.

(b) The non-Federal entity must make available upon request, for the Federal awarding agency or pass-through entity preprocurement review, procurement documents, such as requests for proposals or invitations for bids, or independent cost estimates, when:

(1) The non-Federal entity's procurement procedures or operation fails to comply with the procurement standards in this part;

(2) The procurement is expected to exceed the Simplified Acquisition Threshold and is to be awarded without competition or only one bid or offer is received in response to a solicitation;

(3) The procurement, which is expected to exceed the Simplified Acquisition Threshold, specifies a "brand name" product;

(4) The proposed contract is more than the Simplified Acquisition Threshold and is to be awarded to other than the apparent low bidder under a sealed bid procurement; or

(5) A proposed contract modification changes the scope of a contract or increases the contract amount by more than the Simplified Acquisition Threshold.

(c) The non-Federal entity is exempt from the pre-procurement review in <u>paragraph (b)</u> of this section if the Federal awarding agency or pass-through entity determines that its procurement systems comply with the standards of this part.

(1) The non-Federal entity may request that its procurement system be reviewed by the Federal awarding agency or pass-through entity to determine whether its system meets these standards in order for its system to be certified. Generally, these reviews must occur where there is continuous high-dollar funding, and third-party contracts are awarded on a regular basis;

(2) The non-Federal entity may self-certify its procurement system. Such self-certification must not limit the Federal awarding agency's right to survey the system. Under a self-certification procedure, the Federal awarding agency may rely on written assurances from the non-Federal entity that it is complying with these standards. The non-Federal entity must cite specific policies, procedures, regulations, or standards as being in compliance with these requirements and have its system available for review.

§ 200.326 Bonding requirements.

For construction or facility improvement contracts or subcontracts exceeding the Simplified Acquisition Threshold, the Federal awarding agency or pass-through entity may accept the bonding policy and requirements of the non-Federal entity provided that the Federal awarding agency or pass-through entity has made a determination that the Federal interest is adequately protected. If such a determination has not been made, the minimum requirements must be as follows:

(a) A bid guarantee from each bidder equivalent to five percent of the bid price. The "bid guarantee" must consist of a firm commitment such as a bid bond, certified check, or other negotiable instrument accompanying a bid as assurance that the bidder will, upon acceptance of the bid, execute such contractual documents as may be required within the time specified.

(b) A performance bond on the part of the contractor for 100 percent of the contract price. A "performance bond" is one executed in connection with a contract to secure fulfillment of all the contractor's requirements under such contract.

(c) A payment bond on the part of the contractor for 100 percent of the contract price. A "payment bond" is one executed in connection with a contract to assure payment as required by law of all persons supplying labor and material in the execution of the work provided for in the contract.

§ 200.327 Contract provisions.

The non-Federal entity's contracts must contain the applicable provisions described in appendix II to this part.
<u>PART 200 - UNIFORM ADMINISTRATIVE REQUIREMENTS, COST PRINCIPLES, AND AUDIT REQUIREMENTS</u> <u>FOR FEDERAL AWARDS https://www.ecfr.gov/current/title-2/subtitle-A/chapter-II/part-200</u>

Code of Federal Regulations Subpart D – Post Federal Award Requirements <u>https://www.ecfr.gov/current/title-2/subtitle-A/chapter-II/part-200/subpart-D</u>

Subpart DPost Federal Award Requirements200.300 - 200.346

§ 200.300	Statutory and national policy requirements.
§ 200.301	Performance measurement.
§ 200.302	Financial management.
§ 200.303	Internal controls.
§ 200.304	Bonds.
§ 200.305	Federal payment.
§ 200.306	Cost sharing or matching.
§ 200.307	Program income.
§ 200.308	Revision of budget and program plans.
§ 200.309	Modifications to Period of Performance.
Property Standards	200.310 - 200.316
§ 200.310 Insurance coverage.	
§ 200.311 <u>Real property.</u>	
§ 200.312 Federally-owned and exempt property.	
§ 200.313 Equipment.	
§ 200.314 <u>Supplies.</u>	
§ 200.315 Intangible property.	
§ 200.316 Property trust relationship.	
Procurement Standards	<u>200.317 – 200.327</u>
§ 200.317 Procurements by states.	
§ 200.318 General procurement standards.	
§ 200.319 Competition.	
§ 200.320 Methods of procurement to be followed.	
§ 200.321 Contracting with small and minority business	ses, women's business enterprises, and labor surplus area firms.
§ 200.322 Domestic preferences for procurements.	
§ 200.323 Procurement of recovered materials.	
§ 200.324 Contract cost and price.	
§ 200.325 Federal awarding agency or pass-through ent	ity review.
§ 200.326 Bonding requirements.	
§ 200.327 Contract provisions.	
Performance and Financial Monitoring and Reporting	200.328 - 200.330
§ 200.328 Financial reporting.	
§ 200.329 Monitoring and reporting program performan	ice.
§ 200.330 Reporting on real property.	
Subrecipient Monitoring and Management	200.331 - 200.333
§ 200.331 Subrecipient and contractor determinations.	
§ 200.332 Requirements for pass-through entities.	
§ 200.333 Fixed amount subawards.	
Record Retention and Access	200.334 - 200.338
	200.001 200.000

§ 200.334	Retention requirements for records.	
§ 200.335	Requests for transfer of records.	
§ 200.336	Methods for collection, transmission, and stor	age of information.
§ 200.337	Access to records.	
§ 200.338	Restrictions on public access to records.	
Remedies f	for Noncompliance	200.339 - 200.343
§ 200.339	Remedies for noncompliance.	
§ 200.340	Termination.	
§ 200.341	Notification of termination requirement.	
§ 200.342	Opportunities to object, hearings, and appeals.	<u>.</u>
§ 200.343	Effects of suspension and termination.	
<u>Closeout</u>		200.344
§ 200.344	<u>Closeout.</u>	
Post-Close	out Adjustments and Continuing	200 345
<u>Responsibi</u>	lities	200.345
§ 200.345	Post-closeout adjustments and continuing resp	onsibilities.
Collection	of Amounts Due	200.346
§ 200.346	Collection of amounts due.	

XII PROCUREMENTS SUBJECT TO FEDERAL FUNDING

12.01 Additional Standards. In addition to the procedures specified elsewhere in this Purchasing Manual, which are incorporated herein by reference, the County shall abide by the following purchasing procedures applicable to procurements that are subject to federal funding as referenced in 2 CFR 200: Uniform Administrative Requirements, Costs Principles and Audit Requirements for Federal Awards (Uniform Guidance), which is hereby incorporated by reference. These procedures are in addition to all other relevant procedures in this Purchasing Manual, except that in the event of a conflict these procedures will control if a purchase is made using federal funds.

12.2 **Background.** The United States Office of Management and Budget (OMB) Issued the Uniform Guidance, which reforms rules applicable to entities receiving federal grant funding bystreamlining and superseding eight OMB circulars (A-2I, A-87, A-122, A-110, A-102, A-133, A-50 and A-89). Thenewprocurement standards are found inSubpart D: Post Federal Award Requirements: 2 CFR §200.317 through §200.327

12.3 Compliance Requirements -Procurement. The following is an overview of the procurement standards and procedures applicable when procuring property and services under a Federal award in accordance with 1CFR §200.317 through §200.327, which are hereby incorporated by reference.

12.03.1 The County, as a non-Federal entity other than a State, will follow §§ 200.318 General procurement standards through 200.327 Contract provisions. [See §200.317].

12.3.2 Procurement Procedures: The County will use its own documented procurement procedures which reflect applicable State and local laws and regulations, provided that the procurement conform to applicable Federal statutes and the procurement requirements identified in 2 CFR part 200. [See §200.3/8(a)] When preparing a federally funded contract, the County Purchasing Dept, Planning Dept., and CountyAttorneywillreviewtherequired federal clauses inAppendix IIandmakesure that all clauses required for the contract is included.

12.3.3 Conflicts of Interest/Standards of Conduct: The County will maintain written standards of conduct covering conflicts of interest and governing the actions of its employees engaged in the selection, awarded and administration of contracts. In addition to the following the County incorporates standards referenced above and Standards of Conduct in applicable County Personnel Manuals. [See §200.318(c)].

a No employee, officer, or agent may participate in theselection, award, or administration of contracts supported by Federal award if he or she has a realorapparent conflict of interest. Such a conflict of interest would arise when the employee, officer, or agent, any member of his or her immediate family, his or herpartner, or an organization which employs or is about to employ any of the parties indicated herein, has a financial or other interest in or a tangible personal benefit from a firm considered for a contract. Addressed in County's Bids, RFP's, RFQ's (Attachment B-No*Collusion Affidavit), (Attachment G-ConflictofInterest Questionnaire) Purchasing Manual (Ethics Policy) [See §200.318(c)(J)].

b. Officers, employees, and agents of the County may neither solicit nor accept gratuities, favors, or anything d monetary value from contractors or parties to subcontracts. However, the County may set standards for situations in which the financial interest is not substantial or the gift is an unsolicited item of nominal value. If this is done these standards will be promulgated like other County policies and procedures. Addressed in County's Bids, RFP 's, RFQ 's (Attachment B -Non-Collusion Affidavit), (Attachment G-Corflict of Interest Questionnaire, Attachment H-Disclosure of Interest Questionnaire) Purchasing Manual (Ethics Policy) {See§200.318(c)(l)}.

c. If the County has an affiliate or subsidiary organization that is not a government entity, the County will also maintain written standards of conduct concerning organizational conflicts of interest arising from its relationship with the affiliate or subsidiary.

d The County will disclose any potential conflicts of interest in writing to the Federal awarding agency or passthrough entity in accordance with applicable Federal awarding agency policy. [See 2 CFR §200.112). Additionally, the County will disclose. in a timely manner. in writing to the Federal awarding agency or pass-through entity all violations of Federal criminal law involving fraud, bribery, or gratuity violations potentially affecting the Federal award. Further, if applicable, the County will make post-award reports as provided by Appendix XII to Part 200.

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e. Violations of this policy may result indisciplinary action consistent with County disciplinary policy, including but not limited todismissal. Further, violations may bereferred to the appropriate law enforcement agency for investigation and possible prosecution.

12.3.4 <u>Oversight:</u>Oncethe Contractis awarded, oversight must be maintained to ensure that contractors perform in accordance with the terms, conditions, and specifications of their contracts or purchase orders. County Contract monitor will be utilized to track and pel form quantity and quality control responsibilities in monitoring role towards compliance verification. [See §200.3J8(b)].

12.3.5 All proposed procurement actions shall be reviewed to avoid the purchase of unnecessary or duplicative items as stated in Independent Procedure IP "Prevention of Unnecessary and Duplicative Purchases".

Where applicable, consideration will be given to consolidating or breaking out procurements to obtain a more economical purchase. Review of all potentially related consolidation in sourcing of items towards economy of scale.

Whereappropriate, an analysis will be made of lease versus purchase alternatives, and any other appropriate analysis to determine the most economical approach Countywill consider leasing of items whenever determined to be more cost effective versus purchase of items which are not necessarily required beyond the immediate or project related intended use. [See §200.318MJ

12.3.6 The County may enter into state and local intergovernmental agreement. or inter-entity agreements where appropriate for procurement oruseofcommonor shared goods and services. County will explore interlocal agreement option withother entities towards sharing of goods and services in an effort or educe overall cost. The County also approved Resolution 20/9R2007 on Febn 1 coy 5, 2019. [See §200.318(e)]

12.3.7 Federal excess and surplus property may be used in lieu of purchasing new equipment and property whenever such use is feasible and reduces project costs. .State and Federal Surplus sites will be reviewed for potential adaptations to meet project needs. [See §200.318(/)]

12.3.8 Deliberately omitted.

12.3.9 Contracts should be awarded only toresponsible contractors possessing the ability to perform successfully under the terms and conditions of a proposed procurement Consideration will be given to such matters as contractor integrity. compliance with public policy, record of past performance, and financial and technical resources, as well as whether the contractor is suspended or debarred receiving federal funds. (See Bids, RFP's, RFQ sAttachment F- Certificate Regarding Debarment, Suspension Ineligibility, Attachment F-2-Swom Statement of Debarment, Attachment F-3-Architects, Engineers, Construction Pel formance, Attachment I-House Bill 89 Verification, Texas Ethics Commission Form 1295) [See §200.318(h)].

12.3.10 The County will maintain records sufficient lo detail the history of procurement. The County's Records Retention Policy as adopted by Commissioners Court and presented by the County Clerks Dept. (Official Records Manager for the County) - Purchasing Bids, RFP's, RFQ's, and contracts is five (5) years (inaccordance with §200.318(i).

12.3.11 The Countymaynotenter acontract withtimeandmaterials basedpricing unless there is a not-to-exceed clauseandthe Purchaser determines that other fee structures are not suitable.

12.3.12 The Countyaloneshall beresponsible for allcontractual and administrative issues arising out of procurements inaccordance with good administrative practice and sound business judgment. County Civil legal Division will coordinate these mailers as they arise. Countyprotest procedures apply to Bid. RFP 's, RFQ 's and written quotations. Once a contract has been executed, any disputes are dealt with at the time they arise. County Civil legal Department addresses contract disputes on behalf of the County.

12.3.13 Discounts, transportation costs, or lifecycle costs will only be considered when they are specified in the bidding documents. These will only be considered whey specified in the Bid !RFP documents.

12.04 Competition. All procurement transactions will be conducted in a manner providing fill and open competition consistent with rhe standards of 2 CFR §200.319. Note 12.06 below identifies sources towards maximizing competitive solicitations. Purchasers will review all Bid specifications and requirements towards eliminating unduly restrictive requirements.

12.4.1.1 In order to ensure objective contractor performance and eliminate unfair competitive advantage, contractors that develop or draft specifications, requirements, statements of work, or invitations for bids or requests for proposals will be excluded from competing for such procurements.

12.4.1.2 The County will avoid the following actions in procurement of goods and services:

- (1) Placing unreasonable requirements on firms in order for them to qualify to dobusiness;
- (2) Requiring unnecessary experience and excessive bonding;
- (3) Noncompetitive pricing practices between firms or between affiliated companies;
- (4) Noncompetitive contracts to consultants that are on retainer contracts;

- (5) Organizational conflicts of interest;
- (6) Except where required and justified as a sole source purchase, Specifying only a "brand name" product instead of allowing "an equal" product to be offered and describing the pel formance or other relevant requirements of the procurement; and
- (7) Any arbitrary action in the procurement process . §200.319(a)

12.04.02 <u>Geographical Limitation</u>: Unless specifically excepted as provided in 2 CFR §200.319(b). the County will not impose state or local geographical preferences in the evaluation of bids or proposals for federally funded contracts.

12.4.3.1 Contract solicitations: Purchaser shall incorporate a clear and accurate description of the technical requirements for the material. product, or service to be procured Detailed specifications and materials Iproduct description must be clearly identified.

12.4.3.2 Contract solicitations shall specify all requirements which the poten lial vendors must fulfill to submit bids or proposals, and identify all other factors to be used inevaluating bids or proposals. Scoring criteria shall be utilized in evaluation and analysis of Proposals.

12.04.04 All prequalified lists of persons, firms, or products which are used in acquiring goods and services shaft bekept current and include enough qualified sources to ensure minimum open and free competition. and potential bidders will not be precluded from qualifying during the solicitation period [See 200.3!9(d)]. County Purchasing Department aore 1¹// and updated Bidders /list See I2.06 below.

12.5 Methods of Procurement with Federal Funds. The County will use one of the following five procurement methods as discussed in 2 CFR §200.320 when making purchases with federal filnds. Should State or local procurement requirements applicable to a purchase being made with federal funds bemore restrictive than Federal requirements, themore restrictive requirements ormethods will be followed. The type of procurement process 10 use will depend on the cost and type o9 f services or item {s} being purchased.

<u>Micro-purchase</u> = County under \$500 - No quotations I competitive process required – Vendors for purchases under \$500 shall be rotated -requisition and Purchase Order required. (Travel regulations and Gas purchases included..

<u>Small purchase procedures</u> - informal Bids = County \$500 to \$14,999 and Commissioners Court approval \$15,000 to \$24,999 - Three written quotations required, requisition, Purchase Order. <u>Sealed Formal</u>

<u>Bids</u> = \$25,000 and more unless exception applies

<u>Competitive proposals</u>=County proposal processfor Professional Services, IT & High Tech and Commissioners Court approved instances of projects not suitable for detailed specifications.

 $Requesr.fo{\underline{r}\ Qualifications} = Qualifications\ based\ no\ price\ proposals\ (Engineering\ \&\ Architecture,\ Land\ Surveying,\ Professional\ services.\ Cameron\ County\ follows\ the\ Professional\ Services\ Procurement\ Act\ Govt.\ Code\ ch\ 2254\ Subch\ A$

<u>Non-competitive proposals</u> SoleSource-under\$15,000Sole Source letter Department Head, Vendor, Purchasing Agent. Commissioners Courtapprovalrequired\$1 5,000 toinclude SoleSourcefeller Department Head, Vendor, Purchasing Agent.

<u>Emergency Purchases</u> over \$15,000 requires Commissioners Court approval/ratification whenever time is crucial in preventing an escalating health and safety concern or preventing acrucial incident asper TexasState Statute 262.024

<u>Special & Discretionary Purchases</u> asper Texas State Statute 262.024. For procurement of Federally funded land surveying Cameron County Will contact the federal awarding agency or pass-through entity (TCEQ), for RESTORE projects to request authorization for noncompetitive procurement under 2 CFR 200.320(c)(4).

Personal service -as per

 $\label{eq:constraint} Under the Micro-Purchase \ dollar \ threshold rotation \ of available vendors will be utilized \\ Over the Micro-Purchase \ dollar \ threshold \ will \ comply \ with \ State \ of \ Texas, \ Local \ Government \ Code \ Ch 262.024(a)(4).$

12.6 Contracting with Small and Minority Businesses, Women's Business Enterprises, and Labor Surplus Area Firms. The County takes all necessary affirmative steps (and will include in all related contracts langue towards Contractor Certification of Small, Minority, or Women Business ownership- when possible) as described in §200.321 to assure minority businesses, Women's Business Enterprises. and labor surplus are used when possible. The County utilizes the following sitestowardsoutreach for County Bidding opportunities for Small, Minority, Women Businesses: U.S. Small Business Administration, ESBDS tate of Texas Bid Posting Site, Associated General Contractors, Dodge Reports, Reed Construction Data, Texas Smart Buy Electronic State Business Daily Search (ESBD). Bk/Net, <u>MWBE@texas.agriculture.gov</u>, Coop Vendorslist, County Current Bidders list. (County will require Prime Contractors to follow allof the affirmative steps when Prime Contractor will be letting subcontracts. The requirements for Prime Contractors as laid out by the County will be on the solicitation list and will benotified when they are potential sources, willdivide total requirements when economically feasible into smaller tasks or quantities, establish delivery schedules as requirements permit, contact the agencies as listed above as an outreach network towards attracting these types of businesses. This information will alsobe included in all contracts) County utilization of/Section 3/H UD (see Purchasing Website) addresses Davis-Bacon, Equal Employment, Vicinity Hiring Preference, Economic Opportunities, HUB, SBA, Local Vendor, and MWBE requirements.

12.6 Procurement of Recovered Materials. The County and (where applicable) its contractors will comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. {See §200.322}.

County will (asper EPA 40CFPpart 247) procure only items containing highest percentage of recovered materials practicable and allow for satisfactory competition based on the \$10,000 year threshold. County will establish affirmative procurement program for recovered materials.

12.7 Contract Cost and Price. The County will abideby the provisions of \$200.324 (as required wuller County Resolution #20/90R2009), including, but not limited to performing a cost or price analysis and negotiating profit as discussed therein

12.8.1 Negotiation Based on Cost Estimates; Negotiatio11 of Profit. In negotiating a contract price based on a cost analysis, the County will require that all estimated costs used to develop the negotiated price must be allowable costs under 2 CFR Parr 200. Subpart E. A comparison between estimated costs and current customary market pricing will be analyzed in an effort to establish allowable cost and ultimately establish negotiated pricing. The County will also require that the profit element be negotiated separately, whether it is included as a separate price element or whether it is rolled into a lump sum price (or similar fixed price). Profit margin will also be compared relative to comparable current market rates to assess potential variances. This cost analysis will be achieved through verification of previous similar purchases , comparison with other public entities, recommendations from professional consultants or project Engineer, or data research (ie: Smart Procure) similar to the specific type of procurement. In addition and in order to establish a/air and reasonable profit, the County will also consider the contractor's risk and investment, complexity of work to be performed at a level of subcontracting . quality and track record of previous performance, and industry profit rates in the approximate SMSA /geographic area/or similar work. At the outset independent estimates will be obtained by the County before receiving Bids or Proposal this also applies to all sole source purchases . All estimates must be allowable subject to analysis as per conditions noted above.

12.8.2 **Cost Plus Percentage of Cost Prohibited.** The County will not enter into a cost plus percentage of cost contract, or a cost plus percentage of construction cost contract.(as per 200.324 d) Engineer and County will examine all Change order pricing as submitted. Profit margin will not be determined based on a percentage of cost and percentage of construction cost methods of contracting must not be used Costs based on estimated costs of contracts under Federal award are allowable only to the extent that costs incurred or cost estimates included in negotiated prices would be allowable for the non-Federal entity under Subpart E Cost Principles of this part. County will reimburse Contractor's Direct and indirect Costs plus a Fixed fee for the project.

12.9 Contract Provisions. Pursuant to §200.327 the Countywill include in all federally-funded contracts, theapplicable provisions described in Appendix 11 to 2 CFRP art 200 - Contract Provisions for non-Federal Entity Contracts under Federal Awards. When preparing a federally funded contract the CountyPurchasing Dept., Planning Dept., and CountyAttorney will review the required federal dames in Appendix ff and make sure that all clauses required/or the contract is included.

1210 Personnel Cost Calculation Pursuant to 2 Code of Federal Regulations (CFR) Part 200, Subpart E the County adopted Resolution # 2019R02008 on February 5, 2019 - Policy and Procedure to Ensure Accurate Completion of Personnel Cost Calculation.

1211 Cost Price Analysis Pursuant to 2 Code of Federal Regulations (CFR) Part 200, the County adopted Resolution # 2019R02009 on February 5, 2019 -Policy and Procedure to Ensure Cost Price Analysis requirement.

1212 Debarment Check Pursuant/a 2 Code of Federal Regulations (CFR) Part 200.318, the County adopted Resolution # 2019R02010 on February 5, 2019 - Policy and Procedure to Ensure Debarment Check is adequately performed.

12.13 Single Proposal requirements Proposal is reviewed for compliance. Determination is made by County as to benefit of resolution or RFP towards a more competitive solicitation. Pricing is reviewed relative to current market costs for comparison. If all is determined to be cost effective and advantageous to County, recommendation is made by Evaluation Committee to Commissioners Court for award Commissioners Court must make a determination that price is fair and reasonable prior to awarding RFP. Prior to Court award ofsole Bid. RFP, or RFQ County Purchasing Dept. will contact the federal awarding agency or pass-through entity (TCEQ for RESTORE projects) torequest authorization for noncompetitive procurement under 2 CFR200.320(c)(2).to proceed towards Commissioners Court approval. Informal Bids not exceeding \$14,999 will require at least 3 informal Bids for comparative I competitive purposes. If the County is unable to obtain at least 3 competitive Bids or Proposals. I funable to obtain more than one (1) Bid or Proposal the County Purchasing Dept. will review pricing relative to current market costs for comparison purposes (utilizing comparable bid results, engineer recent historic data, Smart Procure comparable data) will contact the federal awarding agency or pass-through entity (TCEQ, for RESTORE projects) to request authorization for noncompetitive procurement under 2 CFR200.320(c)(2) prior to proceed in warding agency or pass-through entity (TCEQ, for RESTORE projects) to request authorization for noncompetitive procurement under 2 CFR200.320(c)(2) prior proceed ing with Agenda towards Commissioners Court approval.

12.13 **Domestic Preferences for Procurement** County will (in awards of iron, aluminum, steel, cement and other goods / manufactured products produced in the United States) utilize and purchase from these suppliers and subawards with apreference towards purchases from these Companies. (see 200.322)

12.14 BidBonds Willalways berequired for construction

contracts: County Purchasing Act:Required

Payment Bond - \$25,000 + (2253.21)

Performance Bond - \$100,000 + (2253.21)

Bid Bond-a) If the contractisfor the construction of public works or is under a contract exceeding \$100,000, the bid specifications or request for proposals may require the bidder to furnish a good and sufficient bid bond in **the amount of five percent of the total contract(262.032)**

Federal funded projects: exceeding \$150,000 (on exception sought from the federal awarding agency. For all Federal funded projects \$150,000 and over Bid Bonds will be mandatory equivalent to five percent of the bid price. A performance bond and payment bond will also be required -both at 100percent of contract price.

12.15Telecommunications and Surveillance Services or EquipmentProposal is reviewed for compliance with2CFR Appendix II (K) 200-216 prior to proceeding with Agenda towards Commissioners Court approval. Determination is
made by County as to ensure that neither loan or grant funds will be utilized for the purchase or obtaining Telecommunications
and Surveillance Services or Equipment from one of the following Vendors or any of their subsidiaries or affiliates :2

Huawei Technologies Co. ZTE Corp. Hytera Communications Corp. Hangzhou Hikvision Digital Technology Co. Dahua Technology Co.

as well as related services (Telecomm. or Video Surveillance provided by entities or using these Companies equipment. Additional Companies determined as by the Secretary of Defense, FBI, National Intelligence are to also be added to the restricted list of firms.

In addition, the vendors listed above will be identified to verify that these firms will not be utilized for contract extension/ renewal, essential components, critical technology, or components of a system.

Proposals will be reviewed for compliance with 2 CFR 200-471 prior to proceeding with Agenda towards Commissioners Court approval prior to obligating or expending funds. County will review all proposals related to Telecommunication and/or video surveillance equipment or service related costs in order to verify that costs associated with procuring, obtaining, extending, entering into, or renewing a contract for equipment, services, or systems are not utilized. BID PROPOSAL FORM (GENERAL CONTRACT)

Project: Cameron County Olmito Nature Park Phase 1

Place: Cameron County Purchasing Department, 1100 E. Monroe Street 3rd Floor, Attention:

Mr. Roberto C. Luna, Jr. Purchasing Agent

Due Date: January 24, 2024

Time: Before 3:00 p.m.

1. Pursuant to and in compliance with the Invitation to Bid and the proposed Contract Documents, prepared by Gomez Mendez Saenz, Inc. relating to the above referenced project, the undersigned, having become thoroughly familiar with the terms and conditions of the proposed Contract Documents and with local conditions affecting the performance and costs of the work at the place where the work is to be completed, and having fully inspected the site in all particulars, hereby proposes and agrees to fully perform the work within the time stated and in strict accordance with the proposed Contract Documents, and addenda, thereto, including furnishing of any and all labor and materials for all roofing, for the following sum of money:

A: BID:

All labor, materials, services and equipment, necessary for completion of the work shown on the drawings and described in the specifications.DOLLARS (\$)

B. ALTERNATES: N/A

2. If awarded this Contract the undersigned will execute a satisfactory Construction Contract, Performance Bond, Labor and Material Payment Bond and proof of insurance coverage, with the Owner for the entire work as per the Contract Documents within 5 days after notice of award. It is agreed that this proposal is subjected to the Owner's acceptance for a period of Thirty (30) days from the above date.

3. All pool projects shall be completed by <u>August 30, 2024</u>. No time extension will be allowed.

4. Enclosed is a Certified Check or Bidders Bond in the amount of \$ compliance with the specification requirements. (5% of the highest amount bid).

The above check or Bidders Bond is to become the property of the Owner in the event the Construction Contract (when offered by the Owner) and the bonds and proof of insurance coverage are not executed within the time set forth above.

5. The undersigned agrees to the following:

- A. To furnish all materials as shown and specified in the plans and specifications.
- B. To start work 5 days after notice of award of contract.
- C.To work _____ working days per week.

6. The full amount of all allowances as specified in the General Requirements, Division 1, of the specifications, in the Base Proposal price shown.

7. Receipt is acknowledged of the following addenda:

No.DatedNo.DatedNo.DatedNo.Dated

8. Bidder agrees that the Owner has the right to accept or reject any or all bids and to waive all informalities.

Respectfully submitted,

By: Signature

Title

Business Address

(Seal - if Bidder is a corporation)

ADDENDUM ACKNOWLEDGEMENT

Receipt of the following addenda is acknowledged (addenda number):

NOTE: Do not detach bid from other papers. Fill in with ink and submit complete with attached papers.

> PROPOSAL FORM PAGE OF

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we the undersigned, as PRINCIPAL, AND ______, as SURETY are held and firmly bound unto _______ hereinafter called the OWNER Dollars, (\$______) lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that Whereas the Principal has submitted the Accompanying Bid, dated_____, 202__, for_____.

NOW, THEREFORE, if the Principal shall not withdraw said Bid within the period specified therein after the opening of the same, or if no period be specified, within thirty (30) days after the said opening, and shall within the period specified therefore, or if no period be specified, within then (10) days after the prescribed forms are presented to him for signature, enter into a written Contract with the Local Public Agency in accordance with the Bid as accepted, and give bond with good and sufficient surety or sureties, as may be required, for the faithful performance and proper fulfillment of such contract; or in the event of the withdrawal of said Bid within the time specified, if the Principal shall pay the Owner the difference between the amount specified in said Bid and the amount for which the Owner may procure the required work of supplies or both, if the latter be in excess of the former, them the above obligation shall be void and of no effect, otherwise, to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals this day of <u>202</u>, the name and corporate seal of each corporate party being here to affixed and these present signed by its undersigned representative, pursuant to authority of its governing body.

	(SEAL)
	(SEAL)
	(SEAL)
ATTEST:	
BY:	
BY:	

Affix Corporate Seal

ATTEST:

BY:_____

BY:_____

Affix Corporate Seal

Countersigned

BY:_____

Attorney-in-Fact, State of

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____, certify that I am the Secretary of the Corporation named as Principal in the within bond; that behalf who signed the said bond on of the Principal was then of said corporation; that I know his signature, and his signature there to is genuine; and that said bond was duly signed, and attested to for and in behalf of said corporation by authority of this governing body.

(Corporate Seal)

Title

Power-of-Attorney for person signing for surety company must be attached to bond.

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENT: that (Name of Contractor or Company)

(Address)

a______hereinafter called Principal, and

(Corporation/Partnership)

(Name of Surety Company)

(Address)

hereinafter called Surety, are held and firmly bound unto

(Name of Recipient)

THE CONDITION OF THE OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER dated the _____ day of _____, 202_, a copy of which is hereto attached and made a part hereof for the construction of:

(Name of Recipient)

(Recipient's Address)

hereinafter called OWNER, in the penal sum of <u>dollars</u> and <u>dollars</u> and <u>cents</u> in lawful money of the United States, for the payment of which sum well and truly to be made we bind ourselves, successors, and assigns, jointly and severally, firmly in these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER dated the ______ day of _____, 20__, a copy of which is hereto attached and made a part hereof for the construction of:

Cameron County Olmito Nature Park Phase 1

NOW THEREFORE, if the Principal shall promptly make payment to all persons, firms, SUB-CONTRACTORS, and corporation furnishing materials or performing labor in the prosecution of the WORK provided for in such contract, and any authorized extension or modification

thereof, including all amounts due for materials, lubricants, oil, gasoline, coal and coke, repairs on machinery, equipment and tools, consumed or used in connection with the construction of such WORK, and all insurance premiums on said WORK, and for all labor, performed in such WORK whether by SUB-CONTRACTOR or otherwise, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, FURTHER that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or the WORK to be performed or the SPECIFICATIONS accompanying the same in any way affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the SPECIFICATIONS

PROVIDED, FURTHER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

e of which shall be deemed an o	riginal, this the	day of	_, 202
	0 / _	·	
TTEST:		(Dringing1)	
		(Principal)	
	BY		(s)
(Principal Secretary)			
(SEAL)			
(Witness as to Principal)			
(Address)			
(Surety)			
TTEST:			
	BY		
(Witness as to Surety)		(Attorney in Fact)	
(Address)		(Address)	

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENT: that

(Name of Contractor or Company)

(Address)

_____hereinafter called Principal, and

(Corporation/Partnership)

(Name of Surety Company)

(Address)

hereinafter called Surety, are held and firmly bound unto

(Name of Recipient)

hereinafter called OWNER, in the penal sum of <u>dollars</u> cents in lawful money of the United States, for the payment of which sum well and truly to be made we bind ourselves, successors, and assigns, jointly and severally, firmly in these presents.

THE CONDITION OF THIS OBLIGATION is such that whereas, the Principal entered into a certain contract with the OWNER dated the ______ day of _____, 202__, a copy of which is hereto attached and made a part hereof for the construction of:

Cameron County Olmito Nature Park Phase 1

NOW THEREFORE, the condition of this obligation is such that, if Contractor shall promptly and faithfully perform said Contract, then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or the WORK to be performed thereunder or the SPECIFICATIONS accompanying the same in any way accompanying the same in any way affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the WORK or to the SPECIFICATIONS.

IN WITNESS WHEREOF, this instrument is exec	uted in		parts,
	(Number)		
one of which shall be deemed an original, this the	day of	, 20 <u>2</u>	·

ATTEST:

BY:_____

(Principal)

PERFORMANCE BOND PAGE 1 OF 2 (Principal Secretary)

(Witness as to Principal)

(Witness as to Surety)

(Address)

ATTEST:

(Surety)

BY:

(Attorney in Fact)

(Address)

(Address)

NOTE: Date of BOND must not be prior to date of Contract. If CONTRACTOR is Partnership, all partners should execute BOND.

IMPORTANT: Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the state where the PROJECT is located.

STATEMENT OF BIDDERS QUALIFICATIONS

All questions must be answered, and the data given must be clear and comprehensive. The statement must be notarized. If necessary, may be answered on separate attached sheets. Bidders may submit any additional information they desire.

Name of Bidder:	Date Organized:	
Address:	Date Incorporated:	
Number of years in contracting bu	siness under present name	
Contracts on Hand:		
Contract	Amount \$ Completion Da	te
Type of work performed by your c	company:	
Have you ever failed to complete a	any work awarded to you?	
Have you ever defaulted on a cont	ract?	
List the projects most recently con	npleted by your firm (include projects of similar i	mportance):
Project	Amount \$ Mo./Yr. Comp	leted
Major equipment available for this	s contract:	
Attach resume(s) for the principal superintendent for the project.	member(s) of your organization, including the of	ficers as well as the proposed
Credit available: \$	Bank Reference:	

The undersigned hereby authorizes and requests any person, firm or corporation to furnish any and all information requested by the ______ for verification of the recitals comprising this Statement of Bidders Qualifications.

Executed this	day of	f,	202	
---------------	--------	----	-----	--

By: (signature)	Title:
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(print name)

LIST OF SUBCONTRATORS

To be submitted in a separate envelope with the Bid Proposal

Owner's Project: <u>Cameron County Olmito Nature Park Phase 1</u>

To: Cameron County

The undersigned submit the following names of subcontractors to be used in performing the Contract. Each subcontractor is required to submit a standard AIA Qualification Statement clearly indicating prior historical restoration project experience and references.

SUBCONTRACTORS

1.	Site Work and Paving	
2.	Concrete	
3.	Masonry	
4.	Finish Carpentry	
5.	Plaster	
6.	Wood Flooring	
7.	Painting	
8.	Elevator	
9.	HVAC	
10.	Plumbing	
11.	Electrical	
12.	Environmental	

All Qualification Statements will be reviewed by the Architect, who will make appropriate recommendations to the Owner.

SPECIAL INSURANCE CONDITIONS OF THE AGREEMENT

The following minimum limits of insurance coverage will be required:

CONTRACTOR shall maintain, at his sole cost, at all times while performing work hereunder, the insurance coverage set forth below with companies satisfactory to the Company with full policy limits applying but not less than as stated. A Certificate evidencing the required insurance and specifically quitting the indemnification provision set forth in this agreement shall be delivered to the Company prior to commencement of the work and shall provide that any change restricting or reducing coverage or the cancellation of any policies under which certificates are issued shall not be valid as respects the Company's interest therein until the Company has received 30 days notice in writing of such change or cancellation.

- (1) <u>Workman's Compensation Insurance</u> as required by laws and regulations applicable to and covering employees of CONTRACTOR engaged in the performance of the work under this agreement.
- (2) <u>Employer's Liability Insurance</u> protecting CONTRACTOR against common law liability, in the absence of statutory liability, for employee bodily injury arising out of the master/servant relationship with a limit of not less than <u>\$100,000</u>.
- (3) <u>Comprehensive General Liability Insurance</u> including products/completed operation with limits of liability of not less than: Bodily Injury <u>\$500,000</u>. each Person, <u>\$500,000</u>. each occurrence/aggregate; Property Damage <u>\$500,000</u>. each occurrence/aggregate. OR Combined Coverage limit <u>\$5,000,000</u>.
- (4) <u>Automobile Liability Insurance</u> including non-owned and hired vehicle coverage with limits of liability of not less than: Bodily Injury <u>\$250,000</u>. each Person, <u>\$500,000</u>. each occurrence; Property Damage <u>\$250,000</u>. each occurrence.
- (5) <u>Excess Liability Insurance</u> Comprehensive General Liability, Comprehensive Automobile Liability and coverage afforded by the policies described above, with minimum limits of <u>\$500,000</u>. excess of the specified limits.
- (6) **<u>Builder's "All-Risk Insurance"</u>** protecting the respective interest of Company and **CONTRACTOR** and its "Field Sub-contractors" covering loss or damage during the course of construction of the project described in this agreement and all property at the job site or in transit thereof which shall become a part of such project. Such insurance shall be maintained until such project is completed and accepted. This insurance shall be terminated with respect to portions of such project when such portions are completed and accepted.

Resolution No. 2008R12092

A RESOLUTION IN SUPPORT OF MAINTAINING A HIGHER MINIMUM WAGE REQUIREMENT FOR ALL CONTRACTORS DOING WORK FOR CAMERON COUNTY.

Whereas, Cameron County, Texas, has in recent years shown unprecedented growth and experienced increasing cost of living expenses; and

Whereas, there exists within Cameron County, and particularly among the elected officials, a desire to improve the living conditions and income potential of the members of the local work force; and

Whereas, the Cameron County Commissioners' Court desires to provide an opportunity for an increase in the standard of living for employees in our area; and

Whereas, the Cameron County Commissioners' Court desires to continue awarding contracts to contractors who support their workers;

Cameron County Commissioners' Court does hereby pass this resolution to demonstrate support for an increase in the minimum wage of all workers employed by the contractors doing work for the County of Cameron;

Now therefore, the Cameron County Commissioners' Court hereby resolves to establish a minimum wage requirement for all contractors bidding on and being awarded contracts for goods or services to be provided to the County of Cameron,

THEREFORE, UPON THE PASSAGE OF THIS RESOLUTION, IT IS HEREBY DECREED, ORDAINED AND RESOLVED that the County of Cameron, Texas will require that all prime and subcontractor contracts explicitly include a minimum wage of \$8.50 per hour for all full time and part time employees hired by prime and subcontractors who bid for and perform all types of contractual work for the County.

Done on this the <u>16th</u> day of December, 2008

Carlos Cascos County Judge



Cameron County Olmito Nature Park Phase 1 INSTRUCTIONS TO PROPOSERS (Special Provisions)

- 1. It shall be the Proposer's responsibility to ensure delivery of his proposal to the proper place and at the proper time.
- 2. Proposals shall be addressed as follows: SEALED PROPOSAL FOR The Cameron County Olmito Nature Park Phase 1

Attn: Roberto Luna Cameron County Courthouse, Purchasing Dept, 4th Floor 964 E. Harrison Brownsville, TX

Proposal Date: January 24, 2024 Time: 3:00 P.M.

3. Use of Separate Proposal Forms:

These Contract Documents include a complete set of Proposal and Contract forms which are for the convenience of Proposers and are not to be detached from the Contract Document, filled out, or executed. <u>Separate copies of Proposal Forms are furnished for that purpose.</u>

4. Interpretations of Addenda:

No oral interpretation will be made to any Proposer as to the meaning of the Contract Documents or any part thereof. Every request for such an interpretation shall be made in writing to the County Engineer. Any inquiry received seven or more days prior to the date fixed for opening of Proposals will be given consideration. Every interpretation made to a Proposer will be in the form of an Addendum to the Contract Documents, and when issued, will be on file in the office of the Engineer at least three days before Proposals are opened. In addition, all Addenda will be mailed or telecopied to each person holding contract Documents, but it shall be the Proposer's responsibility to inquire as to the Addenda issued. All such Addenda shall become part of the Contract and all Proposers shall be bound by such Addenda, whether or not received by the Proposers.

5. **Inspection of Site:**

Each Proposer should visit the site of the proposed work and fully acquaint himself with the existing conditions there, relating to construction and labor, and should fully inform himself as to the facilities involved, the difficulties and restrictions attending the performance of the Contract. The Proposer should thoroughly examine and familiarize himself with the Drawings, Technical Specifications, and all other Contract documents. The Contractor by the execution of the Contract shall in no way be relieved of any obligation under it, due to his failure to receive or examine any form or legal instrument or to visit the site and acquaint himself with the conditions there existing, and the Owner will be justified in rejecting any claim based on facts regarding which the Contractor should have been on notice as a result thereof.

6. Alternative Proposals:

No alternative Proposals will be considered unless alternative Proposals are specifically requested by the technical specifications or Proposal package. Base Proposals must be provided for each **item**, even though an alternative Proposal item is also specified.

7. **Proposals:**

- A. All Proposals must be submitted on forms supplied by the Owner and shall be subject to all requirements of the Contract Documents including the Drawings, and these INSTRUCTIONS TO PROPOSERS. All Proposals must be regular in every respect and no interlineation, excisions or special conditions shall be made or included in the Proposal Form by the Proposer.
- B. Proposal Documents including the Proposal, the Proposal Guaranty, the Non-Collusion Affidavit and the Statement of Proposer's Qualifications (If required) shall be enclosed in an envelope, which shall be sealed and clearly labeled with the words "Proposal Documents", name of Proposer, date and time of the Proposal opening in order to guard against premature opening of the Proposal.
- C. The Owner may consider as irregular any Proposal on which there is an alteration to or departure from the Proposal Form hereto attached and at its option may reject the same.
- D. If the contract is awarded, it will be awarded by the Owner to a responsible Proposer on the basis of the lowest Proposal and the selected Alternative Proposal items, if any. The Contract will require the completion of the work according to the Contract Documents.
- E. Each Proposer shall include in his Proposal the following information:

<u>Principals</u> Names Social Security Number Home Addresses, including City, State & Zip Code

<u>Firm</u> Name Treasury Number Address City, State & Zip Code

8. **Proposal Guaranty:**

- A. The Proposal must be accompanied by a Proposal Guaranty which shall not be less than 5 percent (5%) of the amount of the Proposal. At the option of the Proposer, the guaranty may be a certified check, bank draft, negotiable U.S. Government Bonds (at par value), or a Proposal bond in the form attached. The Proposal bond shall be secured by a guaranty, or a surety company Licensed to do business in the State of Texas. The amount of such Proposal bond shall be within the maximum amount specified for such Company. No Proposal will be considered unless it is accompanied by the required guaranty. Certified check or bank draft must be made payable to the order of County of Cameron. Cash deposits will not be accepted. The Proposal guaranty shall insure the execution of the Agreement and the furnishing of the surety bond or bonds by the successful Proposer, all as required by the Contract documents.
- B. Revised Proposals submitted before the opening of Proposals, whether forwarded by mail or telegram, if representing an increase in excess of ten percent (10%) of the original Proposal, the Proposal will not be considered.
- C. Certified checks or bank drafts, or the amount thereof, Proposal Bonds and negotiable U.S. Government bonds of unsuccessful Proposers will be returned as soon as practical after the opening of the Proposals.

9. **Collusive Agreement:**

- A. Each Proposer submitting a Proposal to the Owner for any portion of the work contemplated by the documents on which Proposal is based shall execute and attach thereto, an affidavit substantially in the form herein provided, to the effect that he has not entered into a collusive agreement with any other person, firm, or corporation in regard to any Proposal submitted.
- B. Before executing any subcontract the successful Proposer shall submit the name of any proposed subcontractor for prior approval and an affidavit substantially in the form to be provided by the Owner. Copies are available upon request.

10. Statement of Proposer's Qualifications:

Each Proposer shall submit on the form furnished for that purpose a statement of the Proposer's qualifications, his experience record in organization and equipment available in the contract, his organization and equipment available for the work contemplated and, when specifically requested by the Owner, a detailed financial statement. The Owner shall have the right to take such steps as it deems necessary to determine the ability of the Proposer to perform his obligations under the Contract and the Proposer shall furnish the owner all such information and data for this purpose as it may request.

The right is reserved to reject any Proposal where an investigation of the available evidence or information does not satisfy the Owner that the Proposer is qualified to carry out properly the terms of the contract.

11. Sub-Contractors:

All Sub-Contractors must be approved by the Owner. A list of all proposed Sub-Contractors must be furnished to the Owner, prior to the start of construction.

12. Interpretation of Quoted Prices:

In case of difference in written words and figures in a Proposal, the amount stated in written words shall govern.

13. Unit Prices:

The unit price for each of the several items in the proposal of each Proposer shall include its pro rata share of overhead for both labor and materials so that the sum of the products obtained by multiplying the quantity shown for each item by the unit price Proposal represents the total Proposal. Any Proposal not conforming to this requirement may be rejected as informal. The special attention of all Proposers is called to this provision, for should conditions make it necessary to revise the quantities, no limit will be fixed for such increased or decreased quantities nor extra compensation allowed, provided the net monetary value of all such additive and subtractive changes in quantities of such items of work (i.e., difference in cost shall not increase or decrease the original contract award price by more than twenty-five percent (25%), except for work not covered in the Drawings and Technical Specifications.

14. **Rejection of Proposals:**

Proposals may be rejected if they show any alteration of works or figures, additions not called for, conditional or uncalled for alternate Proposals, incomplete Proposals, any alteration or words or figures, or erasures not initialed by the person or persons signing the proposal, or irregularities of any kind.

15. **Time for Receiving Proposals:**

Proposals received prior to the advertised hour of opening shall be kept securely sealed. The officer appointed to open the Proposals shall decide when the specified time has arrived and no Proposal received thereafter will be considered; except that when a Proposal arrives by mail after the time fixed for opening, but before the reading of all other Proposals is completed, and it is shown to the satisfaction of the County that the late arrival of the Proposal was solely due to delay in the mails for which the Proposer was not responsible, such Proposal will be received and considered.

16. **Opening of Proposals:**

The County shall, at the time and place fixed for the opening of Proposals, cause each Proposal to be publicly opened and read aloud, irrespective of any irregularities therein.

Proposers and other interested individuals may be present.

17. Withdrawal of Proposals:

Proposals may be withdrawn on written or telegraphic request dispatched by the Proposer in time for delivery in the normal course of business to the time fixed for opening; provided, that written confirmation of any telegraphic withdrawal over the signature of the Proposer is placed in the mail and postmarked prior to the time set for Proposal opening. The Proposal guaranty of any Proposer withdrawing his Proposal in accordance with the foregoing conditions will be returned promptly.

18. Award of Contract: Rejection of Proposals

- A. The Contract will be awarded to the responsible Proposer submitting the lowest responsive Proposal complying with the conditions of the Invitation for Proposals. The Proposer to whom the award is made will be notified at the earliest possible date. The Owner, however, reserves the right to reject any and all Proposals and to waive any informality in Proposals received whenever such rejection or waiver is in its interest.
- B. The Owner reserves the right to consider as unqualified to do work of general construction any Proposer who does not habitually perform with his own forces the major portions of the work involved in construction of the improvements embraced in this Contract.
- C. Time is of the essence in this Contract and the Owner may weigh the calendar days or working days Proposal in award of the Contract. The calendar days or working days will be valued equal to the liquidated damages charged per day of delay.

19. Execution of Agreement: Performance and Payment Bond

- A. Subsequent to the award and within ten (10) days after the prescribed forms are presented for signature, the successful Proposer shall execute and deliver the Owner an Agreement in the form included in the Contract Documents in such number of copies as the Owner may require (not to exceed six (6) copies).
- B. Having satisfied all conditions of award as set forth elsewhere in these documents, the successful Proposer shall, within the period specified in paragraph "a" above, furnish a surety bond in a penal sum not less than the amount of the Contract as awarded, as security for the faithful performance of the Contract, and for the payment of all persons, firms or corporations to whom the Contractor may become legally indebted for labor, materials, tools, equipment, or services of any nature including utility and transportation services, employed or used by him, in performing the work. Such bond shall be in the same form as that included in the Contract Documents and shall bear the same date as, or a date sub-sequent to that of the Agreement. The current **Power of Attorney** for the person who signs for

any surety company and issued be attached to such bond. This bond shall be signed by a guaranty or surety company authorized to do business in the State of Texas.

- C. The failure of the successful Proposer to execute such Agreement and to supply the required bond or bonds within ten (10) days after the prescribed forms are presented for signature, or within such extended period as the Owner may grant, based upon reasons determined sufficient by the Owner, shall constitute a default, and the Owner may either award the Contract to the next lowest responsible Proposer or readvertise for Proposals, and may charge against the Proposer the difference between the amount of the Proposal and the amount of which a Contract for the work is subsequently executed, irrespective of whether the amount thus due exceeds the amount of the Proposal Bond. If a more favorable Proposal is received by readvertising, the defaulting Proposer shall have no claim against the Local Public Agency for a refund.
- D. Full (100%) performance and payment bonds are required on all contracts in excess of \$25,000.00. The only exception is that if the contract is less than \$50,000.00, the entity may hold all payment, with no interim payments made, until final completion and presentation of lien releases from all subcontractors and suppliers, in lieu of the performance bond. Such bonds must be issued by a corporate surety authorized to do business in the State of Texas.

20. This project will be awarded for construction in accordance with these specifications and upon approval by the Owner.

21. Insurance:

See Special Conditions of the Agreement.

22. Certificate of Insurance:

The successful Proposer will furnish a completed Certificate of Insurance with the executed contract. This Certificate of Insurance shall include all applicable policies and their numbers. These policies will cover all sub-contractors and the sub-contractors' Certificate of Insurance will also be submitted covering the same amount stated above for the Contractor.

23. In case of discrepancies or conflicts between the specifications, Proposal documents or contract documents, the following order of priority shall govern:

- 1. Proposal Documents
- 2. Instructions to Proposers
- 3. Special Instructions to Proposers
- 4. Supplemental General Conditions
- 5. Technical Specifications
- 6. Standard Form of Agreement

- 7. General Conditions of the Agreement
- 8. Special Conditions of the Agreement
 9. Other Contract Documents

The award of the low Proposal does not constitute award of a contract. A contract 24. will be binding on both parties when executed by both parties and a purchase order is issued.

GENERAL CONDITIONS OF THE AGREEMENT

Contract and Contract Documents

The project to be constructed subject to all applicable Federal and State laws and regulations.

The Plans, Specifications, Supplemental Conditions (or Special Conditions), and Addenda shall form part of this contract and the provisions thereof shall be as binding upon the parties hereto as if they were herein fully set forth:

DEFINITIONS

Whenever used in any of the contract Documents, the following meanings shall be given to the terms here in defined:

- A. The term "Contract" means the Contract executed between the County of Cameron, hereinafter called the "**County**" and, <u>**********</u> hereinafter called "**Contractor**", of which these GENERAL CONDITIONS form a part.
- B. The term "Project Area" means the area within which is the specified Contract limits of the Improvements contemplated to be constructed in whole or in part under this contract.
- C. The term "Engineer" means the Cameron County Engineer, Engineer in charge, serving the **County** with architectural or engineering services, his successor, or any other person or persons, employed by the **County** for the purpose of directing or having in charge the work embraced in this Contract.
- D. The term "Architect" means the architect contracted for the project by Cameron County.
- E. The term "Contract Documents" means and shall include the following: Executed Contract, Addenda (if any), Invitation for Bids, Instructions to Bidders, Signed Copy of Bid, General Conditions, Special Conditions, Technical Specifications, and Drawings (as listed in the Schedule of Drawings).

ADMINISTRATION OF THE CONTRACT BY ARCHITECT AND ENGINEER

The Engineer and Architect will provide administration of the Contract and will be the Owner's representatives (1) during construction and (2) until final payment is due. The Architect will advise and consult with the Owner and Engineer.

The Architect may appoint an employee or other person to assist him during the construction. These representatives will be instructed to assist the **Contractor** in interpreting the Contract Documents; however, such assistance shall not relieve the Contractor from any responsibility as set forth by the Contract Documents. The fact that the Architect's representative may have allowed work not in accordance with the Contract Documents shall not prevent the Architect from insisting that the faulty work be corrected with the Contract Documents and the Contractor shall correct same.

SUPERVISION BY CONTRACTOR

- A. Except where the **Contractor** is an individual and gives his personal supervision to the work, the **Contractor** shall provide a competent superintendent, satisfactory to the **County** and the **Engineer**, on the work at all times during working hours with full authority to act for him. The **Contractor** shall also provide an adequate staff for the proper coordination and expediting of his work.
- B. The **Contractor** shall lay out his own work and he shall be responsible for all work executed by him under the Contract. He shall verify all figures and elevations before proceeding with the work and will be held responsible for any error resulting from his failure to do so.
- C. The **Contractor** expressly recognizes that the **Architect** does not owe him any duty to supervise or direct his work so as to protect the **Contractor** from the consequences of his own acts or omissions.

SUBCONTRACTS

- A. The **Contractor** shall not execute an agreement with any subcontractor or permit any subcontractor to perform any work included in this contract until he has verified the subcontractor as eligible to participate in federally funded contracts.
- B. No proposed subcontractor shall be disapproved by the **County** except for cause.
- C. The **Contractor** shall be fully responsible to the **County** for the acts and omissions of his subcontractors, and of persons either directly or indirectly employed by them.
- D. The **Contractor** shall cause appropriate provisions to be inserted in all subcontracts relative to the work that require compliance by each subcontractor with the applicable provisions of this Contract.
- E. Nothing contained in the Contract shall create any contractual relation between any subcontractor and the **County**.

FITTING AND COORDINATION OF WORK

The **Contractor** shall be responsible for the proper fitting of all work and for the coordination of the operations of all trades, subcontractors, or material suppliers engaged upon this Contract.

PAYMENTS TO CONTRACTOR

- A. Partial Payments
 - 1. The **Contractor** shall prepare his requisition for partial payment as of the last day of the month and submit it, with the required number of copies, to the Architect and Engineer for their approval, on a notarized AIA G702 Application and

Certificate for Payment form, and continuation sheet. In any contract where the total contract price at time of execution of the contract is \$400,000.00 or more and the contract provides for retainage of five percent (5%) of periodic contract payments, the Owner shall deposit the retainage in an interest-bearing account, and interest earned on such retainage funds shall be paid to the General Contractor upon completion of the contract. If the total contract price is less than \$400,000.00, then the retainage amount will be 10%. The amount of the payment due the Contractor shall be determined by adding to the total value of work completed to date, the value of materials properly stored on the site and deducting (1) five percent (5%) or ten percent (10%) of the total amount, to be retained until final payment and (2) the amount of all previous payments. The total value of work completed to date shall be based on the estimated quantities of work completed and on the unit prices contained in the agreement. The value of materials properly stored on the site or bonded warehouse shall be based upon the estimated quantities of such materials and the invoice prices, Copies of all invoices shall be available for inspection of the Architect and Engineer.

- 2. Monthly or partial payments made by the **county** to the **Contractor** are monies advanced for the purpose of assisting the contractor to expedite the work of construction. The **Contractor** shall be responsible for the care and protection of all materials and work upon which payments have been made until final acceptance of such work and materials by the **County**. Such payments shall not constitute a waiver of the right of the **County** to require the fulfillment of all terms of the Contract and the delivery of all improvements embraced in this Contract complete and satisfactory to the **County** in all details. Such payments will be made by the County within thirty days of receipt of the invoice by the County Auditor's Office.
- B. Final Payment
- 1. After final inspection and acceptance by the **County** and Architect of all work under the Contract, the **Contractor** shall prepare his requisition for final payment which shall be based upon the careful inspection of each item of work at the applicable unit prices stipulated in the Agreement. The total amount of the final payment due the **Contractor** under this contract shall be the amount computed as described above less all previous payments.
- 2. The **County** before paying the final estimate shall require the **Contractor** to furnish releases (AIA G706A Contractor's Affidavit of Release of Liens form) or receipts from all subcontractors having performed any work and all persons having supplied materials, equipment (installed on the Project) and services to the **Contractor**, if the **County** deems it necessary in order to protect its interest. The **County** may, if it deems such action advisable, make payment in part or in full to the **Contractor** without requiring the furnishing of such releases or receipts and any payments made shall in no way impair the obligations of any surety or sureties furnished under this Contract. Other close out documents shall include AIA G706 Contractor's Affidavit of Payment of Debts and Claims, AIA G707 Consent of Surety Company to Final Payment.

- 3. Any amount due the **County** under Liquidated Damages shall be deducted from the final payment due the contractor.
- C. Payments Subject to Submission of Certificates

Each payment to the **Contractor** by the **County** shall be made subject to submission by the **Contractor** of all written certifications required of him and his subcontractors.

D. Withholding Payments

The **County** may withhold from any payment due the **Contractor** whatever is deemed necessary to protect the **County**, and if so elects, may also withhold any amounts due from the **Contractor** to any subcontractors or material dealers, for work performed or material furnished by them. The foregoing provisions shall be construed solely for the benefit of the **County** and will not require the **County** to determine or adjust any claims or disputes between the **Contractor** and his subcontractors or material dealers, or to withhold any moneys for their protection unless the **County** elects to do so. The failure or refusal of the County to withhold any moneys from the **Contractor** shall in no way impair the obligations of any surety or sureties under any bond or bonds furnished under this Contract.

CHANGES IN THE WORK

A. The **County** may make changes in the scope of work required to be performed by the **Contractor** under the Contract without relieving or releasing the **Contractor** from any of his obligations under the Contract or any guarantee given by him pursuant to the Contract provisions, and without affecting the validity of the guaranty bonds, and without relieving or releasing the surety or sureties of said bonds. All such work shall be executed under the terms of the original Contract unless it is expressly provided otherwise.

B. Except for the purpose of affording protection against any emergency endangering health, life, limb or property, the Contractor shall make no change in the materials used or in the specified manner of constructing and/or installing the improvements or supply additional labor, services or materials beyond that actually required for the execution of the Contract, unless in pursuance of a written order from the **County** authorizing the **Contractor** to proceed with the change. No claim for an adjustment of the Contract Price will be valid unless so ordered.

- C. If applicable unit prices are contained in the Agreement, the **County** may order the **Contractor** to proceed with desired unit prices specified in the Contract; provided that in case of a unit price contract the net value of all changes does not increase the original total amount of the agreement by more than twenty-five percent (25%) or decrease the original the total amount by twenty-five percent (25%).
- D Each change order shall include in its final form:
 - 1. A detailed description of the change in the work.

- 2. The Contractor's proposal (if any) or a confirmed copy thereof.
- 3. A definite statement as to the resulting change in the contract price and/or time.
- 4. The statement that all work involved in the change shall be performed in Accordance with contract requirements except as modified by the change order.
- 5. The procedures as outlined in this Section for a unit price contract also apply in any lump sum contract.
- 6. The signatures of authorized representatives of Contractor and County.

CLAIMS FOR EXTRA COST

- A. If the **Contractor** claims that any instructions by Drawings or otherwise involve extra cost or extension of time, he shall, within ten days after the receipt of such instructions, and in any event before proceeding to execute the work, submit his protest thereto in writing to the **County**, stating clearly and in detail the basis of his objections. No such claim will be considered unless so made.
- B. Claims for additional compensation for extra work, due to alleged errors in ground elevations, contour lines, or benchmarks, will not be recognized unless accompanied by certified survey data, made prior to the time the original ground was disturbed, clearly showing that errors exist which resulted, or would result, in handling more material, or performing more work, than would be reasonably estimated from the Drawings and maps issued.
- C. Any discrepancies, which may be discovered between actual conditions and those represented by the Drawings and maps, shall be reported at once to the Architect and the Engineer and work shall not proceed except at the Contractors risk, until written instructions have been received by him from the Engineer.
- D. If, on the basis of the available evidence, the **County** determines that an adjustment of the Contract Price and/or time is justifiable, a change order shall be executed.

EXTRA WORK

The term "EXTRA WORK" as used in the agreement shall be understood to mean and include all work that may be required by the Engineer or **County** to be done by the **Contractor** to accomplish any change, alteration or addition to the work shown upon the plans, or reasonably implied by the specifications, and not covered by the Contractor's proposal. It is agreed that the Contractor shall perform all Extra Work under the direction of the Engineer when presented with a written Work Order signed by the Engineer; Subject, however, to the right of the **Contractor** to require a written confirmation of such Extra Work Order by the **County**. It is also agreed that the compensation to be paid the **Contractor** for performing said Extra Work shall be determined by one or more of the following methods:

Method (a): By agreed unit prices. Method (b): By agreed lump sum. Method (c): If neither Method (a) nor Method (b) can be agreed the "actual field cost" of the work plus ten (10) percent.

In the event said Extra Work be performed and paid for under Method (c), then the provisions of this paragraph shall apply and the "actual field cost" is hereby defined to include the cost of all workmen, such as foremen, time keepers, mechanics and laborers, and materials, supplies, trucks, rental of machinery and equipment for the time actually employed or used on such Extra Work plus actual transportation changes necessarily incurred if the kind of equipment or machinery is not already on the job, together with the power, fuel, lubricants, water and similar operating expenses, also all necessary incidental expenses incurred directly on account of such Extra Work, including Social Security, Old Age Benefits and other payroll taxes, and a ratable proportion of premiums on Construction and Maintenance Bonds, Public Liability and Property Damage and Workmen's Compensation, and all other insurance as may be required by any law or ordinance, or directed by the Engineer or County, or by them agreed. The Engineer may direct the form in which accounts of the "actual field cost" shall be kept and may also specify in writing, before the work commences, the method of doing the work and the type and kind of machinery and equipment to be used, otherwise these matters shall be determined by the Contractor. Where practicable the terms and prices for the use of machinery and equipment shall be incorporated in the Written Extra Work Order.

The ten (10) percent of the "actual field cost" to be paid the **Contractor** shall cover and compensate him for his profit, overhead, general superintendence and field office expense, and all other elements of cost and expense not embraced within the "actual field cost" as above defined, save that where the Contractor's Camp or Field Office must be maintained primarily on account of such Extra Work, then the cost to maintain and operate same, excluding staff, shall be included in the "actual field cost".

No claim for extra work of any kind will be allowed unless ordered in writing by the Engineer. In case any orders or instructions, either oral or written, appear to the Contractor to involve extra work for which he should receive compensation, he shall make written request to the Engineer for written order authorizing Extra Work. Should a difference of opinion arise as to what does or does not constitute extra work, or as to the payment therefore, and the Engineer insists upon its performance, the **Contractor** shall proceed with the work after making written order and shall keep an accurate account of the "actual field cost" thereof, as provided under Method (c). The **Contractor** will thereby preserve the right to submit the matter for payment, as herein above described. Change orders shall be executed on form similar to AIA G701Change Order document.

TERMINATION, DELAYS, AND LIQUIDATED DAMAGES

A. <u>Right of the County to Terminate Contract</u>.

In the event that any of the provisions of this contract are violated by the **Contractor**, or by any of his subcontractors, the **County** may serve written notice upon the **Contractor** and the Surety of its intention to terminate the contract. The notices shall contain the reasons for such intention to terminate the contract, and unless such violation or delay shall cease and satisfactory arrangement of correction be made within ten days, the contract shall, upon the expiration of said ten (10) days, cease and terminate. In the event of any such termination, the **County** shall immediately serve notice thereof upon the Surety and the **Contractor**. Surety shall have the right to take over and perform the contract. Provided, however, that if the Surety does not commence performance thereof within ten (10) days from the date of the mailing to such Surety of notice of termination, the **County** may take over the work and complete the project by bid/contract or by force account at the expense of the **Contractor** and his Surety shall be liable to the **County** for any excess cost incurred In such event the **County** may take possession of and utilize in completing the work, such materials, appliances, and plant as may be on the site of the work and necessary therefore.

B. <u>Liquidated Damages for Delays</u>.

If the work is not complete within the time stipulated in the applicable bid for Lump Sum or Unit Price Contract provided, the **Contractor** shall pay to the **County** as fixed, agreed, and liquidated damages (it being possible to determine the actual damage occasioned by the delay) the amount of Three Hundred Dollars (\$300.00) for each calendar day of delay, until the work is completed. The **Contractor** and his sureties shall be liable to the **County** for the amount thereof.

C. <u>Hindrance and Delays</u>.

No damages for delays shall be paid to the **Contractor** by the **County**, except for any unreasonable delays caused by the **County**.

D. <u>Excusable Delays.</u>

The right of the **Contractor** to proceed shall not be terminated nor shall the **Contractor** be charged with liquidated damages for any delays in the completion of the work due to:

- (1) Any acts of the Government, including controls or restrictions upon or requisitioning of materials, equipment, tools, or labor by reason of war, national defense, or any other national emergency.
- (2) Any acts of the **County**.
- (3) Causes not reasonably foreseeable by the parties to this Contract at the time of the execution of the Contract which are beyond the control and without the fault or negligence of the **Contractor**, including, but not restricted to, acts of God or of the public enemy, acts of another **Contractor** in the performance of some other contract with the **County**, fires, floods, epidemics, quarantine, restrictions, strikes, freight embargoes, and weather of unusual severity such as hurricanes, tornadoes, cyclones and other extreme weather conditions.

Provided, however, that the **Contractor** promptly notifies the **County** within ten (10) days in writing of the cause of the delay. Upon receipt of such notification, the **County** shall ascertain the facts and the cause and extent of delay. If, upon the basis of the facts and the terms of this contract, the delay is properly excusable, the **County** shall extend the time for completing the work for a period of time commensurate with the period of excusable delay.

The Contractor shall include a time to complete the scope of work stated in calendar days that
includes anticipated number of working days that construction may be unable to take place, due to inclement weather and muddy ground. Extensions to the completion date will be granted only if, in the opinion of the Architect, climatological conditions that impede the progress of construction significantly exceed conditions for the local area. A guide for average climatological conditions will be the "Local Climatological Data" bulletin published by the Department of Commerce.

ASSIGNMENT OR NOVATION

The **Contractor** shall not assign or transfer, whether by an assignment or novation, any of its rights, duties, benefits, obligations, liabilities, or responsibilities under this **Contract** without the written consent of the **County**; provided, however, that assignments to banks or other financial institutions may be made without the consent of the **County**. No assignment or novation of this Contract shall be valid unless the assignment or novation expressly provides that the assignment of any of the **Contractors** rights or benefits under the Contract is subject to a prior lien for labor performed, services rendered, and materials, tools, and equipment supplied for the performance of the work under this Contract in favor of all persons, firms, or corporations rendering such labor or services or supplying such materials, tools, or equipment.

DISPUTES

- A. All disputes arising under this Contract or its interpretation except those disputes covered by FEDERAL LABOR STANDARDS PROVISIONS whether involving law or fact or both, or extra work, and all claims for alleged breach of contract shall, within ten (10) days of commencement of the dispute, be presented by the **Contractor** to the Architect and Engineer for review and decision. Any claim not presented within the time limit specified in this paragraph shall be deemed to have been waived, except that if the claim is of a continuing character and notice of the claim is not given within ten (10) days of its commencement, the claim will be considered only for a period commencing ten (10) days prior to the receipt of the Architect and Engineer.
- B. The **Contractor** shall submit in detail his claim and his proof thereof.
- C. If the **Contractor** does not agree with any decision of the Architect and Engineer, he shall in no case allow the dispute to delay the work but shall notify the Architect and Engineer promptly that he is proceeding with the work under protest.

TECHNICAL SPECIFICATIONS AND DRAWINGS

Anything mentioned in the Technical Specifications and not shown on the Drawings or vice versa shall be of like effect as if shown on or mentioned in both. In case of difference between Drawings and Technical Specifications, the Technical Specifications shall govern. In case of any discrepancy in Drawings, or Technical Specifications, the matter shall be immediately submitted to the Architect and Engineer, without whose decision, said discrepancy shall not be adjusted by the **Contractor**, save only at his own risk and expense.

SHOP DRAWINGS

- A. All required shop drawings, machinery details, layout drawings, etc. shall be submitted to the Architect and the Engineer in copies for approval sufficiently in advance of requirements to afford ample time for checking, including time for correcting, resubmitting and rechecking if necessary. The **Contractor** may proceed, only at his own risk, with manufacture or installation of any equipment or work covered by said shop drawings, etc. until they are approved and no claim, by the **Contractor**, for extension of the contract time shall be granted by reason of his failure in this respect.
- B. Shop drawings and samples shall be dated and marked to show the names of the Project, Architect, **Contractor**, Originating Subcontractor, Manufacturer or Supplier. Shop drawings shall completely identify specification section and locations at which materials or equipment is to be installed. All shop drawings are to be reviewed first by the **General Contractor** who shall affix his signature. Any drawings submitted without the Contractor's stamp of approval will not be considered and will be returned to him for proper resubmission. If any drawings show variations from the requirements of the Contract because of standard shop practice or other reason, the **Contractor** shall make specific mention of such variation in his letter of transmittal in order that, if acceptable, suitable action may be taken for proper adjustment of contract price and/or time, otherwise the **Contractor** will not be relieved of the responsibility for executing the work in accordance with the Contract even though the drawings have been approved.
- C. The **Contractor** shall submit and, if necessary, resubmit one (1) reproducible and four (4) copies of the shop drawings.
- D. If a shop drawing is in accordance with the contract or involves only a minor adjustment in the interest of the **County**, not involving a change in contract price or time; the Engineer may approve the drawing. The approval shall not relieve the **Contractor** from his responsibility for adherence to the contract or for any error in the drawing.

REQUESTS FOR SUPPLEMENTARY INFORMATION

It shall be the responsibility of the **Contractor** to make timely requests of the **County** for any additional information not already in his possession which should be furnished by the **County** under the terms of this Contract, and which he will require in the planning and execution of the work. Such requests may be submitted from time to time as the need approaches, but each shall be filed in ample time to permit appropriate action to be taken by all parties involved so as to avoid delay. Each request shall be in writing and list the various items and the latest date by which each will be required by the **Contractor**. The first list shall be submitted within two weeks after Contract award and shall be as complete as possible at that time. The **Contractor** shall, if requested, furnish promptly any assistance and information the Engineer may require in responding to these requests of the **Contractor**. The **Contractor** shall be fully responsible for any delay in his work or to others arising from his failure to comply fully with the provision of this section.

MATERIALS AND WORKMANSHIP

A. Unless otherwise specifically provided for in the technical specifications, all workmanship, equipment, materials and articles incorporated in the work shall be new

and the best grade of the respective kinds for the purpose. Where equipment, materials, articles or workmanship are referred to in the technical specifications as "equal to" any particular standard, the Engineer shall decide the question of equality.

- B. The **Contractor** shall certify in writing that no materials used in the work contain asbestos materials in them excess of amounts allowed by Local/State standards, laws, codes rules and regulations; the Federal Environmental Protection Agency (EPA) standards and/or the Federal Occupational Safety and Health Administration (OSHA) standards, whichever is most restrictive. The **Contractor** shall provide this written certification to the Engineer.
- C. The **Contractor** shall furnish to the **County** for approval the manufacturer's detailed specifications for all machinery, mechanical and other special equipment, which he contemplates installing together with full information as to type, performance characteristics, and all other pertinent information as required, and shall likewise submit for approval full information concerning all other materials or articles which he proposes to incorporate.
- D. Products are generally specified by ASTM or other reference standard, and/or by manufacture's name and model number or trade name. When specified only by reference standard, the **Contractor** may select any product meeting this standard by any manufacturer. When several products or manufacturers are specified as being equally acceptable, the **Contractor** has the option of using any product and manufacturer combination listed. When only one product manufacturer is specified, this is the basis of the Contract, without substitution or exception.
- E. Substitutions will not be considered if they are indicated or implied on shop drawing submissions without formal request, or for their implementation they require a substantial revision of the Contract Documents in order to accommodate their use.
- F. No request for the substitution of products in place of those specified shall be considered after the Contract has been executed.
- G. Not later than seven (7) days from the Contract Date, the **Contractor** shall provide a list showing the name of the manufacturers proposed to be used for each of the products identified in the General Requirements of the Specifications, and where applicable, the name of the installing subcontractor.
- H. Machinery, mechanical and other equipment, materials or articles installed or used without such prior approval shall be at the risk of subsequent rejection.
- I. Materials specified by reference to the number or symbol of a specific standard, shall comply with requirements in the latest revision thereof and any amendment or supplement thereto in effect on the date of the Invitation for Bids, except as limited to type, class or grade, or modified in the technical specifications shall have full force and effect as though printed therein.
- J. The **County** may require the **Contractor** to dismiss from the work such employee or

employees as the **County** or the Engineer may deem incompetent, or careless, or insubordinate.

SAMPLES, CERTIFICATES AND TESTS

- A. The **Contractor** shall submit all material or equipment samples, certificates, affidavits, etc., as called for in the contract documents or required by the Engineer, promptly after award of the contract and acceptance of the Contractor's bond. No such material or equipment shall be manufactured or delivered to the site, except at the Contractor's own risk, until the required samples or certificates have been approved in writing by the Engineer. Any delay in the work caused by late or improper submission of samples or certificates for approval shall not be considered just cause for an extension of the contract time.
- B. Each sample submitted by the **Contractor** shall carry a label giving the name of the **Contractor**, the project for which it is intended, and the name of the producer. The accompanying certificate or letter from the **Contractor** shall state that the sample complies with contract requirements, shall give the name and brand of the product, its place of origin, the name and address of the producer and all specifications or other detailed information which will assist the Engineer in making a prompt decision regarding the acceptability of the sample. It shall also include the statement that all materials or equipment furnished for use in the project will comply with the samples and/or certified statements.
- C. Approval of any materials shall be general only and shall not constitute a waiver of the **County's** right to demand full compliance with Contract requirements. After actual deliveries, the Engineer will have such check tests made as he deems necessary in each instance and may reject materials and equipment and accessories for cause, even though such materials and articles have been given general approval. If materials, equipment or accessories which fail to meet check tests have been incorporated in the work, the Engineer will have the right to cause their removal and replacement by proper materials or to demand and secure such reparation by the **Contractor** as is equitable.
- D. Except as otherwise specifically stated in the Contract, the costs of sampling and testing will be divided as follows:
 - 1. The **Contractor** shall furnish without extra cost, including packing and delivery charges, all samples required for testing purposes, except those samples taken on the project by the Engineer.
 - 2. The **Contractor** shall assume all costs of re-testing materials, which fail to meet contract requirements.
 - 3. The **Contractor** shall assume all costs of testing materials offered in substitution for those found deficient.
 - 4. The **County** will pay all other expenses.

GCA-11

PERMITS AND CODES

A. The **Contractor** shall give all notices required by and comply with all applicable laws, ordinances, and codes of the Local Government. All construction work and/or utility installations shall comply with all applicable ordinances, and codes including all written waivers. Before installing any work, the **Contractor** shall examine the drawings and technical specifications for compliance with applicable ordinances and codes and shall immediately report any discrepancy to the **County**. Where the requirements of the drawings and technical specifications fail to comply with such applicable ordinances or codes, the Architect will adjust the Contract by Change Order at his expense to conform to such ordinances or codes (unless waivers in writing covering the difference have been granted by the governing body or department).

Should the **Contractor** fail to observe the foregoing provisions and proceed with the construction and/or install any utility at variance with any applicable ordinance or code, including any written waivers (notwithstanding the fact that such installation is in compliance with the drawings and technical specifications), the **Contractor** shall remove such work without cost to the **County**,

- B. The **Contractor** shall at his own expense, secure and pay for all permits for street pavement, sidewalks, shed, removal of abandoned water taps, sealing of house connection drains, pavement cuts, buildings, electrical, plumbing, water, gas and sewer permits required by the local regulatory body or any of its agencies.
- C. The **Contractor** shall comply with applicable local laws and ordinances governing the disposal of surplus excavation, materials, debris and rubbish on or off the Project Area and commit no trespass on any public or private property in any operation due to or connected with the Improvements contained in this Contract.

CARE OF WORK

- A. The **Contractor** shall be responsible for all damages to person or property that occur as a result of his fault or negligence in connection with the prosecution of the work and shall be responsible for the proper care and protection of all materials delivered and work performed until completion and final acceptance.
- B. The **Contractor** shall provide sufficient competent watchmen, both day and night, including Saturdays, Sundays, and holidays, from the time the work is commenced until final completion and acceptance.
- C. In an emergency affecting the safety of life, limb or property, including adjoining property, the **Contractor**, without special instructions or authorization from the **County** is authorized to act at his discretion to prevent such threatened loss or injury, and he shall so act. He shall likewise act if instructed to do so by the **County**.
- D. The **Contractor** shall avoid damage as a result of his operations to existing sidewalks, streets, curbs, pavements, utilities (except those which are to be replaced or removed), adjoining property, etc., and he shall at his own expense completely repair any damage thereto caused by his operations.

E. The **Contractor** shall shore up, brace, underpin, secure, and protect as maybe necessary, all foundations and other parts of existing structures adjacent to, adjoining, and in the vicinity of the site, which may be in any way affected by the excavations or other operations connected with the construction of the improvements included in this Contract. The **Contractor** shall be responsible for the giving of any and all required notices to any adjoining or adjacent property owner or other party before the commencement of any work. The **Contractor** shall indemnify and save harmless the County from any damages on account of settlements or the loss of lateral support of adjoining property and from all loss or expense and all damages for which the **County** may become liable in consequence of such injury or damage to adjoining and adjacent structures and their premises.

ACCIDENT PREVENTION

- A. No laborer or mechanic employed in the performance of this Contract shall be required to work in surroundings or under working conditions, which are unsanitary, hazardous, or dangerous to his health or safety as determined under construction safety and health standards promulgated by the Secretary of Labor.
- B. The **Contractor** shall exercise proper precaution at all times for the protection of persons and property and shall be responsible for all damages to persons or property, either on or off the site, which occur as a result of his prosecution of the work.
- C. The **Contractor** shall maintain an accurate record of all cases of death, occupational disease, or injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment on work under the Contract. The **Contractor** shall promptly furnish the **County** with reports concerning these matters
- D. The **Contractor** shall indemnify and save harmless the **County** from any claims for damages resulting from property damage, personal injury and/or death suffered or alleged to have been suffered by any person as a result of any work conducted under this contract.
- E. The **Contractor** shall provide trench protection for all trenches in excess of a depth of five (5) feet, in the manner specified in the technical specifications and drawings.

SANITARY FACILITIES

The contractor shall furnish, install and maintain ample sanitary facilities for the workmen. As the needs arise, a sufficient number of enclosed temporary toilets shall be conveniently placed as required. Drinking water shall be provided from an approved source, so piped or transported as to keep it safe and fresh and served from single service containers or satisfactory types of sanitary drinking stands or fountains. All such facilities and services shall be furnished in strict accordance with existing and governing health regulations.

USE OF PREMISES

A. The **Contractor** shall confine his equipment, storage of materials, and construction

operations to the contract limits as shown on the drawings and as prescribed by ordinances or permits, or as may be desired by the **County**, and shall not unreasonably encumber the site or public rights of way with his materials and construction equipment.

- B. The Contractor shall comply with all reasonable instructions of the County and all existing state and local regulations regarding signs, advertising, traffic, fires, explosives, danger signals, and barricades
- C. Smoking and chewing of tobacco products is prohibited in the enclosed new construction.

REMOVAL OF DEBRIS, CLEANING, ETC.

The **Contractor** shall, periodically or as directed during the progress of the work, remove and legally dispose of all surplus excavated material and debris, and keep the Project Area and public rights of way reasonably clear. Upon completion of the work, he shall remove all temporary construction facilities, debris and unused materials provided for work, and put the whole site of the work and public rights of way in a neat and clean condition.

INSPECTION

- A. All materials and workmanship shall be subject to inspection, examination, or test by the **County**, the Architect, and the Engineer at any and all times during manufacture or construction and at any and all places where such manufacture or construction occurs. The **County** shall have the right to reject defective material and workmanship or require its correction. Unacceptable workmanship shall be satisfactorily corrected. Rejected material shall be promptly segregated and removed from the Project Area and replaced with material of specified quality without charge. If the **Contractor** fails to proceed at once with the correction of rejected workmanship or defective material, the **County** may by contract or otherwise have the defects remedied or rejected materials removed from the Project Area and charge the cost of the same against any Monies which may be due the **Contractor**, without prejudice to any other rights or remedies of the **County**.
- B. The **Contractor** shall furnish promptly all materials reasonably necessary for any tests which may be required. All tests by the **County** will be performed in such manner as not to delay the work unnecessarily and will be made in accordance with the provisions of the technical specifications.
- C. The **Contractor** shall notify the **County** sufficiently in advance of back filling or concealing any facilities to permit proper inspection. If any facilities are concealed without approval or consent of the **County**, the **Contractor** shall uncover for inspection and recover such facilities at his own expense, when so requested by the **County**.
- D. Should it be considered necessary or advisable by the **County** at any time before final acceptance of the entire work to make an examination of work already completed by uncovering the same, the **Contractor** shall on request promptly furnish all necessary facilities, labor, and material. If such work is found to be defective in any important or essential respect, due to fault of the **Contractor** or his subcontractors, the **Contractor** shall defray all the expenses of such examination and of satisfactory reconstruction. If,

however, such work is found to meet the requirements of the Contract, the actual cost of labor and material necessarily involved in the examination and replacement, shall be allowed the **Contractor** and he shall, in addition, if completion of the work of the entire Contract has been delayed thereby, be granted a suitable extension of time on account of the additional work involved

- E. Inspection of materials and appurtenances to be incorporated in the improvements included in this Contract may be made at the place of production, manufacture or shipment, whenever the quantity justifies it, and such inspection and acceptance, unless otherwise stated in the technical specifications, shall be final, except as regards (1) latent defects, (2) departures from specific requirements of the Contract, (3) damage or loss in transit, or (4) fraud or such gross mistakes as amount to fraud. Subject to the requirements contained in the preceding sentence, the inspection of materials as a whole or in part will be made at the Project Site.
- F. Neither inspection, testing, approval nor acceptance of the work in whole or in part, by the **County** or its agents shall relieve the **Contractor** or his sureties of full responsibility for materials furnished, or work performed not in strict accordance with the Contract.

REVIEW BY COUNTY

The **County** and its authorized representatives and agents shall have access to and be permitted to observe and review all work, materials, equipment, payrolls, personnel records, employment conditions, material invoices, and other relevant data and records pertaining to this Contract, provided, however that all instructions and approval with respect to the work will be given to the **Contractor** only by the **County** through its authorized representatives or agents.

FINAL INSPECTION

When the Improvements included in this Contract are substantially completed, the Architect shall notify the **County** in writing that the work will be ready for final inspection on a definite date, which shall be stated in the notice. The **County** will make the arrangements necessary to have final inspection commenced on the date stated in the notice, or as soon thereafter as is practicable. The AIA Certificate of Substantial Completion G704 form shall be used to determine date of substantial completion.

DEDUCTION FOR UNCORRECTED WORK

If the **County** deems it not expedient to require the **Contractor** to correct work not done in accordance with the Contract Documents, an equitable deduction from the Contract Price will be made by agreement between the **Contractor** and the **County** and subject to settlement, in case of dispute, as herein provided.

INSURANCE

The **Contractor** shall not commence work under this contract until he has obtained all the insurance required under this paragraph and such insurance has been approved by the **County**.

GCA-15

- A. <u>Compensation Insurance:</u> The **Contractor** shall procure and shall maintain during the life of this contract Workers Compensation Insurance as required by the State of Texas for all of his employees to be engaged in work at the site of the project under this contract and, in case of any such work sublet, the **Contractor** shall require the subcontractor similarly to provide Worker's Compensation Insurance for all of the employees to be engaged in such work unless such employees are covered by the protection afforded by the Contractors Workers Compensation Insurance.
- B. <u>Contractors Public Liability and Property Damage Insurance and Vehicle Insurance:</u> The **Contractor** shall procure and shall maintain during the life of this contract Contractor's Public Liability Insurance, Contractor's Property Damage Insurance and Vehicle Liability Insurance in the following amounts: See Special Conditions of the Agreement.
- C. <u>Proof of Insurance:</u> The **Contractor** shall furnish the **County** with certificates showing the type, amount, class of operations covered, effective dates and date of expiration of policies. Such certificates shall also contain substantially the following statement: "The insurance covered by this certificate will not be canceled or materially altered, except after ten (10) days written notice has been received by the **County**."

INDEMNITY

Contractor shall indemnify, defend and hold harmless the Architect and **Cameron County**, its officials, officers, agents, and employees, from any and all liabilities, claims, demands, actions, losses, damages and costs, including all costs of defense thereof, of any nature whatsoever, for injury to or death of persons or loss or damage to property, or for any other reason (except for those resulting from the negligence of the County's or Architects' officials, officers, agents, and employees) occurring on the premises or in any manner arising out of or connected with Contractor's contractual obligations, including any claims, liabilities and actions based upon the acts or omissions of Contractor's officers, agents and employees.

WARRANTY OF TITLE

No material, supplies, or equipment to be installed or furnished under this Contract shall be purchased subject to any chattel mortgage or under a conditional sale, lease-purchase or other agreement by which an interest is retained by the seller or supplier. The **Contractor** shall warrant good title to all materials, supplies, and equipment installed or incorporated in the work and upon completion of all work, shall deliver the same together with all improvements and appurtenances constructed or placed by him to the **County** free from any claims, liens, or charges. Neither the Contractor -nor any person, firm, or corporation furnishing any material or labor for any work covered by this Contract shall have any right to a lien upon any improvement or appurtenance. Nothing contained in this paragraph, however, shall defeat or impair the right of persons furnishing materials or labor to recover under any law permitting such persons to look to funds due the **Contractor** in the hands of the **County**. The provisions of this paragraph shall be inserted in all subcontracts and material contracts and notice of its provisions shall be given to all persons furnishing materials for the work when no formal contract is entered into for such materials.

WARRANTY OF WORKMANSHIP AND MATERIALS

Neither the final certificate of payment nor any provision in the Contract nor partial or entire use of the improvements included in this Contract by the **County** or the public shall constitute an acceptance of work not done in accordance with the Contract or relieve the **Contractor** of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The **Contractor** shall promptly remedy any defects in the work and pay for any damage to other work resulting therefrom, which shall appear within a period of twelve (12) months from the date of final acceptance of the work.

COMPLIANCE WITH AIR AND WATER ACTS

In compliance with the Clean Air Act, as amended, 41 U.S.C. Sec 7401 ET. Seq., and the regulations of the Environmental Protection Agency with respect thereto, the **Contractor** agrees that:

- 1. Any facility to be utilized in the performance of this contract or any subcontract shall not be a facility listed on the EPA List of Violating Facilities pursuant to 40 CFR 15.20.
- 2. He will comply with all requirements of Section 114 of the Clean Air Act, as amended.

EQUAL EMPLOYMENT OPPORTUNITY

- A. The **Contractor** will not discriminate against any employee or the applicant for employment because of race, color, religion, sex, or national origin.
- B. The **Contractor** will cause the foregoing provision to be inserted in all subcontracts for any work covered by this contract so that such provisions will be binding upon each subcontractor, provided that the foregoing provisions shall not apply to contracts or subcontracts for standard commercial supplies or raw materials.
- C. Nothing herein provided shall be construed as a limitation upon the application of other laws, which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents.

AFFIRMATIVE ACTION FOR HANDICAPPED WORKERS

The **Contractor** will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant for employment is qualified.

NON-SEGREGATED FACILITIES

The **Contractor** certifies that he does not and will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not and will not permit his employees any segregated facilities at any of his establishments or permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. As used in this paragraph the term "segregated facilities" means any waiting rooms, work areas, rest rooms and washrooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment

areas, transportation. And housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise.

JOB OFFICES

- A. The **Contractor** will maintain such office and storage facilities on the site as are necessary for the proper conduct of the work. Subcontractors may do the same. These shall be located so as to cause no interference to any work to be performed on the site. The **County** shall be consulted with regard to locations.
- B. Upon completion of the improvements, or as directed by the **County**, the **Contractors** shall remove all such temporary structures and facilities from the site and leave the site of the work in the condition required by the Contract.

CONTRACT DOCUMENTS AND DRAWINGS

The **Contractor** will be furnished a maximum number of TWENTY (20) free of charge, copies of Drawings and Project Manuals. Additional sets will be furnished at the cost of reproduction, postage, and handling.

CONTRACT PERIOD

The work to be performed under this contract shall commence within the time stipulated by the **County** in the Notice to Proceed and shall be fully completed within <u>180</u> calendar days thereafter.

ABANDONMENT BY CONTRACTOR

In case the **Contractor** should abandon or fail to resume work within ten (10) days after written notification from the **County** or the Engineer, or the **Contractor** fails to comply with the orders of the Engineer when such orders are consistent with this contract or this Agreement or with the specifications hereto attached, then and in that case, the Surety on the bonds shall be notified in writing and directed to complete the work, and a copy of said notice shall be delivered to the **Contractor**.

After receiving said notice of abandonment, the **Contractor** shall not remove from the work any machinery, equipment, tools, materials or supplies then on the job, but the same, together with any materials and equipment under contract for work, may be held for use on the work by the **County** or the Surety on the construction bond, or another **Contractor**, in completion of the work; and the **Contractor** shall not receive any rental or credit therefore (except when used in connection with extra work, where credit shall be allowed as provided for under "Extra Work"), it being understood that the use of such equipment and materials will ultimately reduce the cost to complete the work and be reflected in the final settlement.

In case the Surety should fail to commence compliance with the notice for completion herein before provided for within ten (10) days after services of such notice, then the **County** may provide for completion of the work in either of the following elective manners:

- A. The **County** may thereupon employ such force of men and use such machinery, equipment, tools, materials and supplies as said **County** may deem necessary to complete the work and charge the expense of such labor, material, machinery, equipment, tools and supplies to said **Contractor** and the expense so charged shall be deducted and paid by the **County** out of such money as may be due, or that may thereafter at any time become due to the **Contractor** under and by virtue of this Agreement. In case such expense is more than the sum which would have been payable under this contract if the same had been completed by the Contractor, then the Contractor and/or his surety shall pay the amount of such excess to the County.
- B. The **County**, under sealed bids, after five (5) days notice published one or more times in a newspaper having a general circulation in the **County** of the location of the work, may let a contract for the completion of the work under substantially the same terms and conditions which are provided in this contract. In case of any increase in cost to the **County** under the new contract as compared to what would have been the cost under this contract, such increase shall be charged to the **Contractor** and the Surety shall be and remain bound thereto. When the work shall have been substantially completed the **Contractor** and his Surety shall be notified and Certificates of Completion and Acceptance shall be issued as provided herein-above, a complete itemized statement of the contract accounts, certified to by the Engineer as being correct, shall then be prepared and delivered to the **Contractor** and his Surety, whereupon the **Contractor** and/or his Surety shall pay the balance due as reflected by said statement within twenty-one (21) days after the date of such Certificate of Completion.

In the event the statement of the account shows that the cost to complete the work is less than that which would have been the cost to the **County** had the work been completed by the Contractor under the terms of this contract and when the Contractor and/or his Surety shall pay the balance shown to be due by them to the **County**, then all machinery, equipment tools, materials or supplies left on the site of the work shall be turned over to the Contractor and/or his Surety. Should the cost to complete the work exceed the contract price and the Contractor and/or his Surety fail to pay the amount due the County within the time designated hereinabove, and there remains any machinery, equipment, tools, material or supplies on the site of the work, notice thereof, together with an itemized list of such equipment and materials, shall be mailed to the Contractor and his Surety at the respective addresses designated in this contract provided, however, that actual written notice given in any manner will satisfy this condition. After mailing or otherwise giving such notice, such property shall be held at the risk of the Contractor and his Surety subject only to the duty of the **County** to exercise ordinary care to protect such property. After fifteen (15) days from the date of said notice the County may sell such machinery, equipment, tools, materials or supplies and apply the net sum derived from such sale to the credit of the Contractor, as the County may elect.

The **County** shall release any machinery, equipment, tools, materials or supplies, which remain on the work and belong to persons other than the **Contractor** or his Surety, to their proper Localities without notice to the **Contractor**.

ABANDONMENT BY THE COUNTY

In case the **County** shall fail to comply with the terms of this contract and should fail or refuse to comply with said terms within ten (15) days after written notifications by the **Contractor**, the **Contractor** may suspend or wholly abandon the work, and may remove therefrom all machinery, tools and equipment. And thereupon the Engineer shall make an estimate of the total earned by the **Contractor**, which estimate shall include the value of all work actually completed by said **Contractor** at the prices stated in the attached proposal, the value of all partially completed work at a fair and equitable price, and the amount of all extra work performed at the prices agreed upon, or provided for by the terms of this contract, and a reasonable sum to cover the cost of any provisions made by the **Contractor**, to carry the whole work to completion and which cannot be utilized. The Engineer shall then make a final statement of the balance due the **Contractor** by deducting from the above estimate all previous payments by the **County**, all other sums that may have been retained by the **Contractor** on or before thirty (30) days after the date of the notification by the **Contractor**, the balance shown by said final statement as due the Contractor under the terms of this Agreement.

BONDS

It is further agreed by the parties of this contract that the **Contractor** shall execute a performance bond and a payment bond, each in the sum of one hundred (100%) percent, in the forms provided for this purpose, and it agreed that this contract shall not be in effect until such bonds are furnished and approved by the **County**.

RIGHTS AND REMEDIES

Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

No action or failure to act by the **County** or Architect or **Contractor** shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such act or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

STANDARD FORM OF AGREEMENT

STATE OF TEXAS

§

COUNTY OF CAMERON §

THIS AGREEMENT, MADE AND ENTERED INTO THIS THE ____ DAY OF ____, 2024, A.D., by and between the County of Cameron thereunto duly authorized so to do, Party of the First Part, hereinafter called County, and, of <u>the Name of Contractor</u>, Party of the Second Part hereinafter termed Contractor.

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned, to be made and performed by the Party of the First Part (County), and under the conditions expressed in the bond bearing every date herewith, the said Party of the Second Part (Contractor), hereby agrees with said Party of the First Part (County), to commence and complete the construction of certain improvements described as follows: Cameron County Olmito Nature Park Phase 1, and any extra work in connection therewith, under the terms as stated in the General Conditions of the Agreement, Special Conditions of the Agreement, Technical Specifications and Plans and at his (or their) own proper cost and expense to furnish all the materials, supplies, machinery, equipment, tools, superintendence, labor, insurance, and other accessories, with the conditions and prices stated in the Proposal attached hereto, in accordance with all General Conditions of the Agreement, Special Conditions of the Agreement, Technical Specifications and Plans and in accordance with the Plans, which include all maps, plats, blueprints and other drawings and printed or written explanatory matter thereof, and the specifications therefore, together with the Contractor's written approval, and the General Conditions of the Agreement, Special Conditions of the Agreement, Technical Specifications and Plans and the Construction Bonds hereto attached, all of which are made a part hereof and collectively evidence and constitute the entire contract.

The Contractor hereby agrees to commence work within ____ days after the date written notice to do so shall have been given to him, and to substantially complete same within calendar days, after the date of the written notice to commence work.

The County agrees to pay the Contractor in current funds the sum of $\underline{\$}$ (to include alternates#) for the performance of the Contract in accordance with the proposal submitted therefore, subject to additions and deductions as provided in the General Conditions of the Agreement, and to make payment on account thereof as provided therein.

Contractor further agrees not to do any work unless he has received a valid Purchase Order issued by Cameron County for payment of the work to be accomplished.

This instrument contains the entire agreement between the parties relating to the rights herein granted and obligations herein assumed. Any oral representations or modifications concerning this instrument shall be of no force or effect, excepting a subsequent modification in writing, signed by the party to be charged. This Agreement may be amended, provided that no amendment, modification, or alteration of the terms of this agreement shall be binding unless the same is in writing and duly executed by the parties hereto.

All notices to Cameron County shall be sent by certified or registered mail, addressed to: Cameron County Judge, Cameron County Courthouse, 964 East Harrison Street, Brownsville, Texas 78520, and Cameron County Engineer, 805 W. Price Rd., Brownsville, Texas 78521, or at such other address as the COUNTY may otherwise designate. All notices to Contractor shall be sent certified or registered mail, addressed to: ______ or at such other address as said Contractor may otherwise designate in writing.

This Agreement shall be governed by the laws of the State of Texas and venue shall be in Cameron County.

IN WITNESS WHEREOF, the parties of these presents have executed this Agreement in quadruplicate in the year and day first above written.

PARTY OF THE FIRST PART Eddie Trevino, Jr. Cameron County Judge PARTY OF THE SECOND PART (Contractor)

ATTESTED BY:

Sylvia Garza Perez, County Clerk

NOTICE OF AWARD

TO:

PROJECT DESCRIPTION: <u>Cameron County Olmito Nature Park – Phase 1</u>

The OWNER has considered the BID submitted by you for the above described WORK in response to its Advertisement and Invitation to Bid dated _____.

You are hereby notified that your BID has been accepted in the amount of ______.

You are required by the Instructions to Bidders to execute the Agreement and furnish the required CONTRACTOR'S Performance Bond, Payment Bond and certificates of insurance within ten (10) calendar days from the date of this Notice to you.

If you fail to execute said Agreement and to furnish said Bonds within ten (10) days from the date of the Notice, said OWNER will be entitled to consider all your rights arising out of the OWNER'S acceptance of your BID as abandoned and as forfeiture of your BID SECURITY. The OWNER will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of the NOTICE OF AWARD to the OWNER.

Dated the _____ day of ______, 202___.

OWNER: CAMERON COUNTY

BY:

TITLE:_____

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged by _____, this the _____ day of _____, 202_.

BY: _____

TITLE: _____

CERTIFICATE AS TO CORPORATE PRINCIPAL

I,	, certify that I am the	, Secretary of the
Corporation nam	ed as Principal in the within	bond; that, who signed the said bond on
behalf of the Prir	ncipal was then	of said corporation; that I know his/her signature,
and his/her signa	ture thereto is genuine; and	that said bond was duly signed, sealed, and attested to, for
and in behalf of s	said corporation by authorit	of this governing body.

Corporate Seal

Title:

* Power-of-attorney for person signing for surety company must be attached to bond.

ATTORNEY'S REVIEW CERTIFICATION

I, the undersigned,	Dylbia L. Jefferies Vega	, the duly aut	horized and acting	legal
representative of the	County of Cameron, Texa	S	, do hereby certi	fy as follows:
I have examined the attack	hed contract(s) and surety	bonds and am o	of the opinion that	at each of the
agreements may be duly	executed by the proper	parties, acting	through their du	ly authorized
representatives; that said re	presentatives have full pov	ver and authority	to execute said a	agreements on
behalf of the respective p	arties; and that the agreem	nents shall const	itute valid and le	egally binding
obligations upon the partie	s executing the same in ac	ccordance with te	erms, conditions a	and provisions
thereof.				

Attorney's signature:	Date:	

Print Attorney's Name:	Dylbia L. Jefferies Vega
2	



Project Name: Cameron County Olmito Nature Park – Phase 1 Project PO #: 240201

<u>T</u> .	TASK DESCRIPTION		COMPLETED	DATE	
A. General Requirements					
1. (E	Cer	tificate of Substantial Completion (AIA G704) ed by Architect/Engineer, Contractor and Owner)			
2.	Insp	pections Certifications			
	a. (By	Certificate of Occupancy Building Inspections Officials)			
	b. (Sha	Copy of Building Official Inspection Card owing required inspection approvals)			
	c.	Regulatory Inspection Sign-Offs (as applicable)			
		(1) General Contract			
		(2) Plumbing Subcontract			
		(3) Fire Protection Contract			
		(4) Mechanical Contract			
		(5) Electrical Contract			
		(6) Certification Reports for All Backflow Assemblie (Includes Plumbing, HVAC, Fire Protection as a	es pplicable)		
		(7) Well Water Quality Test Report (if applicable)			
		(8) Other Certifications as Required (NCDFS, NC DOT, Land Quality, Local Govern Dept., Fireproofing Certification, Structural Ste	ment, Utilities, H el Inspection Cer	 Iealth rtification, etc.)	
3.	Clos	seout Reports & Documentation			
	a. Owner Instruction and Training with Equipment and Systems (Memo/List of Attendees required for each session)				
	b. H	IVAC Test and Balance Report (Approval cover letter from Architect/Engineer requ	uired)		



Project Name: Cameron County Olmito Nature Park – Phase 1 Project PO #: 240201

B.

TASK DESCRIPTION	COMPLETED	DATE
c. Attic Stock Turnover (Transfer to Owner with Typed Inventory Required)		
d. Keys & Permanent Hardware Changeover (Delivery of Final Keys and Cabinet to Owner; Memo of Hardware Changeover Date)		
e. Insurance Coverage Change Over		
f. Utility Account Change Over		
(1) Electric Service		
(2) Gas Service		
(3) Water Service		
(4) Other Utility Service		
Record Document Requirements As-built drawings (as applicable) 		
a. Site/Civil		
b. Architectural & Structural		
c. Plumbing		
d. Fire Protection		
e. Mechanical		
f. Electrical		
g. Security		
h. Other (Kitchen Equipment, etc.)		
 Final Finish Schedule (updated with actual finishes and bound in with O+M Manual) 		



Project Name: Cameron County Olmito Nature Park – Phase 1 Project PO #: 240201

	TA	SK DESCRIPTION	COMPLETED	DATE
3.	Ope	ration & Maintenance (O+M) Manuals (Approval cover letter from Designer required)		
		a. Product & Operations Data		
		b. Maintenance Information		
		c. Product Warranty Certificates/Maintenance Agreements		
	4. (Wi	Shop Drawings – Complete Set th Architect's Review Stamp)		
C.	5. (Co Fin	Construction Site Documentation htractor's Job Log and Photographs) al Accounting Requirements – by Contractor		
	1.	Affidavit of Release of Liens (AIA G706A)		
	2.	Affidavit of Payment of Debts and Claims (AIA G706)		
	3.	Consent of Surety to Final Payment (AIA G707)		
	4.	Final Request for Payment Certified by Architect/Engineer		
D.	Fin	al Accounting Requirements - by Architect/Engineer		
	1.	Cover Letter of Approval of Roof Warranty		
	2.	Cover Letter of Approval for O&M Manuals		
	3.	Certification by Architect of Completed Final Punch List		
	4.	Final Completion Certificate executed by Architect/Engine	eer	
	5.	Final Liquidated Damages analysis by Architect/Engineer		
	6. 7.	Record Drawings (electronic CAD files +set of pdf files + 3 reproducible set drawings based on Contractor As-Builts) Certification of Project Compliance	s of all	
	8.	MSDS Asbestos Free Building Letter		



Project Name: Cameron County Olmito Nature Park – Phase 1 Project PO #: 240201

	TASK DESCRIPTION	COMPLETED	DATE
E.	Warranty Period		
	 Pre-Expiration Warranty Inspection (Inspection 30 days prior to warranty expiration date) 		
F.	Cameron County requirements		
	1. Final Payment Requires Commission Approval.		
	2. TDLR Accessibility Compliance Letter from Registered Accessibility Specialist (RAS)		
	3. Windstorm Certification – Flood Zone Certification, if requi Zone A designated areas for new buildings and additions	ired in	
	 Required Training documentation/logs, complete with sign sheets on personnel present for Elevators and Boilers, TDLR certification of Inspection. 	n in	

List of Sub-Contractors may be submitted at the time of Bid or within 48 hours after Bid. If not sure on certain trades, please provide list of potential subcontractors. Do not leave blank. Email list to rgg@gmsarchitects.com If lists are not received within 48 hours after bid, no points will be received for this section.

LIST OF PROPOSED SUB-CONTRACTORS/SUPPLIERS PROJECT: Cameron County Parks – Olmito Park Improvements

BIDDER:	DATE:
	ITEM NAME OF SUB-CONTRACTOR/SUPPLIER
ΡΕRΕΩRΜΔΝ/CE-ΡΔΥΜΕΝΤ ΒΩΝΩ	(As applicable)
CONCRETE WALKS CURBS AND PAVING	
METAL FABRICATIONS	
ROUGH CARPENTRY	
ARCHITECTURAL WOOD WORK	
INSULATION	
PREFORMED METAL ROOFING	
JOINT SEALERS	
FLUSH WOOD DOORS	
FINISH HARDWARE	
TILE	
PAINTING	
TOILET PARTITIONS	
MOBILE STORAGE SHELVING	
DIVISION 10 SPECIALTIES	
KITCHEN EQUIPMENT	
DIVISION 15	
HVAC SUBCONTRACTOR	
HVAC EQUIPMENT	
HVAC CONTROLS	
PLUMBING SUBCONTRACTOR	
DIVISION 16	
ELECTRICAL SUBCONTRACTOR	
FIRE ALARM, INTERCOM, INT DET SUBCONTRACTOR	

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010 - SUMMARY OF WORK:

- 1.1 Location: The project site for Cameron County Parks Olmito Park Improvements is located at 9538 Hayes Road, Olmito, TX.
- 1.2 Approval of Working Surfaces: Any contractor performing work over the work of other contractors shall notify the Architect of any unsatisfactory condition. Beginning of work by any contractor shall constitute the acceptance of the previous work.
- 1.3 Checking Dimensions at Site: Before ordering any materials or doing any work, verify all measurements of the building and be responsible for the correctness of them. No extras will be allowed for variations from drawings in existing conditions or for work performed under this contract. Any discrepancies found shall be submitted to the Architect for instruction before proceeding. The Section shall be enforced diligently.
- 1.4 Cutting & Patching: No excessive cutting will be permitted, nor shall any structural members be cut without the approval of the Architect. Each contractor shall leave all chases and openings straight, true and of the proper size in his work as may be necessary for the proper installation of his and/or other contractor's work. After such work has been installed, he shall carefully fit around, close up, repair, patch and point up same as directed, to the entire satisfaction of the Architect.
- 1.5 Cooperation: The General Contractor, all other contractors and all subcontractors shall coordinate their work with all adjacent work and shall cooperate with all other trades to facilitate the general progress of the work. Each trade shall afford all other trades every reasonable opportunity for installation of their work and storage of their materials.
- 1.6 Project Logbook: The project superintendent shall maintain a daily project logbook, indicating which subcontractors were on the job, time of arrival, and the number of workers. Statements as to the daily progress shall be logged. This logbook shall be made available to the Architect and shall be kept at the job site office.
- 1.7 Inspection and Tests: Architect and his representative shall at all times have access to the work whether it is in preparation or progress. Provide proper and safe facilities for such access and inspection. Make all inspections and test in connection with this entire contract as required by the Architect. All material testing shall be paid for by the Testing Allowance and be done by an independent testing laboratory meeting the approval of the architect.
- 1.8 Security: Provide security fencing in all work areas. See Temporary Facilities.
- 1.9 Mockup Panel: Provide a mock-up for evaluation of product and application workmanship.
 - 1. Install in area and of size designated by Architect.
 - a. Construct mockup to illustrate backup wall, exterior sheathing, air barrier, cavity wall, connectors, weep holes, cavity vents, and through wall flashing.
 b. Construct mockup panel 72 inches by 72 inches to illustrate coursing, anchorage, mortar joints and color, window opening and flashing system.

- 2. Do not proceed with work until finish color, texture, pattern, joint sizes, and installation workmanship are approved by Architect.
- 3. Correct mock-up area as required to produce acceptable work.

2. ALLOWANCES:

See Paragraph 4.8 of the General Conditions.

- 2.1 Testing Allowance: A recognized, independent material testing laboratory will be selected and paid directly by the Owner.
- 2.2 Betterment Allowance: Include the sum set forth below as a Betterment Allowance which will, if needed, be expended on Betterment to the Project, as directed in writing by approved change orders.

Betterment Allowance: \$50,000.00

2.3 Structural Allowance: Include the sum set forth below as a Betterment Allowance which will, if needed, be expended on Betterment to the Project, as directed in writing by approved change orders.

Reinforcing Steel Allowance: \$ 10,000.00

Fabricated Steel Allowance: \$ 15,000.00

2.4 Signage Allowance: Include the sum set forth below as a Betterment Allowance which will, if needed, be expended on Betterment to the Project, as directed in writing by approved change orders.

Signage Allowance: \$ 15,000.00

SECTION 0110 - BID SCHEDULE

1. BID SCHEDULE: All proposals and alternate bid items shall be subject to the General and Special Conditions and all other related sections of the specifications and requirements of the drawings. The Owner shall have the right to accept or reject any or all alternates.

- 1.1 BASE BID: The Contractor shall state on the General Contract Bid Proposal under the Base Bid, the amount for all work, complete in all respects in accordance with plans and specifications, to construct Olmito Park Improvements. The scope of work is defined in the plans and specifications.
- 1.2 ALTERNATES: The Contractor shall state on this Bid Form, under each Alternate the amount to add to this bid to perform all work, complete in all respects, in accordance with the plans and specifications to construct work required by the Alternates.

N/A

SECTION 0120 - AS BUILT DRAWINGS:

As the work proceeds, keep careful records of piping, electrical circuits, duct work and other concealed work whose installed location varies from that shown on plans. Refer to Section 01705 Project Closeout for additional requirements.

SECTION 0130 - REPORTS:

The Contractor will provide a written report to the Architect after each inspection

conducted by the City Inspectors concerning their findings.

SECTION 0140 - QUANTITIES & WARRANTIES:

All guarantees and warranties expressed or implied shall be provided to the Architect in written form prior to final payment.

SECTION 0150 - PICTURES:

In addition to the required monthly progress photos, the Contractor will provide the following:

- 1. Aerial job photos.
- 2. Sequence photographs showing the flashing in place prior to application of roof. This is MANDATORY. Close-ups of all flashing are required.

The Contractor is required to submit progress photos with each month's application for payment.

SECTION 0160 - CERTIFICATION OF CONSTRUCTION:

The building contractor or construction manager shall certify in writing that the facility has been constructed in accordance to the construction documents and its specifications.

<u>SECTION 0170 - CERTIFICATION OF NON-USE OF ASBESTOS PRODUCTS</u> The General Contractor shall provide the Architect with written certification letters from all sub-contractors and suppliers that no asbestos products shall be use on this project.

SECTION 0180 - SCOPE AND SEQUENCE OF CONSTRUCTION

1.1 General:

No time extensions shall be considered.

The successful bidder shall under no circumstances leave this project unsecured or unprotected at any time during construction. The General Contractor is to refer to Section 01505 Temporary Facilities for all requirements required by this project.

The General Contractor to provide all necessary precautions and safeguards during construction for protection of personnel utilizing the site and any visitor who might visit the project site. The General Contractor shall provide in a neat format project monthly reports with photos showing progress of construction for their review.

SECTION 01340 - SUBMITTALS

<u> PART 1 - GENERAL</u>

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specifications, apply to work of this section.

DESCRIPTION OF REQUIREMENTS:

The types of submittal requirements for specified in this section including shop drawings, product data, samples and miscellaneous work related Submittals. Individual submittal requirements are specified in applicable sections for each unit of work. Refer to other Division 1 sections and other contract documents for requirements of administrative Submittals.

Definitions: Work related Submittals of this section are categorized for convenience as follows:

Shop drawings include specially prepared technical data for this project including drawings, diagrams; performance curves data sheets schedules, templates, patterns, reports, calculations, instructions, measurements and similar information not in standard printed form for general application to a range of similar projects.

Product data includes standard printed information on manufactured products that has not been specially prepared for this project, other than the designation of selections from among available choices printed therein.

Samples include both fabricated and un-fabricated physical examples of materials, products and units of work; both as complete units and as smaller portions of units of work; either for limited visual inspection or (where indicated) for more detailed testing and analysis.

Mock ups are special forms of samples, which are too large or otherwise inconvenient for handling in the manner specified for transmittal of sample Submittals.

Miscellaneous Submittals related directly to the work (non administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records quality testing and certification reports, copies of industry standards, record drawings, field measurement data, operating and maintenance manuals, overrun stock, and similar information, devices and materials applicable to the work and not processed as shop drawings, product data or samples.

GENERAL SUBMITTAL REQUIREMENTS:

Scheduling: Where appropriate in administrative submittals, (listing of products, manufacturers, suppliers and sub-contractors, and in job progress schedule), show principal work related submittals and time requirements for coordination of submittal activity with related work in each instance.

Listing: Prepare a separate listing; organized by related specification section number sequence, showing principal work related submittals and their initial submittal dates as required for coordination of the work. Submit listing within 45 days of date of commencement of the work.

Coordination and Sequencing: Coordinate preparation and processing of submittals with the performance of the work so that work will not be delayed by submittals. Coordinate and sequence different categories of submittals for same work, and for interfacing units of work, so that one will not be delayed for coordination of A/E's review with another.

Preparation of Submittals: Provide permanent marking on each submittal to identify project, date, Contractor, subcontractor, Submittal name, and similar information to distinguish it from other submittals. Show Contractor's executed review and approval markings and provide space for the Architect/Engineer's "Action" marking. Package each submittal appropriately for transmittal and handling. Submittals which are received from sources other than through Contractor's office will be returned by A/E "without action".

SPECIFIC CATEGORY SUBMITTAL REQUIREMENTS:

General: Except as otherwise indicated in the individual work sections, comply with the requirements specified herein for each indicated category of submittal. Provide and process intermediate submittals, where required between initial and final, similar to initial submittals.

Shop Drawings: Provide newly prepared information, on reproducible sheets, with graphic information at accurate scale (except as otherwise indicated), with name of preparer indicated (firm name). Show dimensions and not which are based on field measurement. Identify materials and products in the work shown. Indicate compliance with standards and special coordination requirements. Do not allow shop drawing copies without appropriate final "Action" markings by the Architect/Engineer to be used in connection with the work.

Initial Submittal: Provide one electronic print with requested testing data, ICC-ES reports and TDI reports, where applicable.

Product Data: Collect required data into one submittal for each unit of work or system; and mark each copy to show which choices and options are applicable to project. Include manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked, and special coordination requirements. Maintain one set of product data (for each submittal) at project site, available for reference by Architect/Engineer and others.

Submittals: Do not submit product data, or allow its use on the project, until compliance with requirements of contract documents has been confirmed by Contractor. Submittal is for information and record, unless otherwise indicated.

Initial submittal is final submittal unless returned promptly by Architect/Engineer, marked with an "Action" which indicates an observed non-compliance. Submit 3 copies where required for maintenance manuals.

Samples: Provide units identical with final condition of proposed materials or products for

the work. Include "range" samples (not less than 3 units) where unavoidable variations must be expected, and described or identify variations between units of each set. Provide full set of optional samples where Architect's/Engineer's selection is required. Prepare samples to match Architect's/Engineer's sample where so indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations, and compliance with standards. Samples are submitted for review and confirmation of color, pattern, texture and "kind" by Architect/Engineer. Architect/Engineer will not "test" samples (except as otherwise indicated) for compliance with other requirements, which are therefore the exclusive responsibility of Contractor.

Submittal: Provide a single set of samples for Architect's/Engineer's review and "Action".

Mock Ups and similar samples specified in individual work sections recognized as a special type of sample. Comply with requirements for "samples" to greatest extent possible, and process transmittal forms to provide a record of activity.

Inspection and Test Reports: Classify each as either "shop drawings" or "product data" depending upon whether report is uniquely prepared for project, or a standard publication of workmanship control testing at point of production and process accordingly.

Warranties: Refer to "Products" section for specific general requirements on warranties, product/workmanship bonds and maintenance agreements. In addition to copies desired for the Contractor's use, furnish 2 executed copies except furnish 2 additional (conformed) copies where required for maintenance manuals.

Closeout Submittals: Refer to Section 01705 Project Closeouts and to individual work sections for specific requirements on submittal of closeout information, materials, tools, and similar items.

Materials and Tools: Refer to individual work sections of for required quantities of spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.

General Distribution: Provide additional distribution of submittals (not included in foregoing copy submittal requirements) to subcontractors, suppliers, fabricators, installers, governing authorities, and others as necessary for the proper performance of the work. Include such additional copies in transmittal to the Architect/Engineer where the submittals are required to receive "Action" marking before final distribution. Record submittal distributions on transmittal forms.

ACTION ON SUBMITTALS

Architect/Engineer's Action: Where action and return is required or requested, the Architect/Engineer will review each submittal, mark with "Action", and where possible return within 2 weeks of receipt.

Where the submittal must be held for coordination, Contractor will be so advised by A/E without delay.

Final Unrestricted Release: Work may proceed, provided it complies with the contract

documents, when submittal is returned with the following: Marking: "Accepted". Marking: "Reviewed".

Final But Restricted Release: Work may proceed, provided it complies with notations and corrections on submittal and with contract documents, when submittal is returned with the following:

Marking: "Accepted as Noted". Marking: "Reviewed as Noted".

Returned for Resubmittal: Do not proceed with work. Revise submittal in accordance with notations thereon, and resubmit without delay to obtain a different action marking. Do not allow submittals with the following marking (or unmarked submittals where a marking is required) to be used in connection with performance of the work:

Marking: "Not Accepted, Resubmit". Marking: "Revise and Resubmit".

Other Action: Where the submittal is returned, for other reasons, with Architect/Engineer's explanation included, it will be marked as follows: Marking: "Action Not Required". Marking: "No Action".

Action Stamp: Architect's/Engineer's action stamp, for use on submittals to be returned to Contractor, is self explanatory as marked.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

SECTION 01505 - - TEMPORARY FACILITIES

<u> PART 1 - GENERAL</u>

RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to the work of this section.

DESCRIPTION OF REQUIREMENTS:

Definitions: Specific administrative and procedural minimum actions are specified in this section, as extensions of provisions in General Conditions and other contract documents. These requirements have been included for special purposes as indicated. Nothing in this section is intended to limit types and amounts of temporary work required, and no omission from this section will be recognized as an indication by Architect or Engineer that such temporary activity is not required for successful completion of the work and compliance with requirements of contract documents. Provisions of this section are applicable to, but not by way of limitation, utility services, construction facilities, support facilities, security/protection provisions, and support facilities.

QUALITY ASSURANCE:

General: In addition to compliance with governing regulations and rules/recommendation of franchised utility companies, comply with specific requirements indicated and with applicable local industry standards for construction work (published recommendations by local consensus "building councils").

ANSI Standards: Comply with applicable provisions of ANSI Al Series standards on construction safety, including A.10.3, A.10.4, A10.5, A10.6, A10.7, A10.8, A10.9, A10.10, A10.11, A10.12, A10.13, A10.14, A10.15, A10.17, A10.18, A10.20, and A10.22.

NFPA Code" Comply with NFPA Code 241 "Building Construction and Demolition Operations."

JOB CONDITIONS:

General: Establish and initiate use of each temporary facility at time first reasonably required for proper performance of the work. Terminate use and remove facilities at earliest reasonable time, when no longer needed or when permanent facilities have, with authorized use, replaced the need.

Conditions of Use: Install, operate, maintain and protect temporary facilities in a manner and at locations which will be safe, non hazardous, sanitary and protective of persons and property, and free of deleterious effects.

PART 2 AND 3 - PRODUCTS AND EXECUTION

TEMPORARY UTILITY SERVICES:

The types of services required include, but not by way of limitation, water, sewerage, surface drainage, electrical power and telephones. Where possible and reasonable, connect to existing franchised utilities for required services; and comply with service

companies' recommendations on materials and methods, or engage service companies to install services. Locate and relocate services (as necessary) to minimize interference with construction operations.

TEMPORARY CONSTRUCTION FACILITIES:

The types of temporary construction facilities required include, but not by way of limitation, water distribution, drainage, enclosure of work, heat, ventilation, electrical power distribution, lighting, hoisting facilities, stairs, ladders, and roads. Provide facilities reasonably required to perform construction operations properly and be large enough to accommodate meetings for 10 persons.

Water Distribution: Provide hose lengths sufficient to reach entire area of construction work, not less than 3/4" hose size. Prevent freezing of water distribution by either prompt drainage after each use, or by suitable protection.

Electrical Power: Provide weatherproof, grounded, power distribution system sufficient to accommodate construction operations requiring power, use of power tools, electrical heating, lighting, and start up testing of permanent electric powered equipment prior to its permanent connection to electrical system. Provide overload protection. Locate multiple outlets (not less than 4 gang boxes) at each story of construction, spaced so that entire area of construction can be reached by power tools on a single extension cord of 100' maximum length.

Supply power for electric welding, if any, from either temporary power distribution system or by engine driven power generator sets, at Contractor's option.

Lighting: Provide sufficient temporary lighting to ensure proper workmanship everywhere; by combined use of daylight, general lighting, and portable plug in task lighting. Provide general lighting with local switching which will enable energy conservation during periods of varying activity (work in progress, traffic only security check, lock up, etc.).

Provide uniformly spaced general lighting equivalent to not less than one 200 watt incandescent lamp per 1000 sq. ft. of floor area, and one 100 watt lamp per 50' of corridor and per flight of stairs.

Access Provisions: Provide ramps, stairs, ladders and similar temporary access elements as reasonably required to perform the work and facilitate its inspection during installation. Comply with reasonable requests of governing authorities performing inspections. When permanent stairs are available for access during construction, cover finished surfaces with sufficient protection to ensure freedom from damage and deterioration at time of substantial completion.

SECURITY/PROTECTION PROVISION:

The types of temporary security and protection provision required include, but not by way of limitation, fire protection, barricades, fencing (wire), warning signs/lights, and similar provision intended to minimize property losses, personal injuries and claims for damages at project site.

Fire Extinguishers: Provide types, sizes, numbers and locations as would be reasonably effective in extinguishing fires during early stages, by personnel at project site. Provide Type A extinguishers at locations of low potential for either electrical or grease oil

flammable liquids fires; provide Type ABC dry chemical extinguishers at other locations; comply with recommendations of NFPA No. 10. Post warning and quick instructions at each extinguisher location, and instruct proper use of extinguishers and other available facilities at project site. Post local fire department call number on each telephone instrument at project site.

Permanent Fire Protection: Complete each fire protection facility at earliest reasonable date, make ready for emergency use, and instruct personnel at site on availability and proper use.

Building Enclosure and Lockup: At earliest possible date, secure building against unauthorized entrance at times when personnel are not working.

Temporary Fencing is required at all work areas (Building Addition, walk-way canopies, soccer field, new parking areas etc.) to provide protection for building occupants using the portion of the building being used. Coordinate locations with Owner.

TEMPORARY SUPPORT FACILITIES:

The types of temporary support facilities required include, but not by way of limitation, field offices, storage sheds, fabrication sheds, sanitary facilities, drinking water, first aid facilities, bulletin board, private telephones, project identification signs, clean up facilities, waste disposal service, and similar miscellaneous general services, all as may be reasonably required for proficient performance of the work and accommodation of personnel at the site including Owner's and Architect's/Engineer's personnel.

Discontinue and remove temporary support facilities, and make incidental similar use of permanent work of the project, only when and in manner authorized by Architect/Engineer; and, if not otherwise indicated, immediately before time of substantial completion. Locate temporary support facilities for convenience of users, and for minimum interference with construction activities.

Contractor's Field Offices: Provide adequate office space for field office personnel plus one spare work station for incidental use by subcontractor's personnel, suitably finished, furnished, equipped and conditioned.

Sanitary Facilities: At contractor's option, provide either piped (wet) toilets facilities or self contained toilet units of type acceptable to governing authorities, adequate (at all stages of construction) for use of personnel at job site. Provide separate facilities for male and female personnel when both sexes are working (in any capacity) at project site.

Project Identification Sign: At locations(s) shown on site plans provide project identification sign complying with sketch/data sheet included at end of this section. Engage an experienced sign painter to paint graphics on sign as indicated. Construct sign of treated wood framing and posts, and 3/4" plywood panels of exterior type Grade B C sanded 2 sides.

END OF SECTION 01505

SECTION 01605 - PRODUCTS AND SUBSTITUTIONS

<u> PART 1 - GENERAL</u>

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

DESCRIPTION OF REQUIREMENTS:

Definitions: "Products" is defined to include purchased items for incorporation into the work, regardless of whether specifically purchased for project or taken from Contractor's stock of previously purchased products. "Materials", is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, installed or applied to form units of work. "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, etc.). Definitions in this paragraph are not intended to negate the meaning of other terms used in contract documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," "special construction," and similar terms, which are self explanatory and have recognized meanings in the construction industry.

Substitutions: The requirements for substitutions do not apply to specified Contractor options on products and construction methods. Revisions to contract documents, where requested by Owner, Architect or Engineer, are "changes" not "substitutions." Substitutions requested during bidding period, which have been accepted prior to Contract Date, are included in contract documents and are not subject to requirements for substitutions as specified herein. Contractor's determination of an compliance with governing regulations and orders issued by governing authorities do not constitute "substitutions;" and do not constitute a basis for change orders, except as provided for in contract documents. Otherwise, Contractor's requests for changes in products, materials and methods of construction required by contract documents after the bidding period are considered requests for "substitutions," and are subject to requirements hereof.

Standards: Refer to Division 1 section "Definitions and Standards" for applicability of industry standards to products of project, and for acronyms used in text of specification sections.

QUALITY ASSURANCE:

Source Limitations: To the greatest extent possible, for each unit of work, provide products, materials or equipment of a singular generic kind and from a single source.

Compatibility of Options: Where more than one choice is available as options for Contractor's selection of a product or material, select an option which is compatible with other products and materials already selected (which may have been from among options for those other products and materials). Total compatibility among options is not assured by limitations within contract documents, but must be provided by Contractor. Compatibility is a basic general requirement of product/material selections.

SUBMITTALS:

Requests for Substitutions: Submit 3 copies, fully identified for product or method being replaced by substitution, including related specification section and drawing number(s), and fully documented to show compliance with requirements for substitutions. Include product data/drawings, description of methods, samples where applicable, Contractor's detailed comparison of significant qualities between specified item and proposed substitution, statement of effect on construction time and coordination with other affected work, cost information or proposal, and Contractor's statement to the effect that proposed substitution will result in overall work equal to or better than work originally indicated.

PRODUCT DELIVER STORAGE HANDLING:

General: Deliver, handle and store products in accordance with manufacturer's recommendations and by methods and means which will prevent damage, deterioration, and loss including theft. Control delivery schedules to minimize long term storage of products at site and overcrowding of construction spaces. In particular, provide delivery/installation coordination to ensure minimum holding or storage times for products recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss.

WARRANTIES (GUARANTEES):

Categories of Specific Warranties: Warranties on the work are in several categories, including those of General Conditions, and including (but not necessarily limited to) the following specific categories related to individual units of work specified in sections of Divisions 2 through 16 of these specifications:

Special Project Warranty (Guarantee): A warranty specifically written and signed by Contractor for a defined portion of the work; and, where required, countersigned by subcontractor, installer, manufacturer or other entity engaged by Contractor.

Specified Product Warranty: A warranty which is required by contract documents, to be provided for a manufactured product incorporated into the work; regardless of whether manufacturer has published a similar warranty without regard for specific incorporation of a product into the work, or has written and executed a special product warranty as a direct result of contract document requirements.

Coincidental Product Warranty: A warranty which is not specifically required by contract documents (other than as specified in this Section); but which is available on a product incorporated into the work, by virtue of the fact that manufacturer of product has published warranty in connection with purchases and uses of product without regard for specific applications except as otherwise limited by terms of warranty.

Refer to individual sections of Divisions 2 through 16 for the determination of units of work which are required to be specifically or individually warranted, and for the specific requirements and terms of those warranties (or guarantees).

General Limitations: It is recognized that specific warranties are intended primarily to protect Owner against failure of the work to perform as required, and against deficient, defective and faulty materials and workmanship, regardless of sources. Except as otherwise indicated, specific warranties do not cover failures in the work which result from: 1.) Unusual and abnormal phenomena of the elements, 2.) The Owner's misuse,
maltreatment or improper maintenance of the work, 3.) Vandalism after time of substantial completion, or 4.) Insurrection or acts of aggression including war.

Related Damages and Losses: In connection with Contractor's correction of warranted work which has failed, remove and replace other work of project which has been damaged as a result of such failure, or must be removed and replaced to provide access for correction of warranted work.

Consequential Damages: Except as otherwise indicated or required by governing regulation, special project warranties and product warranties are not extended to cover damage to building contents (other than work of Contract) which occurs as a result of failure of warranted work.

Reinstatement of Warranty Period: Except as otherwise indicated, when work covered by a special project warranty or product warranty has failed and has been corrected by replacement or restoration, reinstate warranty by written endorsement for the following time period, starting on date of acceptance of replaced or restored work.

A period of time is equal to original warranty period of time.

Replacement Cost, Obligations: Except as otherwise indicated, costs of replacing or restoring failing warranted units or products is Contractor's obligation, without regard for whether Owner has already benefited from use through a portion of anticipated useful service lives.

Rejection of Warranties: Owner reserves the right, at time of substantial completion or thereafter, to reject coincidental product warranties submitted by Contractor, which in opinion of Owner tend to detract from or confuse interpretation of requirements of contract documents.

Contractor's Procurement Obligations: Do not purchase, subcontract for, or allow others to purchase or sub subcontract for materials or units of work for materials or units of work for project where a special project warranty, specified product warranty, certification or similar commitment is required, until it has been determined that entities required to countersign such commitments are willing to do so.

Specific Warranty Forms: Where a special project warranty (guarantee) or specified project warranty is required, prepare a written document to contain terms and appropriate identification, ready for execution by required parties. Submit draft to Owner (through Architect/Engineer) for approval prior to final executions.

PART 2 PRODUCTS

GENERAL PRODUCT COMPLIANCES:

General: The compliance requirements, for individual products as indicated in contract documents, are multiple in nature and may include generic, descriptive, proprietary, performance, prescriptive, compliance with standards, compliance with codes, conformance with graphic details and other similar forms and methods of indicating requirements, all of which must be complied with. Also "allowances" and similar provisions of contract documents will have a bearing on selection process.

Procedures for Selecting Products: Contractor's options for selecting products are limited by contract document requirements, and governing regulations, and are not controlled by industry and governing regulations, and are not controlled by industry traditions or procedures experienced by Contractor on previous construction projects.

Required procedures include, but are not necessarily limited to, the following for various indicated methods of specifying:

Single Product/Manufacturer Name: Provide product indicated, except advice Architect/Engineer before proceeding, where known that named product is not a feasible or acceptable selection.

Two or More Product/Manufacturer Names: Provide one of the named products, at Contractor's option; but excluding products which do not comply with requirements. Do not provide or offer to provide an unnamed product, except where none of named products comply with requirements or are a feasible selection; advise Architect/Engineer before proceeding.

"Or Equal": Where named products in specifications text are accompanied by the term "or equal", or other language of similar effect, comply with those contract document provisions concerning "substitutions" for obtaining Architect/Engineer's approval (by change order) to provide an unnamed product. This product must meet or exceed the original specified product specifications.

"Named", except as otherwise indicated, is defined to mean manufacturer's name for product, as recorded in published product literature, of latest issue as of date of contract documents. Refer requests to use products of a later (or earlier) model to Architect/Engineer's for acceptance before proceeding.

Standards, Codes and Regulations: Where only compliance with an imposed standard, code or regulation is required, selection from among products which comply with requirements including those standards, codes and regulations, is Contractor's option.

Performance Requirements: Provide products which comply with specific performances indicated, and which are recommended by manufacturer (in published product literature or by individual certification) for application indicated. Overall performance of a product is implied where product is specified with only certain specific performance requirements.

Prescriptive Requirements: Provide products which have been produced in accordance with prescriptive requirements, using specified ingredients and components, and complying with specified requirements for mixing, fabricating, curing, finishing, testing and similar operations in manufacturing process.

SUBSTITUTIONS:

Conditions: Contractor's request for substitution will be received and considered when extensive revisions to contract documents are not required and changes are in keeping with general intent of contract documents; when timely, fully documented and properly submitted; and when one or more of following conditions is satisfied, all as judged by Architect/Engineer. Otherwise, requests will be returned without action except to record non compliance with these requirements.

Where required product, material or method cannot be provided in a manner which is compatible with other materials of the work, or cannot be properly coordinated therewith,

or cannot be warranted as required, or cannot be used without adversely affecting Owner's insurance coverage on completed work, or will encounter other substantial non compliance which are not possible to otherwise overcome except by making requested substitution, which Contractor thereby certifies to overcome such non compatibility, non coordination, non warranty, non insurability or other non compliance as claimed.

Work Related Submittals: Contractor's submittal of (and Architect/Engineer's acceptance of) shop drawings, product data or samples which relate to work not complying with requirements of contract documents, does not constitute an acceptable or valid request for a substitution, nor approval thereof.

GENERAL PRODUCT REQUIREMENTS:

General: Provide products which comply with requirements, and which are undamaged and unused at time of installation, and which are complete with accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for intended use and effect.

Standard Products: Where available, provide standard products of types which have been produced and used previously and successfully on other projects and in similar applications.

Nameplates: Except as otherwise indicated for required approval labels, and operating data, do not permanently attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view either in occupied spaces or on exterior of the work.

Labels: Locate required labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface which, in occupied spaces, is not conspicuous.

Equipment Nameplates: Provide permanent nameplate on each item of service connected or poser operated equipment. Indicate manufacturer, product name, model number, serial number, capacity, speed, ratings and similar essential operating data. Locate nameplates on an easily accessed surface which, in occupied spaces, is not conspicuous.

PART 3 EXECUTION (not applicable)

END OF SECTION 01605

SECTION 01705 - PROJECT CLOSEOUTS

<u> PART 1 - GENERAL</u>

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

DESCRIPTION OF REQUIREMENTS:

<u>Definitions</u>: Closeout is hereby defined to include general requirements near the end of the Contract Time, in preparation for final acceptance, final payment, normal termination of contract, occupancy by Owner and similar actions evidencing completion of the work. Specific requirements for individual units of work are specified in sections of Divisions 2 through 16. Time of closeout is directly related to "Substantial Completion", and therefore may be a single time period for entire work which have been certified as substantially complete at different dates. That time variation (if any) shall be applicable to other provisions of this section.

PREREQUISITES TO SUBSTANTIAL COMPLETION:

<u>General</u>: Prior to requesting the Architect/Engineer's inspection for certification of substantial completion, (for either the entire work or for portions thereof), complete the following and list known exceptions in the request:

Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.

Obtain and submit releases enabling Owner's full, unrestricted use of the work and access to services and utilities (where required), include occupancy permits, operating certificates, and similar releases.

Deliver tools, spare parts, extra stocks of materials, and similar physical items to the Owner.

Attic stock or extra materials for the Owner are not to be used for punchlist or warranty work unless permission is given. In such case, the material is to be restocked and provided to the Owner.

Make final changeover of locks and transmit the keys to the Owner and advise the Owner's personnel of change over in security provisions.

Complete start up testing of systems, and instructions of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities and services from the project site, along with construction tools and facilities, mockups, and similar elements.

Complete final cleaning up requirements, including touch up of painting of marred surfaces.

Inspection Procedures: Upon receipt of the Contractor's request Architect/Engineer will either proceed with inspection or advise Contractor of unfilled prerequisites. Following the initial inspection, the Architect/Engineer will either prepare the certificate of

substantial completion or will advise the Contractor of work which must be performed prior to the issuance of certificate; and repeat the inspection when requested and when assured that the work has been substantially completed. Results of the completed inspection will form the initial "punch list" for final acceptance.

Attic Stock Quantities:

Vinyl Composition Tile:	(2) Boxes – Each Color
Rubber Base:	60 LF
Paint:	(1) 5-gallon - Each Color
	(1) 5-gallon – Each Accent Color

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
- Fuse Pullers: Two for each size and type.

SECTION 262913 - ENCLOSED CONTROLLERS

Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
- 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.
- Indicating Lights: Two of each type and color installed.
- Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
- Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

SECTION 265116 - INTERIOR LIGHTING

Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- Lamps: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
- Diffusers and Lenses: One for every 100 of each type and rating installed.
 Furnish at least one of each type.
- Fluorescent-luminaire-mounted emergency battery pack: One for every 40 emergency lighting unit.
- Globes and Guards: One for every 20 of each type and rating installed.
 Furnish at least one of each type.

SECTION 265219 - EMERGENCY AND EXIT LIGHTING

Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
- Luminaire-mounted, emergency battery pack: One for every 20 emergency lighting units. Furnish at least one of each type.
- Diffusers and Lenses: two for every 100 of each type and rating installed.
 Furnish at least one of each type.
- Globes and Guards: One for every 20 of each type and rating installed.
 Furnish at least one of each type.

SECTION 267240 - INTRUSION DETECTION

Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

 Intrusion Detection Devices: Furnish quantity equal to two percent of the number of units of each type installed, but no less than one of each type.

PREREQUISITES TO FINAL ACCEPTANCE:

<u>General</u>: Prior to requesting Architect/Engineer's final inspection for certification of final acceptance, and final payment, as required by the General Conditions, complete the following and list known exceptions, (if any), in request.

Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

Submit an updated final statement, accounting for final additional changes to the Contract Sum.

Submit certified copy of the Architect/Engineer's final punch list of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance and has been endorsed and dated by the Architect.

Submit consent of surety.

Re-inspection Procedure: Upon receipt of the Contractor's notice that the work has been completed, including punch list items resulting from earlier inspections, and excluding incomplete items delayed because of acceptable circumstances, the Architect/Engineer will re-inspect the work.

Upon completion of re-inspection, the Architect/Engineer will either prepare a certificate of final acceptance or will advise the Contractor of work that is incomplete or obligations not fulfilled, as required for final acceptance. If necessary, procedure will be repeated.

RECORD DOCUMENT SUBMITTALS:

<u>General</u>: Specific requirements for record documents are indicated in individual sections of these specifications. Other requirements are indicated in the General Conditions. General submittal requirements are indicated in the "Submittals" sections. Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire resistive location; provide access to record documents for Architect/Engineer's reference during normal working hours.

Record Drawings: Maintain a white print set (blue line or white prints of contract drawings and shop drawings in a clean, undamaged condition with mark up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing the actual "field" condition fully and accurately; however, where shop drawings are used for mark up, record a cross reference at the corresponding location on the working drawings. Mark with legible erasable pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Verify colors will be visible during scanning of record drawings. Mark up new information, which is recognized to be of importance to Owner, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed work that would be difficult to measure and record at a later date. Note related change order numbers where applicable. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on cover of each set.

Provide two electronic copies on CD of the record drawings to the Owner.

Record Specifications: Maintain one copy of specifications, including addenda, change orders and similar modifications issued in printed form during construction, and mark up variations (of substance) in the actual work in comparison with the text of the specifications and modifications as issued. Give particular attention to substitutions, selection of options and similar information on work where it is concealed or cannot otherwise be readily discerned at a later date by direct observation. Note related record drawing information and product data, where applicable. Upon completion of mark up, submit to Architect/Engineer for Owner's records.

Record Product Data: Maintain one copy of each product data submittal and mark up significant variations in actual work in performed in comparison with the submitted information. Include both variations in product as delivered to site, and variations from the manufacturer's instructions and recommendations for installation. Give particular attention to concealed products and portions of the work which cannot otherwise be readily discerned at a later date by direct observation. Note related change orders and mark up of record drawings and specifications. Upon completion of mark up, submit complete set to Architect/Engineer for the Owners' records.

Miscellaneous Record Submittals: Refer to other sections of these specifications for requirements of miscellaneous record keeping and submittals in connection with the actual performance of the work. Immediately prior to the date(s) of substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect/Engineer for the Owner's records.

Maintenance Manuals: Organize maintenance and operating manual information into suitable sets of manageable size and bind into individual binders properly identified and indexed (thumb tabbed). Include emergency instructions, spare parts listing, and copies of warranties, wiring diagrams, recommended "turn around" cycles, inspection procedures, shop drawings, product data, and similar applicable information. Bind each

manual of each set of data in a heavy duty 2", 3 ring vinyl covered binder, and include pocket folders for folded sheet information. Mark identification on both front and spine of each binder.

PART 2 PRODUCTS (not applicable)

PART 3 EXECUTIONS

CLOSEOUT PROCEDURES:

General Operating and Maintenance Instructions: Arrange for each installer of work requiring continuing maintenance or operation, to meet with Owner's personnel, at the project site, to provide basic instruction needed for proper operation and maintenance of the entire work. Include instructions by the manufacturer's representatives where installers are not experts in the required procedures. Review maintenance manuals, record documentation, tools, spare parts and materials, lubricants, fuels identification system, control sequences, hazards, cleaning and similar procedures and facilities. For operational equipment, demonstrate start up, shut down, emergency operations, noise and vibration adjustments, safety, economy and efficiency adjustments energy effectiveness, and similar operations. Review maintenance and operations in relation with applicable warranties, agreements to maintain, bonds and similar continuing commitments.

FINAL CLEANING:

<u>General</u>: Special cleaning for specific units of work is specified in sections of Divisions 2 through 16. General cleaning during the progress of the work is specified in General Conditions and as "Temporary Facilities" section of this Division. Provide final cleaning of the work, at time indicated, consisting of cleaning each surface or unit of work to normal "clean" condition expected for a first-class building cleaning and maintenance program. Comply with manufacturer's instructions for cleaning operations. The following are examples but not by way of limitation, of cleaning levels required.

Remove labels which are not required as permanent labels.

Clean transparent materials, including mirrors and window/door glass, to a polished condition, removing substances which are noticeable as vision obscuring materials. Replace broken glass and damaged transparent materials.

Clean exposed exterior and interior hard surface finishes to a dirt free condition, free of dust, stains, films and similar noticeable distracting substances. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surface. Restore reflective surfaces to their original reflective condition.

Wipe surfaces of mechanical and electrical equipment clean, including elevator equipment and similar equipment; remove excess lubrication and other substances.

Remove debris and surface dust from limited access spaces including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.

Clean concrete floors in non-occupied spaces broom clean. Vacuum clean carpeted surfaces and similar soft surfaces.

Clean plumbing fixtures to a sanitary condition, free of stains including those resulting

from water exposure.

Clean food service equipment to a condition of sanitation ready and acceptable for intended food service use.

Clean light fixtures and lamps so as to function with full efficiency.

Clean project site (yard and grounds), including landscape development areas, of litter and foreign substances.

Sweep paved areas to a broom clean condition; remove stains, petro chemical spills and other foreign deposits. Rake ground which are neither planted nor paved, to a smooth, even textured surface.

Pest Control: Engage an experienced exterminator to make a final inspection of project and to rid project of rodents, insects, and other pests.

Removal of Protection: Except as otherwise indicated or requested by the Architect/Engineer, remove temporary protection devices and facilities which were installed during the course of the work to protect previously completed work during the remainder of the construction period.

Compliance: Comply with safety standards and governing regulations for cleaning operations. Do not burn waste materials at the site. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile or other harmful or dangerous materials into drainage systems. Remove waste materials from site and dispose of in a lawful manner.

Close-Out Required Documents

Required Documents provided to Owner:

- 2 Sets of As-Built Drawings (Hard Copy)
 - o 1 Set is to be provided to County Facilities Manager
 - o 1 Set is to be provided to the Parks Director
- 2 CD of As-Built Drawings provided to County Facilities Manager
 - o 1 CD is to be provided to County Facilities Manager
 - 1 Cd is to be provided to the Parks Director
- 2 Sets of Close-Out Binders
 - o 1 Set is to be provided to County Facilities Manager
 - o 1 Set is to be provided to the Parks Director

Required Electronic Documents sent to Owner's Representative:

- Punch Lists
- Special Tests
- Special Inspector Sign-Off
- Asbestos Affidavit
- Certificate of Occupancy
- Certificate(s) of Substantial Completion
- Owner Training / System Demonstrations (Sign-In sheet w/ hours)
- Change Orders
- As-Built Drawings
- Spare Parts / Attic Stock (Transmittal of delivery to site & Parks sign-off)

- Subcontractor / Supplier Contact ListWarranties
- Elevation Certificates
- Final Release of Liens
- Consent of Surety

END OF SECTION 01705

SECTION 02060 - DEMOLITION

PART 1 - GENERAL:

SUBMITTALS:

The procedures proposed for the accomplishment of salvage and demolition work shall be submitted for approval. The procedures shall provide for safe conduct of the work, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations.

GENERAL REQUIREMENTS:

The work includes demolition or removal of all construction indicated or specified. All materials resulting from demolition work, except as indicated or specified otherwise, shall become the property of the Contractor and shall be removed from the limits of the property. Rubbish and debris shall be removed from the property daily unless otherwise directed so as to not allow accumulation inside or outside the building. Materials that cannot be removed daily shall be stored in areas specified by the Architect.

DUST CONTROL:

The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to occupied portions of the building and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create hazardous or objectionable conditions such as ice, flooding and pollution.

PROTECTION:

1. Protection of Existing Work: Before beginning any cutting or demolition work, the Contractor shall carefully survey the existing work and examine the drawings and specifications to determine the extent tot the work. The Contractor shall take all necessary precautions to insure against damage to existing work to remain in place, to be reused, or to remain the property of the owner, and any damage to such work shall be repaired or replaced as approved by the Architect at no additional cost to the owner. The Contractor shall carefully coordinate the work of this section with all other work and construct and maintain shoring, bracing and supports, as required. The Contractor shall insure that structural elements are not overloaded and be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under any part of this contract.

2. Protection of building from the Weather: The interior of the building and all materials and equipment shall be protected form the weather at all times.

3. Protection of Trees: Trees within the project site which might be damaged during demolition, and which is indicated to be left in place shall be protected by a 6-foot high fence. The fence shall be securely erected a minimum of 5-feet from the trunk of individual trees of follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the work under this contract shall be replaced.

4. Environmental protection: All work and Contractor operations shall comply with the requirements of SECTION: ENVIRONMENTAL PROTECTION.

BURNING: The use of burning at the project site of the disposal of refuse and debris will not be permitted.

USE OF EXPLOSIVES: Use of explosives will not be permitted.

PART 2 - EXECUTION:

EXISTING FACILITIES:

1. Structural, Walls, and Partitions: Existing walls and partitions indicated shall remain.

DISPOSITION OF MATERIAL:

1. Title of Materials: Title to all materials and equipment to be demolished, excepting owners salvage and historical items, is vested in the Contractor upon receipt of notice to proceed. The owner will not be responsible for the condition, loss or damage to such property after notice to proceed.

2. Material for Contractor Salvage: Material for salvage shall be stored as approved by the Architect. Salvage materials shall be removed form Owner's property before completion of the Contract. Material for salvage shall not be sold on the site.

CLEAN UP:

1. Debris and Rubbish: Debris created by the demolition of existing roofs shall be removed form site and buildings.

2. Debris Control: Debris shall be removed and transported in a manner as to prevent spillage on streets or adjacent areas.

3. Regulations: Local regulations regarding hauling and disposal apply.

END OF SECTION 02060

PART 1 - GENERAL

- 1.1 SUMMARY
 - A. Site preparation shall include furnishing necessary equipment and labor to remove vegetation and rubbish and the placement of approved excess excavation in conformity with the lines, grades, dimensions, and details shown on the Contract Documents.
 - B. Within limits shown on the Contract Documents, or in areas where existing grade is altered, strip existing topsoil to a depth of 6-inches and stockpile in approved areas for subsequent replacement. Contractor to remove and dispose of all excess materials.
- 1.2 RELATED SECTIONS
 - A. Section 02060 Demolition
- 1.3 REFERENCES
 - A. ASTM D698-1991: Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft [600 kN-m/m]).
- 1.4 DEFINITIONS
 - A. Borrow. Material taken from designated areas to make up any deficit of excavated material.

1.5 SUBMITTALS AND WORK

A. Coordinate activities with other work being performed so as not to cause any interruption of activities being completed under other Sections of the Contract Documents.

1.6 REGULATORY REQUIREMENTS

- A. Work under this Section shall conform to applicable City Regulations for disposal of debris, including safety requirements during performance of the work.
- B. Work under this Section shall be coordinated with utility companies and any the management of any existing facilities in order to prevent any disruption in operation and/or utility service.
- C. Permits, fees, disposal charges and licenses shall be secured and paid by Contractor.

PART 2 - PRODUCTS

- 2.1 MANUFACTURER(S) (not used)
- 2.2 EQUIPMENT
 - A. The Contractor may use equipment and materials necessary to properly complete the tasks described under this Section.
- 2.3 MATERIALS
 - A. Fill:
 - 1. Source: Obtain embankment fill from required excavation or, if excavated material is insufficient, from borrowed areas approved by the Geotechnical Engineer.

- Suitability: Use the best material available from excavation or borrow. Suitability of fill material is subject to the Geotechnical Engineer's approval.
- 3. Quality: Fill material must be free of excessive silts. Do not use soil containing brush, roots, sod or similar perishable material.
- 4. Excess Excavation: Use excess excavation or borrowed material with prior approval of the Engineer. Borrow material from the approved source and excavate. On completion of work borrowed area to be cleaned and dressed. Reuse of material stripped from borrow site is not allowed unless specifically indicated on the Drawings.
- 2.4 FABRICATION (not used)
- 2.5 QUALITY CONTROL
 - A. Fill materials to be acquired as specified in Plans and/or by the Geotechnical Engineer.
- PART 3 EXECUTION
- 3.1 GENERAL
 - A. Verify existing plant life designated to remain and tag as such.
 - B. Locate, identify and protect all utilities.
 - C. Locate, identify and protect bench marks and existing structures.
 - D. Maintain surface drainage on site during construction. Remove unsatisfactory fill material and waste vegetation from jobsite and dispose of properly.

3.2 PRESERVATION AND RESTORATION

- A. Protect trees that are to remain in the project area or in adjacent areas. Take special care not to damage trees outside limits of construction.
- B. Fill depressions made by grubbing with suitable material to make new surface conform to the existing adjacent ground surface.
- C. Final Cleanup: Level washes, ruts, depressions, and mounds to give areas smooth finish.

3.3 CLEARING

- A. Remove designated trees and shrubs along with stumps, roots, rubbish and other objectionable material from the designated areas.
- B. Remove grass and weeds to a depth of two (2) inches below existing soil line.
- C. Remove stumps, roots, muck and spongy materials within the area to a depth of eighteen (18) inches.
- D. For areas where paving will be built remove stumps and roots within pavement section to depth of two feet below finish subgrade elevation.
- E. Provide demolition as required and specified in Section 02115 and the Drawings.

3.4 REMOVING MATERIAL

A. Unless otherwise specified, cleared and grubbed material shall become property of the Contractor and be removed from the work site or disposed of in manner not to damage the Owner.

B. Burning of cleared and grubbed material on the Owner's property is not permitted.

END OF SECTION

SECTION 02200 EARTHWORK

PART 1 GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Extent of earthwork is indicated on drawings.

Preparation of subgrade for building slabs, walks, and pavements is included as part of this work.

Backfilling of trenches within building lines is included as part of this work.

<u>Definition</u>: "Excavation" consists of removal of material encountered to subgrade elevations indicated and subsequent disposal of materials removed.

QUALITY ASSURANCE:

<u>Codes and Standards</u>: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

Testing and Inspection Service:

Employ, at Contractor's expense, testing laboratory to perform soil testing and inspection service for quality control testing during earthwork operations.

SUBMITTALS:

<u>Test Reports Excavating</u>: Submit following reports directly to Architect/Engineer from the testing services, with copy to Contractor:

Field density test reports.

One optimum moisture maximum density curve for each type of soil encountered.

Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.

JOB CONDITIONS:

<u>Site Information</u>: Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings. It is expressly understood that Owner will not be responsible for interpretations or conclusions drawn therefrom by Contractor. Data are made available for convenience of Contractor.

<u>Existing Utilities</u>: Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of support and protection during earthwork operations.

Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

<u>Protection of Persons and Property</u>: Barricade open excavations occurring as part of this work and post with warning lights.

Operate warning lights as recommended by authorities having jurisdiction.

Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

Perform excavation within drip line of large trees to remain by hand and protect the root system from damage or dry out to the greatest extent possible. Maintain moist condition for root system and cover exposed roots with burlap. Paint root cuts of 1" diameter and larger with emulsified asphalt tree paint.

PART 2 PRODUCTS

SOIL MATERIALS:

General:

<u>Backfill and Fill Materials</u>: Provide satisfactory soil materials for backfill and fill, free of clay, rock or gravel larger than 3" in any dimension, debris, waste, frozen materials, vegetable matter, and other deleterious matter. Uses excavated or borrow material that has been sample, tested and approved as satisfactory material. Backfill excavations as promptly, as the work permits, but not backfill until completion of all inspections, testing, approvals, and recording locations of underground utilities.

<u>Select Fill</u>: Fill under all floor slabs (and Extending 5'-0" beyond the building area), walks, and paved areas to consist of low plasticity index materials (12 or less) as approved by the Architect which is to be placed in 8" layers and compacted by use of sheep foot rollers, pneumatic tired roller, tamp rollers or other compaction equipment capable of obtaining the required density thru out the entire layer. This material shall be predominately sandy in nature, ideally with enough binder to facilitate trenching operations, and with more than 50% retained on a #200 sieve. On-site materials are generally acceptable for use but should be laboratory tested for compliance.

<u>Sand Cushion</u>: Material immediately below sidewalks and at other locations indicated on the drawings shall consist of a clean sand, free of silts, fines, or other organic impurities capable of supporting the migration of water, as approved by the Architect. This material shall be loosely compacted as in typical screeding and placement operations.

<u>Dirt Fill</u>: Fill dirt approved by the Architect shall be furnished, hauled, and spread on the site by this Contractor at all locations where other materials are not specified, and in

accordance with drawings. <u>High PI soils are not to be used for dirt fill or in landscape</u> areas.

<u>All other materials</u>, not specifically described but required for proper completion of the work of this Section, shall be as selected by the Contractor subject to the approval of the Architect.

PART 3 EXECUTION

GENERAL:

<u>Ground Surface Preparation</u>: remove vegetation, debris unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

When the existing ground surface is a density less than that specified under "Compaction" for the particular area classification, break up the optimum moisture content, and compact to the required depth and percentage of maximum density.

EXCAVATION:

Excavation to grades shown on drawings if grades not shown excavate as required to accommodate installation.

<u>Excavation consists</u> of the removal and disposal of all materials encountered to obtain the required subgrade elevations, including earth, rock, etc., necessary for footings, columns, beams, slabs, etc.

<u>Unauthorized Excavation</u>: Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations without the specific direction of the Architect.

<u>Backfill and compact</u> unauthorized excavations as specified for authorized excavations of the same classification, unless otherwise directed by the Architect.

Excavation for Pavements: Cut the ground under pavements to comply with the cross sections, elevations, and grade as shown on the drawings.

<u>Excavation for Ditches</u>: Cut ditches to the cross sections and grades as shown on the drawings. Deposit excavated materials a sufficient distance from the edges of ditches to prevent cave ins or material falling or sliding into ditch. Keep ditches free of an accumulation of leaves, sticks and other debris until final acceptance of work.

<u>Removal of Unsatisfactory Soil Materials</u>: Excavate unsatisfactory soil materials encountered that extend below the required elevations, to the additional depth directed by the Architect. Such additional excavation, provided it is not due to the fault or neglect of the Contractor, will be measured as directed by the Architect and paid for by the Owner as a change in the work. Where the removal of unsatisfactory soil materials, is due to the fault or negligence of the Contractor in his performance of earthwork ad site grading operations, excavate the resulting unsatisfactory soil material and replace with compacted satisfactory soil material as required. <u>Unauthorized excavation</u> consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be at Contractor's expense.

Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required too elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Architect.

Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Architect.

<u>Additional Excavation</u>: When excavation has reached required subgrade elevations, notify Architect who will make an inspection of conditions.

If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Architect.

Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

<u>Stability of Excavations</u>: Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

Maintain sides and slopes of excavations in safe condition until completion of backfilling.

<u>Shoring and Bracing</u>: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross braces, in good serviceable condition. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

<u>Dewatering</u>: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to collecting or run off areas. Do not use trench excavations as temporary drainage ditches.

<u>Material Storage</u>: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

Locate and retain soil materials away from edge of excavations. Do not store within drip line of trees indicated to remain.

Dispose of excess soil material and waste materials as herein specified.

<u>Excavation for Structures</u>: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10' and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.

In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

Do not backfill trenches until tests and inspections have been made and backfilling authorized by Architect. Use care in backfilling to avoid damage or displacement of pipe systems.

<u>Cold Weather Protection</u>: Protect excavation bottoms against freezing when atmospheric temperature is less than 35° F. (1°C).

COMPACTION:

<u>General</u>: Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated below.

<u>Percentage of Maximum Density Requirements</u>: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well defined moisture density relationship (cohesive soils) determined in accordance with ASTM D 1557; and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well defined moisture density relationship (cohesion-less soils).

<u>Structures, Building Slabs</u>: Compact subgrade and each layer of backfill or fill material at 95% relative density.

<u>Lawn or Unpaved Areas</u>: Compact top 6" of subgrade and each layer of backfill or fill material at 85% maximum density for cohesive materials and 90% relative density for cohesion-less soils.

<u>Walkways</u>: Compact top 6" of subgrade and each layer of backfill or fill material at 90% relative density.

<u>Moisture Control</u>: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.

Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

BACKFILL AND FILL:

<u>General</u>: Place acceptable soil material in layers to required subgrade elevations, for each area classification listed below.

In excavations, uses satisfactory excavated or borrow material.

Under grassed areas, use satisfactory excavated or borrow material.

<u>Under walks and pavements</u>, use subbase material or satisfactory excavated or borrow material, or combination of both.

Under building slabs, use drainage fill material.

<u>Backfill excavations</u> as promptly as work permits, but not until completion of the following:

Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation. Inspection, testing, approval, and recording locations of underground utilities.

Removal of concrete formwork.

Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities or leave in place if required.

Removal of trash and debris.

Permanent or temporary horizontal bracing is in place on horizontally supported walls.

<u>Ground Surface Preparation</u>: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture condition to optimum moisture content, and compact to required depth and percentage of maximum density.

<u>Placement and Compaction</u>: Place backfill and fill materials in layers not more than 8" in loose depth for material compacted by heavy compaction equipment, and not more than 4" in loose depth for material compacted by hand operated tampers.

Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

GRADING:

ROUGH GRADING

After excavation is made to lines shown on the Drawings, and under proposed embankments and structures, as adjusted for topsoil and landscaping depths, remove soft or undesirable material as specified in this Section. Break down sides or holes or depressions to flatten the slopes.

Locate and correct any irregularities in the subsoil, filling each depression with the appropriate subsoil resulting in a level surface. Place any fill necessary in layers moistened and compacted as specified in this Section.

Shape all areas designated for grading, including cut and fill areas, to receive a minimum of 4-inches of topsoil. Topsoil depth at areas receiving landscaping, shrubs or trees shall be coordinated through Landscaping Sections and Drawings

Scarify subsoil to a depth of 4 inches where topsoil is scheduled and in areas where subsoil has been compacted due to equipment activity. Shape all areas designated for grading, including cut and fill areas, to receive a minimum of four inches of topsoil.

Verify that subsoil has been appropriately contoured and shaped.

Tolerance on top surface of subgrade is plus/minus 1/10 foot.

FINISH GRADING

Place topsoil in areas where seeding, sodding and planting is indicated on Drawings or otherwise scheduled.

Place topsoil while soil is dry and during dry weather. Perform topsoil spreading so that planting can proceed with little additional tillage or soil preparation. Fine grade topsoil, eliminating rough or low rough areas. Manually place topsoil around trees, plants, and buildings to prevent any damage. Lightly compact topsoil.

Verify that finish grades and contours as indicated on Drawings have been maintained after placement of topsoil and any landscape soil.

Tolerance of finish grade is plus/minus 1/2".

FIELD QUALITY CONTROL

<u>Quality Control Testing During Construction</u>: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.

Perform field density tests in accordance with ASTM D 1556 (sand cone method), ASTM D2922-81 (nuclear density method), ASTM D 2167 (rubber balloon method), as applicable.

<u>Footing Subgrade</u>: For each strata of soil on which footings will be placed, conduct at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to Architect.

<u>Building Slab Subgrade</u>: Make at least one field density test of subgrade for every 2000 sq. ft. of building slab, but in no case less than 3 tests. In each compacted fill layer,

make one field density test for every 2000 sq. ft. of overlaying building slab but in no case less than 3 tests.

If in opinion of Architect, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional expense.

MAINTENANCE:

<u>Protection of Graded Areas</u>: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.

Repair and re-establish grades in settled, eroded, and rutted areas too specified tolerances.

<u>Reconditioning Compacted Areas</u>: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re shape, and compact to required density prior to further construction.

<u>Settling:</u> Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work and eliminate evidence of restoration to greatest extent possible.

DISPOSAL OF EXCESS AND WASTE MATERIALS:

<u>Removal to Designated Areas on Owner's Property</u>: Transport acceptable excess excavated material to designated soil storage areas on Owner's property. Stockpile soil or spread as directed by Architect.

<u>Removal from Owner's Property</u>: Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it off Owner's property.

END OF SECTION 02200

SECTION 02444 VINYL COATED CHAIN LINK FENCES AND GATES

PART 1 GENERAL

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

DESCRIPTION OF WORK:

Extent of vinyl coated chain link fences and gates is shown on drawings.

QUALITY ASSURANCE

Provide chain link fences and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.

SUBMITTALS

<u>Submit Product data</u> in the form of manufacturer's technical data, specifications, and installation instructions for metal fencing and gates.

PART 2 PRODUCT

<u>GENERAL</u>

Exterior Chain Link Fence 7ft High (Match Existing) Black Vinyl, and Black Vinyl Posts

Dimensions shown form pipe, roll formed, and H sections are outside dimensions.

MANUFACTURERS

Vinyl Coated Steel Fencing and Fabric: Allied Tube and Conduit Corp. Anchor Fence, Inc. Colorguard Corp. Davis Walker Corp. Dominion Fence and Wire Prod. United States Steel. Merchants Metals

STEEL FENCING (STFN):

<u>Fabric:</u> No. 9 ga. (0.148") finished steel wires, 2" mesh, with top selvages knuckled for fabric 60" high and under, and both top and bottom selvages twisted and barbed for fabric over 60" high. Furnish one-piece fabric widths for fencing up to 12' high.

<u>Fabric coating</u>: The zinc coating of the fabric shall be minimum .30 oz./sq. ft. of uncoated wire surface. The weight of zinc coating on the fabric shall be determined in accordance with ASTM A-90.

<u>PVC:</u> Wire shall be coated with a minimum of 7 mils of poly-vinyl chloride permanently bonded to the galvanized wire by the thermal fusion bonded method. Chain link fabric shall conform to the requirements of ASTM F-668, class 2b.

HARDWARE AND ACCESSORIES:

Framework: Galvanized steel, ASTM A 120 or A 123, with not less than 2.0 oz. zinc per sq. ft. of surface. <u>All framework and components shall be coated with 10 to 15 mils of PVC.</u>

End, Corner, and Pull Posts: Minimum sizes and weights as follows:

<u>Up to 6 feet fabric height</u>: 2.375 inch OD steel pipe, 3.65 lbs. per lin. ft., or 3.5 inch by 3.5 inch roll formed sections weighing 4.85 lb. per lin. ft.

Over 6 feet fabric height: 2.875 inch OD steel pipe, 5.79 lbs. per lin. ft., or 3.5 inch by 3.5 inch roll formed sections weighing 4.85 lbs. per lin. ft.

<u>Line posts</u> Space 10' o.c. maximum, unless othewise indicated, of following minimum sizes and weights.

<u>Up to 6 feet fabric height</u>: 1.90 inch OD steel pipe, 2.70 lbs. per lin. ft. or 1.875" x 1.625" C sections, 228 lbs. per lin. ft.

<u>6' to 8' fabric height</u>, 2.375" OD steel pipe, 3.65 lbs. per lin. ft. or 2.25" x 1.875" H sections, 2.64 lbs. per lin. ft.

Over 8 feet fabric height: 2.875 inch OD steel pipe, 5.79 lbs. per lin. ft. or 2.25" x 1.875" H sections, 3.26 lbs. per lin. ft.

<u>Gate Posts</u>: Furnish posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:

Leaf Width	Gate Post	Lbs./Lin. Ft.
Up to 6'	3.5" x 3.5" roll formed	4.85
	section or 2.875" OD	pipe 5.79
Over 6' to 13'	4.000" OD pipe	9.11
Over 13' to 18'	6.625" OD pipe	18.97
Over 18'	8.625" OD pipe	28.55

<u>Tension Wire</u>: 7 gage, coated coil spring wire, metal finish to match fabric. Locate wire at bottom of fabric.

<u>Top Rail:</u> Provide 1 -5/8" diameter galvanized steel.

<u>Post Brace Assembly</u>: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid height of fabric. Use same material as top rail for brace, and truss to line posts with 0.375"diameter rod and adjustable tightener.

Post Tops: Weathertight closure cap for tubular posts. Provide one cap for each post.

<u>Stretcher Bars</u>: One piece lengths equal to full height of fabric, with minimum cross section of $3/16" \times 3/4"$. Provide one stretcher bar for each gate and end post, and two for each corner and pull post, except where fabric is integrally woven into post.

<u>Corner Bracing</u>: Install diagonal cross bracing consisting of 3/8" diameter adjustable length truss rods on corner posts to ensure frame rigidity without sag or twist, if required.

<u>Stretcher Bar Bands:</u> Space not over 15" oc., to secure stretcher bars to end, corner, pull and gate posts.

GATES

<u>Fabrication</u>: Fabricate gate perimeter frames of 1.90" OD pipe. Metal and finish to match fence framework. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware, and accessories. Space frame member's maximum of 8 feet apart.

Assemble gate frames by welding or with special fittings and rivets, for rigid connections. Use same fabric as for fence, unless otherwise indicated. Install fabric with stretcher bars at vertical edges. Bars may also be used at top and bottom edges. Attach stretchers to gate frame at not more than 15" o.c. Attach hardware to provide security against removal or breakage.

Install diagonal cross bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist, if required.

Gate Hardware: Furnish the following hardware and accessories for each gate.

<u>Hinges:</u> Size and material to suite gate size, non lift off type, offset to permit 180 deg gate opening. Provide 1 1/2 pair of hinges for each leaf over 6 foot nominal height.

<u>Latch</u>: Forked type or plunger bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

<u>Keeper</u>: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it in open position until manually released.

<u>Sliding Gates</u>: Provide manufacturer's standard heavy duty track, ball bearing hanger sheaves, overhead framing and supports, guides, stays, bracing, hardware, and accessories as required.

<u>Wire Ties:</u> For tying fabric to line posts, use wire ties spaced 12" o.c. For typing fabric to rails and braces, use wire ties spaced 24" o.c. For tying fabric to tension wire, use hog rings spaced 24" o.c.

Manufacturer's standard procedure will be accepted if of equal strength and durability.

Concrete: Provide concrete consisting of Portland cement, ASTM C150, aggregates, ASTM C33, and clean water. Mix materials to obtain concrete with a minimum 28 day compressive strength of 2500 psi using at least 4 sacks of cement per cu. yd., 1" maximum size aggregate, maximum 3" slump, and 2% to 4% entrained air.

PART 3 EXECUTION

INSTALLATION

Do not begin installation and erection before final grading is completed, unless otherwise

permitted.

Excavation: Drill holes for posts to diameters and spacings shown, in firm, undisturbed or compacted soil.

If not shown on drawings, excavate holes for each post to minimum diameter recommended by fence manufacturer.

Unless otherwise indicated, excavate hole depths approximately 3 inches lower than post bottom, with bottom of posts set not less than 36 inches below finish grade surface.

Setting Posts: Center and align posts in holes 3 inches above bottom of excavation.

Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.

<u>Center Rails</u>: Provide center rails where shown. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.

<u>Brace Assemblies</u>: Install braces so posts are plumb when diagonal rod is under proper tension.

<u>Tension Wire</u>: Install tension wires before stretching fabric and tie to each post with not less than 6 ga. galvanized wire. Fasten fabric to tension wire using 11 gage galvanized steel hog rings of spaced 24 inches o.c.

<u>Fabric</u>: Leave approximately 2 inches between finish grade and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

<u>Stretcher Bars</u>: Thread through or clamp to fabric 4 inches o.c., and secure to posts with metal bands spaced 15 inches o.c.

<u>Gates</u>: Install gates plumb, level, and secure for full opening without interference. Install ground set items in concrete for anchorage as recommended by manufacturer. Adjust hardware for smooth operation and lubricate where necessary.

<u>Tie Wires</u>: Use U shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least 2 full turns. Bend wire to minimize hazard to persons or clothing.

<u>Fasteners</u>: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

END OF SECTION 02444

SECTION 02514 CONCRETE WALKS

PART 1 - GENERAL

RELATED DOCUMENTS:

Requirements of Drawings, General and Supplementary Conditions and Division-1 apply to work of this section.

SCOPE:

Provide all concrete walk, curb and paving work including but not necessarily limited to: Walks

Related work specified elsewhere:

Earthwork	Section 02200
Concrete Work	Section 03010
Joint Sealers	Section 07900

QUALITY ASSURANCE:

Comply with local governing regulations of more stringent than herein specified.

SUBMITTALS:

Furnish samples, manufacturer's product data, test reports and materials certifications as required in the referenced Sections for concrete and joint fillers and sealers. Submit data on color admixtures or color finish materials and samples of exposed aggregate if applicable to project.

QUALITY ASSURANCE:

Cast mockup of size directed by Architect of each type of concrete walk to demonstrate typical joints, surface finish, texture, color, and standard of workmanship for Architect's review and acceptance.

When Architect determines that mockup does not meet requirements, demolish, and review if from the site and cast another until the mockup is accepted.

Keep accepted mockup undisturbed during construction as a standard for judging completed paving. Undamaged mockup may be incorporated into the work.

Demolish accepted mockup and remove from site when directed by Architect.

PROJECT CONDITIONS

Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2 - MATERIALS

Forms: steel, wood or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use

straight forms, free of distortion and defects, to provide continuous, straight, smooth exposed surfaces.

Use flexible spring steel forms of laminated boards to form radius bends as required.

Coat forms with a non-staining form release agent that will not discolor or deface the surface of the concrete.

Plain, cold-drawn steel wire: ASTM A182.

Welded wire mesh: Welded plain cold-drain steel wire fabric, ASTM A 185.

Furnish in flat sheets, not rolls, unless other acceptable to Architect.

Reinforcing bars: deformed steel bars, ASTM A615, Grade 60, unless otherwise indicated.

Joint dowel bards: plain steel bars, ASTM A 615, Grade 60, unless otherwise indicated. But bards true to length with ends square and free of burrs.

Metal expansion caps: furnish for one end of each dowel bar in expansion joints. Design caps with one end closed and a minimum length of 3" to allow bar movement of not less than 1", unless otherwise indicated.

Hook bolts: ASTM A307, Grade 1 Bolts, internally and externally threaded. Design hook bolt joint assembly to hold the coupling against pavement form and in position during concreting operation and to permit removal without damage to concrete or hook bolt.

Supports for reinforcement: chairs, spacers, dowel bar supports and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric and dowels in place. Use wire type for supports complying with CRSI specifications.

Use support with sand plates or horizontal runners where base material will not support chair legs.

Concrete materials: comply with requirements of applicable DIVISION 3 Sections for concrete materials, admixtures, bonding materials, curing materials and others as required.

Bonding Agent: Acrylic or styrene butadiene.

Expansion joint materials: comply with requirements of SECTION 07900 for preformed expansion joint fillers and sealers.

CONCRETE MIX, DESIGN & TESTING

Comply with requirements of applicable DIVISION 3 Sections for concrete mix design, sampling and testing, and quality control and as herein specified.

Design the mix to produce standard -weight concrete consisting of portland cement, aggregate and water to produce the following properties:

Compressive strength:	3000 psi, minimum at 28-days
Slump range:	2" to 4"

PART 3 - EXECUTION

INSPECTION:

Examine areas and conditions under which concrete walks are to be installed. Do not proceed with the work until satisfactory conditions have been corrected.

SURFACE PREPARATION

Remove loose material from compacted sub-base surface immediately before placing concrete.

Proof-roll prepared sub-base surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

FORM CONSTRUCTION

Set forms to required grades and lines, rigidly braced, and secured.

Install sufficient quantity of forms to allow continuous progress of the work and so that forms can remain in place at least 24-hours after concrete pavement.

Check completed formwork for grade and alignment to the following tolerances:

Top of forms not more than 1/8" in 10'

Vertical face on longitudinal axis, not more than 1/4" in 10'

Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

REQUIREMENTS

Locate, place and support reinforcement as specified in SECTION 03010.

CONCRETE PLACEMENT

Comply with requirements of SECTION 03010 for mixing and placing concrete and as herein specified.

Do not place concrete until sub-base and forms have been checked for lime and grade. Moisten sub-base if requirements to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment. Remove snow, ice or frost from subbase surface and reinforcing before placing concrete.

Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse, joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square=faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than $\frac{1}{2}$ hour, place a construction joint.

When adjacent walks are placed in separate pours, do not operate equipment on concrete until concrete has attained sufficient strength to carry the loads without injury.

JOINTS

Construct expansion, weakened-plane (construction), and construction joints true-to-line with face perpendicular to surface of concrete, as shown on drawings. Construct transverse joints at right angles to centerline, unless otherwise indicated.

When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on Drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:

Tooled joints: form weakened-plane joints in fresh concrete by grooving and finishing edges with a radiused jointing tool.

Provide expansion joints of pre-molded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.

Locate expansion joints, unless otherwise indicated, at following spacings: Walks 40' - 0" o.c.

Extend joint fillers full-width and depth of joint, and not less than $\frac{1}{2}$ " or more than 1" below finished surface where joint sealer is indicated. If not joint sealer, place top of joint filler flush with finished concrete surfaces.

Furnish joint fillers in one-piece lengths for full width being placed, where possible. Where more than one length is required, lace or clip joint filler sections together.

Protect top edge of joint filler during concrete placement with a metal cap or other temporary materials. Remove protection after concrete has been placed on both sides of joint.

Comply with requirements of SECTION 01900 for preparation of joints, materials, installation, and performance, and as herein specified.

Where load transfer-slip dowel devices are used, install so that one end of each dowel bar is free to move.

CONCRETE FINISHING

After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compare surfaces and produce a uniform texture.

After floating, test surface for trueness with a 10' straightedge.

Distribute concrete as required to remove surface irregularities and refloat repaired areas to provide a continuous smooth finish. Finish surfaces to true planes within a tolerance of 1/4" in 10 feet in any direction.

Work edges of slabs, gutters, back to p edge of curb, and formed joints with an edging tool, and round to 3/8" radius, unless otherwise indicated.

Eliminate any tool marks on concrete surface.

After completion of floating and when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

Provide light broom finish by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Architect.

On inclined slab surfaces, provide a course, non-slip finish by scoring surface with a stiffbristled broom, 1/16" to 1/8" deep, perpendicular to line of traffic.

Do not remove forms for 24-hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects as directed by Architect.

CURING

Protect and cure finished concrete surfaces, complying with applicable requirements of SECTION 03010. Use moist-curing methods for initial curing whenever possible.

REPAIRS & PROTECTIONS

Remove and replace broken, damaged, or defective concrete, concrete with defective finishes, or concrete that does not meet the requirements of this Section.

Protect concrete from damage until acceptance of work. Exclude traffic from walks for at least 14-days after placement. When construction traffic is permitted, maintain walks as clean as possible by removing surface stains and spillage of materials as they occur and covering with suitable cover.

Maintain concrete walks free of stains, discolorations, dirt and other foreign material, sweep and clean concrete walks just prior to Substantial Completion inspection.

Protect adjacent construction from concrete splatter. Clean off any splatter and remove any concrete spills from ground surfaces.

END OF SECTION

SECTION 02810 – IRRIGATION

PART 1 – GENERAL

1.01 SCOPE

A. An automatic underground irrigation system for exterior landscaped areas including, but not limited to, supply an installation of water meter, backflow device and controller, boring and sleeving, rotary heads and spray heads in lawn areas and spray heads and drip lines in shrub, ground cover, and flower bed areas.

NOTE:

This project is a nature park and funded through grants with Texas Parks & Wildlife (TPWD). The project site has sensitive and valuable native vegetation & habitat. The grant and specifications require the contractor to protect all existing vegetation on the project site. Any damage to existing vegetation shall be the responsibility of the general contractor and shall be replaced with equal size and species as approved by SSP/CC.

1.02 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Provide connection to water source (existing mainline) and new water meters as specified and in accordance with local code requirements.
 - 2. Provide for an electro-mechanical controller.
- B. Performance Requirements: Provide for irrigation at a rate of 1 in. per week applied at 2 or 3 day intervals.

1.03 QUALIFICATIONS

A. Irrigation work to be performed by a Texas licensed irrigation company specializing in commercial irrigation installation with a minimum of five (5) years experience on similar projects. Owner/SSP Design to review qualifications and approve subcontractor prior to commencing work.

1.03 SCHEDULE OF VALUES

- A. Landscape/Irrigation subcontractor shall submit costs for GC schedule of values as follows:.
 - 1. Irrigation Sleeving
 - 2. Irrigation Water Meter, Backflow, Permits, Testing
 - 3. Irrigation System
 - 4. Landscape Athletic Field Grading and Soil Mix
 - 5. Landscape Athletic Field Sod
 - 6. Landscape Planting, Materials, Installation, Warranty
 - 7. Landscape / Irrigation 90 Day Maintenance

1.04 SUBMITTALS

A. Submittals shall be formatted electronically in a PDF file with a table of contents and tabs

SECTION 02810 – IRRIGATION

identifying each section. The following submittals are required for this section:

 Product Data: Manufacturers' technical data (Cut Sheets) and installation information for all components including: Backflow Assembly (Pressure Vacuum Breaker PVB or Reduced Pressure, Backflow Preventer RPZ (as specified), Y strainer (if required), Ball valves, PVC pipe, PVC fittings, PVC primers, solvents, cement, glue, etc., Control wire / tracking wire, Wire connectors, Pump stations, booster pumps (if specified), Pump enclosures (if specified), Controller (incl. communications modules, etc.), Rain/freeze sensors, Valves, Valve boxes, Decoders (if specified), Rotors, Sprays, Nozzles, Bubblers, Drip line, Drip filters, Drip indicators (Operind), Air relief valves, flow sensor.

1.05 QUALITY CONTROL

A. Submit verification of water pressure at meter or point of connection.

1.06 MAINTENANCE/WARRANTY

- A. Provide the following extra materials to the Owner:
 - 1. Two (2) quick coupler hose bib keys.
 - 2. Four (4) keys for the controller door lock.
- B. Maintenance Requirements: Maintain the work of this Section for ninety days after 'substantial completion' and until final acceptance by Owner. Notify the owner in writing of 'substantial completion'. Maintenance period begins after owner's acceptance of 'substantial completion'.
- C. Maintenance Service: Perform the following maintenance operations at least once a week during construction and for 90 day maintenance period after substantial completion:
 - 1. Test entire system and adjust timer as necessary and as directed by landscape contractor, landscape designer or owner.
 - 2. Ensure and confirm existing irrigation system is operational and functioning properly. Existing irrigation system must remain fully functional and operational during the construction period and for 90 days after substantial completion.
 - 3. Replace or repair any broken parts or equipment.
 - 4. Report any significant problems in writing to landscape contractor, owner and landscape designer.
- D. Warranty: Warranty shall cover all parts and equipment for a period of one year from the date of final acceptance. Repairs and replacements shall be completed within two weeks of notification from owner.

PART 2- PRODUCTS

2.1 MATERIALS

A. PVC Plastic Pipe: ASTM D 2241-83, SDR21, class 160 lateral piping; ASTM D1785, class 200 mainline piping.

- B. Pipe Fittings:
 - 1. Pipe under 3 in., id: Socket type, ASTM D 2466-78, with solvent Cement, ASTM D 2564-80.
 - 2. Pipe 3 in. id and Larger: Gasketed fittings of epoxy coated steel with non-hardening pipe dope or Teflon tape for threads.
- C. Concrete: 2500 psi min. compressive strength.

2.2 MANUFACTURED UNITS

- A. Controller: Electro-mechanical, 24 hr./14-day clock with manual operation capacity, with adequate number of stations for system operating requirements (two wire) (see irrigation equipment table). Provide both freeze-protection and rain-sensor devices with controller. Provide ground-fault interrupt and lightning protection. Provide flow sensor, flow control, and IQ System and software. Contractor to coordinate setup and connection to IQ software including training.
- B. Water Meters: Water meters in locations shown on plans. Contractor to coordinate application, permit and installation with local utility company. Contractor responsible for water meters and all associated installation costs.
- C. Booster Pump: If required on plans, contractor shall furnish and install booster pump with enclosure as specified in plans/details. Contractor shall also provide a concrete pad and any and all fittings, adaptors, connections, enclosure, etc. for the complete installation and proper operation of booster pump. If booster pump is existing, contractor must ensure and confirm new system is programmed and functioning properly.
- D. Backflow Preventers: Provide and install backflow devices per local codes, specifications and requirements. Provide steel mesh enclosure per plans/schedule.
- E. Electric Valves: Normally closed, 24v AC, 60 cycle, solenoid actuated, globe pattern, diaphragm type. Cast brass or plastic body and nylon reinforced nitrile rubber diaphragm.
- F. Flow Sensor: Flow sensor size as specified on plans. Coordinate with IQ setup and learned flow for controller scheduling.
- G. Quick coupling Valves: Cast brass body with self-closing cover. Provide (2) brass keys with 1 in. female threaded outlet.
- H. Sprinkler Heads: Heavy-duty plastic sprinkler case, high density plastic sprinkler body, corrosion-resistant internal parts, plastic spray nozzles with adjustable flow and direction features.
- I. Control Wire: 24v UL/UF., approved for direct burial. Provide color-coded wire with white used for common (14-gauge, single-strand copper) and red for control (14-gauge single-strand copper).
- J. Tracking Wire: 18 gauge copper (only where mainline and wiring bundle are separated)
- K. Valve Boxes: Heavy-duty commercial grade, fiberglass reinforced, plastic with locking

SECTION 02810 – IRRIGATION

covers. Rainbird VB series, 10" Round or Standard Rectangular Min. or apprvd equal.

- L. Swing Joints: 3 high density polyethylene street ells with 8 in. Schedule 80 PVC nipple; sized the same as inlet to sprinkler head.
- M. Sleeves: Schedule 40 PVC. Boring as required under all existing pavement, walls or curbs.

PART 3-EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine the site and conditions under which irrigation work is to be performed. Irrigation contractor shall notify the landscape contractor in writing, with a copy to Construction Manager, if the site is unsatisfactory. Do not begin the work until unsatisfactory conditions have been corrected in a manner acceptable to irrigation contractor. Beginning of work indicates acceptance of the site as satisfactory by the irrigation contractor.

3.02 INSTALLATION

- A. General: Install tracking wire along mainline pipe if separate from valve wiring bundle.
- B. Excavating and Filling:
 - 1. Cover for Piping:
 - a) Mains: 18 in. min.
 - b) Laterals: 12 in. min.
 - 2. Use clean backfill material without stones larger than 1/2 in., debris or extraneous material that may damage pipe assembly.
 - 3. Compact all trenches to a minimum 95% Standard Proctor Density.
- C. Pipe:
 - 1. Install in existing sleeves under pavement or provide boring and sleeves under pavement as required.
 - 2. Clean pipe and joints before making connections. Purple primer to be used on all joints before applying solvent. Per TCEQ Regulations.
 - 3. Attach joints according to manufacturer's instructions. Threaded joints to be coated with "Teflon" tape. Allow joints to set for at least 24 hrs. before applying water pressure to the system.
 - 4. Thoroughly flush piping before sprinkler heads are installed and test under pressure for leaks in each line separated by valves.
- D. Water Meters: Provide and install water meters per local codes, specifications and requirements. Coordinate permit and application with owner and local utility company. Adjust locations as necessary to coordinate with existing water line locations.
- E. Back Flow Protection: Provide and install backflow devices per local codes, specifications and requirements including enclosure.
- F. Valves:
 - 1. Provide isolation valve on inlet side of every electric control valve (if specified).
SECTION 02810 – IRRIGATION

- 2. Install electric and gate valves with at least 10 in. of cover over the valve and at least 6 in. of cover over the stem.
- 3. Install valve box centered over the flow control handle. Provide 1 cu. ft. of clean pea gravel in the bottom of each valve box with filter fabric below.
- 4. In lawn areas, valve boxes to be set flush with existing grade; in planting bed areas valve boxes shall be set 2" above grade.
- G. Controllers: Hard wire to nearest power source and CAT6 data line/ethernet or cellular module as specified on plans. Coordinate with general contractor. Install on exterior wall in location as shown on plans or as directed/approved by SSP.
- H. Sprinkler Heads: Install all heads on swing joint assemblies and flush with finish grade.
- I. Drip Line: Install dripline as specified in plans/details. All drip lines, fittings, etc. to be buried a minimum of 2" below finish grade and then covered additionally with mulch per depth on plans/details. All dripline to be pinned with galvanized drip pins no more than 36" spacing and at all fittings and joint locations.
- J. Wiring:
 - 1. Bundle and tape wires at 10 ft. o.c., max.
 - 2. Snake wire in trenches to allow for expansion. Provide expansion coils at 100 ft. o.c. max., and at the entry to each valve box.
 - 3. Splice wires using mechanical sealant connector for a waterproof connection. Make all wire splices within valve boxes. Use RB WPCONN N90300 or approved equal.

3.03 FIELD QUALITY WORK

- A. General: Notify the Construction Manager at least 48 hours before testing is begun.
- B. Hydrostatic Test: Test mainline piping to a hydrostatic pressure of not less than 100 psi for a minimum of 24 hours. Piping may be tested in sections to expedite work. Remove and repair piping and connections which do not pass hydrostatic testing.
- C. Operational Testing: Perform operational testing after hydrostatic testing is completed, backfill is in place, and sprinkler heads adjusted to final position.

3.04 ADJUSTING

- A. Check sprinkler heads for arc of spray. Adjust as necessary to provide 100% coverage of all landscaped areas.
- B. Adjust layout to conform to actual layout of landscape plantings.

3.05 **DEMONSTRATION**

A. Demonstrate operation of the system to Owner's personnel and staff.

3.06 CLOSE-OUT DOCUMENTS

A. As-Built Drawings: Submit 'As-Built' drawings before project close-out showing the irrigation system layout, including line locations and sizes, spray heads and types, points of connection, booster pump, location of backflow device(s), controller, and other installation

SECTION 02810 – IRRIGATION

information.

- B. Warranty Letters: Submit warranty letters for all irrigation items including labor for the specified warranty period.
- C. Operation and Maintenance Data: Submit Manufacturers' operation and maintenance instructions and laminated colored (11x17) valve Zoning Diagram.

END OF SECTION

SECTION 02825 - ORNAMENTAL FENCES AND GATES

2.01 MANUFACTURER:

The fencing system shall be Industrial Aluminum Fence #202 Series as manufactured by Jerith Manufacturing Co., Inc., 14400 McNulty Road, Philadelphia, PA 19154. (Telephone: 800-344-2242; Fax: 215-676-9756; email: sales@jerith.com.)

Elite Fence Products, Inc., 835 Scott St, Murfreesboro, TN 37129; (615) 849-1886, Industrial EFF-20 is an approved manufacturer.

2.02 MATERIALS:

A. Aluminum Extrusions: All posts and rails used in the fence system shall be extruded from HS-35[™] aluminum alloy having minimum yield strength of 35,000 psi. All pickets shall have minimum yield strength of 25,000 psi. 6063-T5 Alloy is <u>not</u> acceptable for any components.

B. Fasteners: All fasteners shall be stainless steel. Square drive screws shall be used to connect the pickets to the horizontal rails. Rail to post connections shall be made using self-drilling hex-head screws.

C. Accessories: Aluminum sand and die castings shall be used for all scrolls, post caps, finials, and miscellaneous hardware. Die castings shall be made from Alloy 360.0 for superior corrosion resistance. Alloy 380.0 is <u>not</u> acceptable.

2.03 FINISH:

A. Pretreatment: A three stage non-chrome pretreatment shall be applied. The first step shall be a chemical cleaning, followed by a water rinse. The final stage shall be a dry-in-place activator which produces a uniform chemical conversion coating for superior adhesion.

B. Coating: Fence materials shall be coated with FencCoat[™], a Super-Durable TGIC polyester powder-coat finish system applied by Jerith Manufacturing Company. Epoxy powder coatings, baked enamel or acrylic paint finishes are <u>not</u> acceptable. The FencCoat finish shall have a cured film thickness of at least 2.0 mils. In addition, the screw heads shall be painted to match the color of the fence. The color of the fence system shall be selected from standard colors.

C. Tests: The cured FencCoat finish shall meet AAMA 2604 "Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels", which includes the following requirements:

1. Humidity resistance of 3,000 hours using ASTM D2247.

2. Salt-spray resistance of 3,000 hours using ASTM B117.

3. Outdoor weathering shall show no adhesion loss, checking or crazing, with only slight fade and chalk when exposed for 5 years in Florida facing south at a 45 degree angle.

Finishes which only meet AAMA 2603 (or the previous version - AAMA 603) are <u>not</u> acceptable.

2.04 CONSTRUCTION:

A. Horizontal rails shall be 15/8" x 15/8" channels formed in a modified "U" shape. Pickets shall pass through holes punched in the top of the rail. The top wall shall be .072" thick and the side walls .082" thick for superior vertical load strength. There shall be 3 horizontal rails in each section. B. Pickets shall be fastened to the rails using painted stainless steel screws. Screws shall be used on only one side of the rail, leaving the other side with a clean appearance. Pickets shall be 1" square and have a wall thickness of .062". Welding the pickets to the rails is not permitted.

C. Posts shall be 2 1/2" square extrusions with pre-punched holes which allow the fence section rails to slide in. Posts shall be spaced 72" on center and have .075 walls. Gate posts shall be 4" square with .125" walls and used on both sides of a gate. Die cast aluminum caps shall be provided with all posts.

D. Gates shall have welded frames and shall support a 250 lb. vertical load on the latch side of the gate without collapsing. Walk gates shall be self-closing and self-latching.

E. Assembled sections shall support a 1,000 lb. vertical load at the midpoint of any horizontal rail.

2.05 ADDITIONAL GATE HARDWARE:

Provide Panic Hardware equal to DAC Industries, Inc.(800.888-9768), Model 6045-B48 Superior Exit Bar Kit with Lockey Model 115p Keypad Lockset.

2.06 WARRANTY:

The entire fence system shall have a written Limited Lifetime Warranty against rust and defects in workmanship and materials. In addition, the FencCoat finish shall be warranted not to crack, chip, peel, or blister for the same period.

PART 3 - EXECUTION

Installation: All material must be checked upon receipt at the job site prior to installation to check for any damage that may have occurred during transport. The fence system must be stored in a safe and dry environment so as to protect if from any potential damage. This aluminum Ornamental Fence system must be installed in accordance with manufacturer's standard procedures.

END OF SECTION 02825

PART 1 - GENERAL

1.01 SCOPE

- A. Supply and installation of all approved materials, labor, equipment, transportation and services required and incidental thereto, in conformity with the plans and specifications, including but not limited to; vegetation protection/pruning, fine grading, earth mounding, bed excavation and preparation, bed edging, planting soil/compost mixes, fertilizer, mulch, trees, palms, shrubs, ground covers, staking, paving, site furniture, clean-up, maintenance, and warranty.
- B. Related Sections:
 - 1. Irrigation 02810
 - 2. Lawns 02930

NOTE:

This project is a nature park and funded through grants with Texas Parks & Wildlife (TPWD). The project site has sensitive and valuable native vegetation & habitat. The grant and specifications require the contractor to protect all existing vegetation on the project site. Any damage to existing vegetation shall be the responsibility of the general contractor and shall be replaced with equal size and species as approved by SSP/CC.

1.02 REFERENCE STANDARDS

- A. General: "Hortus Third," 1976.
- B. Texas Association of Nurserymen, Grades and Standards for Nursery Stock.
- C. Plant Material: "American Standard for Nursery Stock," ANSI Z60.1-1990.
- D. National Arborist Association Standards

1.03 DEFINITIONS

A. Specimen Plants: Plants having exceptional character, superiority in form and branching, and the best attributes of the species; all as determined by the Architect, Landscape Designer or Owner.

1.04 QUALIFICATIONS

A. Landscape work to be performed by a single firm specializing in commercial landscape work with a minimum of five (5) years experience on similar type projects. Owner/SSP Design to review qualifications and approve subcontractor prior to commencing work.

1.03 SCHEDULE OF VALUES

- A. Landscape subcontractor shall submit costs for GC schedule of values as follows:.
 - 1. Irrigation Sleeving
 - 2. Irrigation Water Meter, Backflow, Permits, Testing

- 3. Irrigation System
- 4. Landscape Athletic Field Grading and Soil Mix
- 5. Landscape Athletic Field Sod
- 6. Landscape Planting, Materials, Installation, Warranty
- 7. Landscape / Irrigation 90 Day Maintenance

1.04 SUBMITTALS

- A. Submittals shall be formatted electronically in a pdf file with a table of contents and tabs identifying each section. The following submittals are required for this section:
 - 1. Landscape Construction Sequence
 - 2. Edging Materials
 - 3. Post emergent Herbicides
 - 4. Pre emergent Herbicides
 - 5. Soils, Compost and Mulch
 - 6. Sources of all Plant Materials (including address and telephone numbers)
 - 7. Product Data Material Safety Data Sheets
 - 8. Paving Materials
 - 9. Staking Materials
 - 10. Samples: One foot sections of edging (as specified on plans), one pound bag sample of each; topsoil, premium compost, mulch, decomposed granite, river rock, washed gravel and example boulder/rocks.
 - 11. Photographs of all plant material prior to ordering/installation
 - 12. Name and License Number of Subcontractor for pruning trees (Certified I.S.A. Arborist required)

1.05 **PROTECTION**

- A. Before commencing work, contractor shall place orange construction fencing around all vegetation labeled "to remain" on landscape plans. Fencing shall be placed squarely around each tree 6' x 6' and at least 60" in height or continuously around groups of vegetation as shown on plans. No work may begin until this requirement is fulfilled. All other vegetation not labeled "to remain" shall be cleared and grubbed including root systems.
- B. In order to avoid damage to roots, bark or lower branches, no truck or other equipment shall be driven or parked within the drip line of any tree, unless the tree overspreads a paved way.
- C. The contractor shall use any and all precautionary measure when performing work around trees, walks, pavements, utilities, and any other features either existing or previously installed under this Contract.
- D. The Contractor shall adjust depth of earthwork and loaming when working immediately adjacent to any of the aforementioned features in order to prevent disturbing tree roots, undermining walks and pavements, and damage in general to any existing or newly incorporated item.
- E. Where excavating, fill or grading is required within the branch spread of trees that are to remain, the work shall be performed as follows:
 - a. TRENCHING: When trenching occurs around trees to remain, the tree roots shall not be cut

SECTION 02900 - PLANTING

but the trench shall be tunneled under or around the roots by careful hand digging and without injury to the roots.

- b. RAISING GRADES: When the existing grade at tree is below the now finished grade, and fill not exceeding 16 inches (16") is required, clean, washed gravel graded from one to two inches (1" 2") in size shall be placed directly around the tree trunk. The gravel shall extend out from trunk on all sides a minimum of 18 inches (18") and finish approximately two inches (2") above the finished grade at tree. Install gravel before any earth fill is placed. New earth fill shall not be left in contact with the trunks of any trees requiring fill. Where fill exceeding 16 inches (16") is required, a dry laid tree well shall be constructed around the trunk of the tree. The tree well shall extend out from the trunk on all sides a minimum of three feet (3') and to three inches (3") above finish grade. Coarse grade rock shall be placed directly around the tree well extending out the drip line of the tree. Clean, washed gravel graded from one to two inches (3"). Approved backfill material shall be placed directly over the washed gravel to desired finished grade.
- c. LOWERING GRADES: Existing trees in areas where the now finished grade is to be lowered shall have regarding work done by hand to elevation as indicated. Roots as required shall be cut cleanly three inches (3") below finished grade and scars covered with tree paint.
- d. Trees marked for preservation that are located more than six inches (6") above proposed grades shall stand on broad rounded mounds and be graded smoothly into the lower level. Trees located more than 16 inches (16") above proposed grades shall have a dry laid stonewall, or other retaining structure as detailed on the plans, constructed a minimum of five feet (5') from the trunk. Exposed or broken roots shall be cut clean and covered with topsoil.
- F. Contractor is responsible for all protection measures listed above. If these procedures are not followed, contractor is responsible for replacement of existing trees with approved trees of equal caliper and height.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Transport plant materials covered or in closed vehicles to protect from exposure to heat and wind. Spray trees and in full leaf with anti-desiccant as recommended by the manufacturer before shipping. Take precautions to protect plant materials from desiccation and from damage to bark, branches and roots. Do not allow root balls to crack. Schedule shipments to coincide with planting work schedule.
- B. Storage and Protection: If planting is delayed after delivery, keep plants in a shaded area, cover roots with mulch or topsoil, and keep plants constantly watered until planted.

1.07 MAINTENANCE/WARRANTY

A. Maintenance Requirements: Maintain the work of this Section throughout construction and for ninety days after 'substantial completion' and until final written acceptance by Owner. Notify the owner in writing of 'substantial completion'. Maintenance period begins after owner's written acceptance of 'substantial completion'.

SECTION 02900 – PLANTING

- B. Maintenance Service: Perform the following maintenance operations at least once a week:
 - 1. Remove and replace dead plant material. Prune plants to remove dead wood and to maintain health of plants.
 - 2. Maintain all mulched areas at a 2 in. depth. Remove weeds and grass from shrub and ground cover areas and from watering basins.
 - 3. Provide insect and disease control to maintain health of plants.
 - 4. Irrigation:
 - a) If the irrigation system is operating, program and monitor the system to provide adequate water for plants.
 - b) If the irrigation system is not operating, hand water plants. Deep water trees each week.
 - 5. Dispose of all maintenance debris/clippings off-site. Owner's dumpsters shall not be used.
 - 6. Keep all site areas tidy and free of grass clippings, mulch or other foreign materials.
 - 7. Submit dates, descriptions and receipts of all maintenance operations to SSP Design for approval.
- C. Warranty: Warranty shall cover all shrubs/groundcovers for a period of three months and trees/palms for a period of one year from the date of final acceptance. Any plant material deemed dead or unrecoverable by the owner shall be replaced with similar species and size within two weeks of notification from owner.

1.08 RIGHT OF REJECTION

A. The Owner/SSP Design reserve the right to inspect and reject plants at any time and at any place.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fertilizer: 13-13-13 Osmocote slow release fertilizer granules or approved equal.
- B. Planting tablets: Agraform 21 gram slow release fertilizer tablets or approved equal.
- C. Compost: Premium grade compost ('9 Kids Compost' or approved equal).
- D. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of 5.4 and maximum 7.0; organic matter to exceed 1.5%, magnesium to exceed 100 units; phosphorus to exceed 150 units; potassium to exceed 120 units; soluble salts/conductivity not to exceed 900 ppm/0.9 mmhos/GC in soil.
- E. Sand: Clean, screened inorganic masonry sand. Silica sand only. River sand not acceptable. Mathis sand, Wright Materials, Plant 3 masonry sand (361) 387-0293 or approved equal
- F. Mulch:
 - 1. Shrub and Ground Cover Planting Areas: Grade A Shredded Hardwood; long, fibrous bark strands free from wood chips. Texas Natives or Approved Equal.
 - 2. Watering basins: Grade A Shredded Hardwood; long, fibrous bark strands free from wood chips. Texas Natives or Approved Equal.

- G. Plants:
 - 1. General: Provide plant materials that are healthy and free from disease, insects, and larvae and without damage to bark, branches, and roots.
 - 2. Approval: All plants must be approved by Owner/SSP Design prior to installation. Any plants not approved by Owner/SSP Design shall be subject to rejection. All trees/palms must be inspected, approved and tagged by Owner/SSP Design at their place of origin or as directed in writing by Owner/SSP Design. Container grown trees shall be obtained by Glen Flora Farms, Inc. or approved equal.
 - 3. Sizes: Measured after pruning and in accordance with the plant schedule.
 - 4. Root Treatment: As follows in accordance with the Reference Standards:
 - a) Palms: Balled and burlapped or containerized if they have been in the container for at least one growing season.
 - b) Trees, Shrubs, Ground Cover Plants: Container grown with a well-established fibrous root system.
 - 5. Palms: All new palms shall be field dug or containerized material in specified sizes shown in plant schedule. All palms shall have good form (straight trunks) consistent of its species, free of scares/abrasions/burn marks and disease and insects, with large healthy root systems. Rootballs sizes for B/B material must meet the following minimum specifications:
 - a) Sabal Palms 44" diameter, 36" height
 - b) Washingtonia Palms 44" diameter, 36" height
 - c) Cuban Royal Palms, Mediterranean Fan Palms, Cocos Palms 30" diameter, 30" height
- H. Staking material:
 - 1. Tree stakes shall be commercial grade T-Posts, 1.25 Gauge, 8' Ht., Green with orange safety caps on tops. Note: Do not drive through stakes through root balls.
 - 2. Tree ties shall be Poly Chain Lock 1" width, black, ProLock or approved equal
 - 3. Palm stakes shall be treated timber braces, stakes, and battens including burlap protection and steel straps sized per palm planting detail. Ground stakes must be at least 48" in length with at least 42" securely embedded in undisturbed soil.
 - 4. All staking to be removed at the end of the maintenance period or at final acceptance, whichever is later.
- I. Edging:
 - 1. Concrete Edging: Extruded, colored, fibermesh reinforced concrete edging (per details) *Curb Appeal (or approved equal)*
 - 2. Tree Rings: 4" Ht., 30" Dia., Black Anodized Aluminum tree rings. *Dreamscapes* (or approved equal)
 - 3. Aluminum edging: 4" Ht., Black Anodized Aluminum Edging. Dreamscapes (or approved equal)

2.2 PLANTING SOILS

- A. Planting Mix: 75 percent sandy-loam topsoil; 25 percent premium compost; (3:1 ratio by volume); and specified fertilizer or planting tablets.
- B. Shrub and Ground Cover Areas:

SECTION 02900 – PLANTING

1. Where no topsoil has been installed: Remove twelve inches of existing soil and replace with ten inches of 'Planting Mix' as described in Item A above.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine the site and conditions under which landscape work is to be performed. Have the installer notify the Contractor in writing, with a copy to SSP Design if the site is unsatisfactory. Do not begin the work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Beginning of work indicates acceptance of the site as satisfactory by the installer.

3.02 EXECUTION

- A. Site Preparation: Contractors must visit and review site prior to bidding. Compacted soils and sub-soils from construction activities must be ripped and tilled until a loose, friable and free-draining condition is met. All existing weeds, grass, stabilized sub-base material, rubble, excavated soil and other material shall be removed from the site and disposed of by the contractor prior to starting any new landscape work. Soil conditions around entire site must be approved by Owner/SSP Design prior to rough and finished grading operations. Contractor shall not install any fill or topsoil in landscape areas prior to site condition approval by Owner/SSP Design.
- B. Drainage: Landscape contractor shall follow grading as shown and specified on Civil Engineer's grading plans. Landscape contractor shall coordinate grading operations with site contractor. Landscape contractor shall ensure final grades conform to the Civil Engineer's grading plan including grades around building, swales, sidewalk under-drains/swales, roof drains, splash blocks and rock swales through planting beds.
- C. Vegetation Protection: Contractors are responsible for protection of existing vegetation labeled on plans "to remain". Protection of existing vegetation includes supply and installation of protective fencing around all existing planting areas.
- D. Bed Preparation and herbicide: All planting areas shall be free of weeds, grass, insects, or any other deleterious material prior to bed preparation. Contractor shall herbicide all planting areas with 'RoundUp' or approved equal at least two times prior to installation of any new plants. Pre-emergent herbicide shall be applied after planting and before placement of mulch.
- E. Planting Beds: Excavate 12" of existing soil within planting beds and replace with 8" of imported topsoil and 2" of premium compost. Mechanically till into top six inches of bed until a loose, friable soil condition is met. Final grades within all planting beds shall be 3" below building weep holes and adjacent curbs to allow for 2" layer of mulch. Contractor to ensure positive drainage throughout all landscape areas. Adjust grades as necessary to direct water away from buildings, structures and planting beds. Report any discrepancies on all drainage issues in writing to Construction Manager or the Civil Engineer. Owner or SSP Design to approve planting beds prior to planting operations.

- F. Edging: Edging shall be installed as shown on plans. Edging shall allow for tapered drainage points (10 feet on center or less) to ensure free drainage away from all structures and walkways. Edging shall be set flush with adjacent paving, sidewalks or driveways.
- G. Grass Areas: Scarify, float and fine grade all areas to receive sod or hydromulch for approval by SSP prior to placement of sod or application of hydromulch. Supply additional topsoil as necessary to fill any/all low areas and ensure positive drainage away building / planting beds. (see specification on lawns for further requirements).
- H. Berms and Mounding: Supply topsoil and construct berms as indicated on plans. Berms shall have a maximum slope of 1:4. Owner or Construction manager to approve berming and mounding prior to planting operations.
- I. Planting:
 - 1. Installation:
 - a) Excavate planting pit and french drains to depth and width indicated on details in drawings.
 - b) Set root ball on undisturbed or compacted soil in planting pit. Remove burlap, rope, wire, and all other wrapping material from top of ball. Remove any binding rope which is not biodegradable completely. Top of root ball shall be set 1" above adjacent finished grade.
 - c) Fill planting pit 2/3 full with planting mix, soak with water and allow settling, and adding fertilizer tablets as detailed. Finish filling pit with planting mix and tamp lightly.
 - d) Construct a watering basin as detailed (or install aluminum edge tree ring) and install 2 in. layer of mulch. Water-in to completely saturate the root ball and planting mix. Add planting mix where any settling or air pockets occur.
 - e) Stake all trees/palms immediately after planting as detailed.
 - 2. Palms: New Washingtonia palms shall be cleaned (skinned) completely of their leaf stem bases and fibers to a height 4 feet below the crown. Sabal palms shall be planted with their leaf stem bases remaining but cleaned and trimmed evenly. All palms shall be planted with several petioles or fronds tied up straight with natural twine. Remaining fronds shall be trimmed or 'hurricane cut' to lighten wind load on terminal bud. Contractor is responsible for removing or cutting the twine supporting the fronds at the appropriate time. All palms must be inspected and approved on site by SSP Design prior to installation.
 - 3. Shrubs: All plants shall be of species denoted on plans and shall be container-grown material at specified sizes. All plants shall be of size equal or greater than T.A.N. standards for their respective container size. All material shall be vigorous, well established, of good form consistent of species, free of disease and insects, with large healthy root systems and with no evidence of being restricted or damaged. All plants shall be inspected and approved on site by SSP Design prior to installation.

SECTION 02900 - PLANTING

- 4. Planting Holes: All tree/palm holes shall be excavated with a diameter at least two times the rootball size and to a depth equal to the height of the rootball. The bottoms and sides of each hole shall be scarified with a pick to allow for free drainage and maximum root penetration. After tree/palm placement, the hole shall be backfilled with a mixture of excavated soil and premium compost mixture (9 Kids Compost or approved equal). All holes shall be tested/inspected by SSP Design for free drainage prior to installation of trees.
- 5. Tree Rings: Tree rings shall be installed on trees within grass areas as indicated on plans. Tree rings are to be aluminum edge or extruded concrete per plans and details. A minimum of 2 inches of specified mulch shall be placed within the tree rings. Tree rings must be maintained and kept free of weeds during the entire maintenance period.
- 6. Watering Basins: Watering basins for all trees/palms that do not include a tree ring shall be constructed in a ring shape around each tree or palm trunk. This earthen berm shall be constructed 6" in height and 36" in diameter so as to hold water and allow infiltration around root ball. A minimum of 2 inches of specified mulch shall be placed within the watering basin. Watering basins must be maintained and kept free of weeds during the entire maintenance period.
- J. Insect and Disease Control: Apply treatment as frequently as required during construction and 90-day maintenance period to prevent damage to plant material. Use only chemicals specifically approved by TNRCC.
- K. Pruning: All existing and new vegetation shall be pruned/trimmed by a Certified I.S.A. Arborist as directed on site by SSP Design.

3.03 CLEANUP AND PROTECTION

- A. Remove debris from landscaped areas daily and sweep clean adjacent pavements, if soiled by landscape activities.
- B. Provide temporary barriers or fences as required to protect landscaping from any type of damage or theft until final acceptance.

3.04 CLOSE-OUT DOCUMENTS

- A. As-Built Drawings: Submit 'As-Built' drawings before project close-out showing the landscape layout, including revised plant material, and other installation information.
- B. Warranty Letters: Submit warranty letters for trees / palms / lawns / shrubs / pavers / furniture / masonry / stone / amenities.

END OF SECTION

PART 1 GENERAL

1.01 SCOPE

General: Section Includes: Labor, materials, necessary equipment and services to complete the tree protection and relocation work.

NOTE:

This project is a nature park and funded through grants with Texas Parks & Wildlife (TPWD). The project site has sensitive and valuable native vegetation & habitat. The grant and specifications require the contractor to protect all existing vegetation on the project site. Any damage to existing vegetation shall be the responsibility of the general contractor and shall be replaced with equal size and species as approved by SSP/CC.

- A. Related Section:
 - 1. 02900 Planting.
- B. Before tree excavation, pruning, removal, or relocation of existing trees, contractor shall engage a certified arborist (ISA Certified) and notify and meet with:
 - 1. SSP
 - 2. Appropriate utility companies for spotting and coordination of service disconnection as necessary to complete work.
 - 3. All other trades associated or affected by this work.

1.02 REFERENCES

- A. General: "Hortus Third," 1976.
- B. Texas Association of Nurserymen, Grades and Standards for Nursery Stock.
- C. Plant Material: "American Standard for Nursery Stock," ANSI Z60.1-1990.
- D. NAA: National Arborist Association Standards
- E. ISA: International Society of Arboriculture

1.03 SCHEDULE OF VALUES

- A. Landscape subcontractor shall submit costs for GC schedule of values as follows:.
 - 1. Tree or palm pruning (ISA Certified Arborist)
 - 2. Tree or palm preparation, relocation, fertilization, mulching, watering system

1.03 DEFINITION

- A. Toxic Substances:
 - 1. Do not deliver any toxic substance or item to the site without furnishing to the owner a Texas Material Safety Data Sheet (MSDS).
 - 2. Provide current MSDS information with each initial shipment.
 - 3. The MSDS shall contain the following information:
 - a. The chemical name and the common name of the toxic substance.
 - b. The hazards or other risks in the use of the toxic substance, including:
 - 1) The potential for fire, explosion, corrosivity and reactivity.

Vegetation Protection & Relocation Cameron County Olmito Nature Park Brownsville, Texas 02902 - 1 SSP Design, LLC November 2023

- 2) The known acute and chronic health effects of risks from exposure, including the medical conditions which are generally recognized as being aggravated by exposure to the toxic substance.
- 3) The primary routes of entry and symptoms of overexposure.
- c. The proper precautions, handling practices, necessary personal protective equipment, any other safety precautions in the use of or exposure to the toxic substance including appropriate emergency treatment in case of overexposure.
- d. The emergency procedure for spills, fire disposal, and first aid.
- e. A description in lay terms of the known specific potential health risks posed by the toxic substance intended to alert any person reading this information.
- f. The year and month, if available, that the information was compiled and the name, address, and emergency telephone number of the manufacturer responsible for preparing the information.

1.04 DESCRIPTION

- A. Protect existing trees to remain during construction phases. Provide tree protection fencing around all trees to remain and barriers for existing trees adjacent to tree transplantation operations. Any trees designated to remain that are scarred, damaged or destroyed shall be replaced at the Contractor's expense, with similar species, size, and quality. Provide temporary watering methods for trees and vegetation to remain on site hand water if required. Watering schedule shall be coordinated by contractors' certified arborist in conjunction with Owner.
- B. Relocate trees/palms as noted on plans. Store and maintain relocated trees/palms in contractor's nursery during construction. Storage and maintenance includes regular watering (or drip irrigation), fertilizing and pruning as necessary for healthy growth. Storage area in contractor's nursery must be approved prior to relocation. Relocate stored material on site in locations shown on final landscape plans or as directed by SSP.
- C. Resulting tree pits of relocated material on site shall be backfilled with clean top soil fill and brought back flush with surrounding grade, unless the pits are to be immediately replanted. Stabilize/compact grade if required. Correct problems caused by erosion, wind, etc., in the reclaimed area. Pits to be quickly replanted shall be surrounded by safety barricades to prevent accidental falls into pits.
 - 1. In areas where new plant material will replace relocated plant material, appropriate planting soil mix shall be used as backfill.
- B. Remove other vegetation per plans or as directed by SSP to accommodate new plantings. Prepare areas to be planted according to Section 02900.

1.05 SUBMITTALS

- A. Submit certified arborist information, protection measures & materials, pruning/trimming/watering schedule, for use in tree protection for approval by SSP.
- B. Submit a list of equipment, procedures, and labor force anticipated for use in tree relocation for approval by SSP.

Vegetation Protection & Relocation Cameron County Olmito Nature Park Brownsville, Texas

- C. Submit a daily/weekly schedule indicating trees/palms to be dug and relocated. Note materials requiring root pruning, and that the relocation schedule is to begin at the end of the specified root pruning period.
- D. Obtain permits required by the local tree or landscape ordinances which may include meeting with the local City or Urban Forester.
- E. Submit written certification that trees indicated to remain have been protected during the course of construction according to industry standards. Certify that where damage did occur:
 - 1. Trees were promptly and properly treated.
 - 2. Indicate which damaged trees (if any) are incapable of retaining full growth potential and are recommended to be replaced.

1.06 QUALITY ASSURANCE

- A. The Contractor's crew used for the relocation of existing trees shall have minimum 10 years' experience in relocation of existing plant materials and shall include an ISA Certified Arborist.
- B. Unless otherwise specified, tree transplanting shall comply with NAA Ref.1.
- C. Comply with NAA standards for pruning and remove branches from trees to remain to clear new construction.
- D. Recommend procedures to compensate for loss of roots (if any) and perform initial pruning of branches and stimulation of root growth where removed to accommodate new construction.
- E. Perform tree repair work for damage incurred by new construction.
- F. Provide routine progress evaluation reports on relocated trees until the end of the maintenance period.
- G. Evaluate existing trees and verify trees are free of disease and ready to survive relocation from the site to their new location on-site or off-site.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Properly handle trees and palms during moving so trunks will not be scarred or damaged and to avoid broken limbs. Broken limbs not causing the tree to be rejected shall be repaired as follows:
 - 1. Properly prune dead, dying, or damaged branches with clean, sharp equipment.
 - 2. Remove injured bark and wood of a tree would with a clean, sharp knife to a point where healthy bark and wood make contact at their margins.
 - 3. Inspect and treat wound for insect and disease.
 - 4. Seal wounds with bituminous base wound paint for all limbs greater than 3 inch diameter.
- B. Transport trees on vehicles of adequate size to prevent overcrowding, broken limbs, foliage damage, or root ball damage.
- C. Keep root balls moist during relocation.
- D. Protect tree crowns with shade cloth to prevent desiccation and wind burn. Crowns shall be periodically sprayed with water to help ensure against desiccation.
- E. Handle plant material only in ways and means accepted by industry standards and accepted by Owner.
- F. Plant material shall be planted the same day it is dug. Coordinate preparation of planting pits or temporary nursery accommodations to ensure this schedule.

Vegetation Protection & Relocation Cameron County Olmito Nature Park Brownsville, Texas

1.08 WARRANTY

- A. For protected/preserved trees or palms that die due to contractor negligence during construction, replace their canopy area with new trees as specified:
 - 1. Canopy spread for trees shall be a minimum of six feet and a caliper of at least 3 inches. Height for replacement palms shall be a minimum of six clear trunk feet.
 - 2. Replacements (mitigation plantings) shall be provided at no additional cost to the Owner.
 - 3. Proposed replacement canopy tree species shall be approved by Owner.
 - 4. The specification requirements for trees and palms are according to Section 02900.
- B. For relocated trees or palms that die, replace their canopy area with new trees as specified:
 - 1. Canopy spread for trees shall be a minimum of six feet and a caliper of at least 3 inches. Height for replacement palms shall be a minimum of six clear trunk feet.
 - 2. Replacements (mitigation plantings) shall be provided at no additional cost to the Owner.
 - 3. Proposed replacement canopy tree species shall be approved by Owner.
 - 4. The specification requirements for trees and palms are according to Section 02900.
- C. Repair damage to other plants and lawn or construction work within the relocation area during tree transplantation at no cost to the Owner. This includes, but is not limited to, damage to curbs, walks, roads, fences, site furnishings, etc. Replacing and replanting of damaged trees, shrubs or turf shall be according to Section 02900.

1.09 MAINTENANCE

- A. Maintain protected/preserved and relocated plant materials throughout construction period and continue until the 90 day maintenance period is complete, upon which time the Owner will take over maintenance of materials following procedures and recommendations of contractor and specifications.
- B. During the maintenance period, maintain protected and relocated plant materials according to procedures described in Section 02900.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Tree Protection Fence: Tree protection fence shall be a minimum of four feet high. Chain Link Fencing (No 9. GA. 2" Mesh with 2" Posts, driven at least 2' into ground @ 6 foot intervals or approved equal-see details on plans for alternate tree protection fencing).
- B. Tree Protection Signage: Vegetation Protection Areas shall be labeled "Vegetation Protection Area". Signs shall be laminated or otherwise weatherproof and printed in bold text so as to be easily read from a distance of 20 feet. Wording on signage shall be provided in both English and Spanish.
- C. Compost, topsoil, planting soil, mulch, staking, and guying, shall be as specified in section 02900.
- D. Fill materials shall be as specified in Section 02900.

Vegetation Protection & Relocation Cameron County Olmito Nature Park Brownsville, Texas 02902 - 4 SSP Design, LLC November 2023

PART 3 EXECUTION

3.01 VEGETATION PROTECTION

- A. Initial Work: No other construction activity may occur on site until Tree Protection Fencing has been installed and approved by SSP.
- B. Construction Activity: All construction activity within the areas fenced off around the trees shall be prohibited. This shall include the following activities:
 - 1. Parking or driving of equipment, machinery or vehicles of any type.
 - 2. Storage of any construction materials, equipment, stockpiling, excavation or fill, soil, gravel, etc.
 - 3. Dumping of any chemicals, (i.e. paint thinner from cleaning brushes), wash-out materials from cleaning equipment, concrete or mortar remainder, trash, garbage, or debris of any kind.
 - 4. Burning within or in proximity to protected areas.
 - 5. Felling trees into protected areas.
 - 6. Trenching or grading within the Critical Root Zones of protected trees for any purpose without notifying Owner 10 days in advance of operation in writing. This includes utilities, lighting, irrigation, drainage etc.
- C. Tree Protection Areas: Any work required by plans which is in a Tree Protection Area shall be performed by hand. All work shall be performed in a manner to prevent compaction, siltation and disturbance of the root systems of all associated trees and understory trees. At no time shall tree protection fencing be removed or relocated without permission of Owner.
- D. Subcontractor: The general contractor shall be responsible for insuring that all subcontractors are aware of all Vegetation Protection Specifications.
- E. Critical Root Zone: Contractor may operate equipment within the root zone of trees to be preserved only if buffered with 1/2" plywood with a 6" layer of wood chips underneath; or 12 inches of wood chips. Approval from Owner is required prior to operation of any equipment in tree protection areas. Root protection measures shall be inspected and maintained throughout construction.
- F. Location: Contractor will be responsible for installation, repairs and upkeep of tree protection fencing around trees and groups of trees to be preserved. See plan for locations.
- G. Flagging: Prior to installation, Contractor shall flag or paint location of fencing in field for verification by Owner.
- H. Contractor shall include supply, installation, maintenance, and removal of fencing in bid.
- I. Tree Protection Fence: Fencing shall remain in place and be continuously maintained for duration of construction.
- J. Watering: Contractor shall engage ISA Certified Arborist to coordinate and submit watering schedule for approval by Owner. Watering shall be scheduled as required specific species, soil conditions, and time or year.

Vegetation Protection & Relocation Cameron County Olmito Nature Park Brownsville, Texas 02902 - 5 SSP Design, LLC November 2023

- K. Damage: Contractor will provide services as necessary to respond to damage by construction activities within 48 hours of notification by the Owner.
- L. Penalties: Failure to comply with specifications will result in penalties as prescribed herein and by local codes and ordinances.

3.02 TRANSPLANTATION

- A. Transplanting shall consist of on-site or off-site transplanting of existing trees or palms from proposed construction areas to storage areas to permanent locations as noted on the drawings.
- B. Digging, Wrapping, and Handling: Plants shall be dug and prepared for moving in a manner that will not cause damage to branches, shape, root system, and development.
- C. Balled and Burlapped Plants:
 - 1. Balls shall be firmly wrapped with wire mesh, burlap or accepted cloth substitute.
 - 2. No balled plant will be acceptable if the ball is cracked and broken or if the stem or trunk is loose in the ball, either before or during transplanting.
 - 3. Balled plants shall be lifted and handled from the bottom of the ball.
 - 4. Protect ball and deliver to the site, plant immediately, and water thoroughly.
 - 5. Ball sizes shall be as recommended in ANSI Z60.1

3.02 PLANTING

- A. Relocated Material:
 - 1. Relocated trees/palms shall be planted according to procedures described for new material, Section 02900. Verify final grades have been established before planting operations. Ensure proposed planting pits drain freely by test-filling with water before transplantation.
 - 2. Continue watering and caring for relocated material as specified.
 - 3. Mulch tree pit areas to reduce weeds, discourage foot traffic, conserve moisture, and minimize temperature fluctuations.
 - 4. Brace trunk and leave in place for approximately one year until trees are wind firm.
 - 5. Wrap trunks and structural branches of thin-barked trees to protect against sun scald and dehydration. Retain through at least one growing season, and through hurricane season.
 - 6. Feed with a diluted solution of N-P-K in solution form with a soil needle, providing water, air, and nutrients.
 - 7. Where foliage is retarded, spray with soluble type foliage feeder.
 - 8. At time of planting, fill air pockets and keep roots, especially feeder roots, moist, live, and healthy. Use soil needles for watering new transplants. Direct fine spray at foliage to help harden-off new leaves.

3.03 STAKING AND GUYING

A. Stake and guy designated material according to procedures described for new plant materials, Section 02900.

3.04 WATERING

Vegetation Protection & Relocation Cameron County Olmito Nature Park Brownsville, Texas

- A. Following transplantation, water trees daily for the first two weeks, every other day for the next three weeks, and every third day for the balance of the three month watering/maintenance period. Such watering shall thoroughly saturate the root ball to its full depth.
- B. Following relocation, trees designated for transplanting shall be watered as specified in this section. Such watering shall thoroughly saturate the root ball to its full depth.
- C. Provide temporary automatic or manual watering of protected/preserved trees and relocated plant materials during construction and for 90 days after substantial completion. If used, after 90-day maintenance period, Contractor shall be responsible for the complete removal of all temporary watering systems.

3.05 TAGGING

A. Trees within the designated areas for relocation shall be clearly marked by means of yellow plastic surveyor's ribbons and coordinated with, inspected, and accepted by Owner before root pruning and digging.

3.06 ROOT PREPARATION

- A. Trees to be relocated shall be root pruned at least 45 days before digging with clean, sharp equipment.
 - 1. Maintain root pruned materials by watering, weeding, mowing, spraying, fertilizing, and other horticulture practices.
 - 2. After root pruning, backfill with good rooting medium, fertilize with organic fertilizer to promote root growth.
 - 3. Mulch to reduce weeds, discourage foot traffic, conserve moisture, and minimize temperature fluctuation.
- B. Root Ball Size Chart: Root ball sizes shall be according to minimum standards set forth in Texas Association of Nurserymen, Grades and Standards for Nursery Stock.
 1. Trees-Minimum Ball Sizes:

Caliper Minimum	Ball Diameter	(Larger sizes increase
proportionally)		
3-1/2" to 4"	28"	
4" to 4-1/2"	30"	
4-1/2" to 5"	32"	
5" to 5-1/2"	34"	
2. Minimum Ball Depth:		
Ball Diameter De	pth	
Less than 20" Not	less than 75 percent of di	ameter.

20" to 30" Not less than 65 percent of diameter.

30" to 48" Not less than 60 percent of diameter.

3.07 CROWN PREPARATION

A. Shade and Flowering Trees:

- 1. Shade Trees: ISA Certified Arborist to selectively prune and thin crown to remove approximately one third of the branches. Preserve the basic shape and form of the tree, eliminate cross-branching and dead or diseased branches.
- 2. ISA Certified Arborist to hand strip selected species of all leaves following pruning and before moving.
- B. Palms: Follow standard procedure for transplantation of palms as specified in Section 02900.

3.08 HAND DIGGING

A. Burlapping is required. Trees that are burlapped for relocation shall comply and be handled in same manner as new plant material specified in Section 02900.

3.09 SPECIAL CONDITIONS

- A. Multi-Trunk Trees: Relocate multi-trunk tree as one unit. Measure trees by taking the aggregate total of all DBH measurements.
- B. Multi-Trunk Palms: Relocate multi-trunk palms as one. Palms shall be measured as follows:

1. 50 percent of the value in dollars of the largest trunk in the grouping times the number of trunks in the clump.

- C. On/Off-site relocation:
 - 1. Relocation shall include root pruning, canopy pruning, on/off-site transportation, off-site storage, watering and maintenance, hauling and dumping of debris, and 90-day maintenance after final planting.
 - 2. If the tree or palm should die within the 90 day maintenance period, remove the tree, replace the material, and restore the site at no additional cost to the Owner.

3.10 CLEANING

- A. Site Clean-up:
 - 1. Upon completion of each day's work, thoroughly clean up the project site.
 - 2. Remove equipment, unused materials, deleterious material, and surplus excavated material.
 - 3. Fine grade all disturbed areas and the areas adjacent to the transplanted material to provide a neat and uniform site.
 - 4. All damaged or altered existing structures, as a result of the landscape work, shall be corrected.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes: The establishment of a complete and uniform lawn by sodding and/or hydromulching.
- B. Related Sections:
 - 1. Section 02810-Irrigation
 - 2. Section 02900-Planting

NOTE:

This project is a nature park and funded through grants with Texas Parks & Wildlife (TPWD). The project site has sensitive and valuable native vegetation & habitat. The grant and specifications require the contractor to protect all existing vegetation on the project site. Any damage to existing vegetation shall be the responsibility of the general contractor and shall be replaced with equal size and species as approved by SSP/CC.

1.02 QUALIFICATIONS

A. Lawn work to be performed by a single firm specializing in commercial landscape work with a minimum of five (5) years experience on similar type projects. Owner/SSP Design to review qualifications and approve subcontractor prior to commencing work.

1.03 SCHEDULE OF VALUES

- A. Landscape subcontractor shall submit costs for GC schedule of values as follows:
 - 1. Irrigation Sleeving
 - 2. Irrigation Water Meter, Backflow, Permits, Testing
 - 3. Irrigation System
 - 4. Landscape Athletic Field Grading and Soil Mix
 - 5. Landscape Athletic Field Sod
 - 6. Landscape Planting, Materials, Installation, Warranty
 - 7. Landscape / Irrigation 90 Day Maintenance

1.03 SUBMITTALS

- A. Submittals shall be formatted electronically in a pdf file with a table of contents and tabs identifying each section. The following submittals are required for this section:
 - 1. Product Data: Manufacturer's specifications and application instructions for fertilizer.
 - 2. Hydromulch mixes, percentages, lbs per acre, etc. for SSP review and approval before application.
 - 3. Samples: Topsoil, compost, silica/masonry sand for SSP review and approval before installation.
 - 4. Certificates: Inspection certificate from Texas Department of Agriculture indicating sod has been found free of, insects and larvae.
 - 5. Certificates: Breakdown of seed types, percentages, and mixture composition.

6. Sod Delivery Tickets: One per truckload indicating sod species, nursery certification, date and time of cutting. diseases

1.04 DELIVERY, STORAGE AND HANDLING

- A. Sod Delivery: Have sod delivered within forty-eight hours of cutting. Stack sod with roots to roots, protected from exposure to elements during shipment.
- B. Storage: Lay sod as soon a practicable after delivery. If installation is delayed more than four hours, store sod under shade and keep constantly moist. Sod must be laid within forty-eight hours of cutting. Do not pile more than two foot depth of sod. Do not tear, stretch or drop sod. Do not allow soil to break free of turf roots.

1.05 **PROJECT CONDITIONS**

A. Utility Construction: Do not lay sod or begin hydro-mulching until all underlying utility work is complete, trenches backfilled, compacted and graded, and topsoil placed and fine graded and sports fields laser leveled and approved by Owner/SSP.

1.06 MAINTENANCE/WARRANTY

A. Maintenance Service: Maintain the work of this Section throughout construction until the Date of Substantial Completion and ninety (90) days thereafter until a complete and uniform lawn has been established and accepted by the Owner / SSP.

- 1. Establish hydro-mulched or sodded lawns per planting plans. Reapply hydro-mulch or re-sod as necessary until **<u>full and uniform</u>** coverage is obtained.
- Mow general lawn areas <u>at least once per week</u> to maintain height of grass at 2 inches for 'common Bermuda grass' and 1" for 'Bermuda 419 sodded grass' and or as directed by Owner/SSP. Mowing of general lawn areas may be carried out using standard rotary type mowing equipment.
- 3. Mow Sports Fields <u>at least twice per week</u> to maintain an initial height of 1" for the establishment period then begin lowering the height over the next 90-days to achieve a final height of 5/8" to ³/₄". Mowing of Sports Field areas shall be carried out using reel type mowers only. Rotary mowers will not be accepted for Sports Field maintenance.
- 4. Trim/edge all lawn areas adjacent to watering basins, pavements, driveways, walls, structures, curbs, planting beds, edges and islands.
- 5. Provide insect and disease control to maintain health of grass.
- 6. Apply pre and post emergent herbicides as required or directed to control weed growth throughout the establishment and maintenance periods.
- 7. Fertilize general lawn areas (minimum two applications) with balanced commercial grade lawn fertilizer until complete and uniform coverage is obtained.
- Fertilize Sports Field areas (minimum four applications) using a high nitrogen formula such as HJ 25-0-0 with Wolftrax or Scotts Sierrablen 27+5+5+Fe or Scotts Fairwaymaster 20+5+8 or approved equal.

Note: Submit fertilizer type for SSP review and approval prior to application. Depending on time of year, SSP may require a fertilizer that includes pre or post emergent herbicide.

- 9. Verti-cut or de-thatch Sports Field turf at least one time at the end of the maintenance period.
- 10. Apply top dressing (clean inorganic sand-see below) to level any divots, depressions or low spots during the maintenance period. Top dressing must be completed utilizing a mechanical top dressing machine and applying a minimum of 1/2" depth sand layer over entire field surface. (approx. 90 cubic yards of sand required).
- 11. Irrigation:
 - a) If the irrigation system is operating, program and monitor the system to provide adequate water for grass.
 - b) If the irrigation system is not operating, hand water grass.
- 12. Submit receipts/dates of all maintenance operations to SSP Design for approval.
 - B. Warranty: Warranty shall cover all lawn grasses for a period of three months from the date of final acceptance. Final acceptance will not be approved until full and uniform lawns are completely established and proof of all fertilizations including receipts have been reviewed and accepted.

PART 2 PRODUCTS

2.01.1 MATERIALS

- A. Fill Soil (sub-grade): Fertile agricultural screened topsoil or amended topsoil from site with amendments as required by soil testing lab. Use of existing site soil is prohibited until a full soil analysis/test has been completed by a certified soil testing lab. Contractor to provide testing of at least two samples from the existing soil proposed for use and submit soil test listed below for SSP / Owner review and approval. Use of existing soil for grading and fill is not acceptable until test results have been submitted and approved.
 https://www.soilkits.com/so55.html SO-55 TPSL® Turfgrass, Lawns & Athletic Fields Specific Test, Item# SO-55, Texas Plant & Soil Lab, Main Phone 956-383-0739, Fax Line 956-383-0730, Address 4915 West, Monte Cristo Road, Edinburg TX 78541
- B. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of 5.4 and maximum 7.0; organic matter to exceed 1.5%, magnesium to exceed 100 units; phosphorus to exceed 150 units; potassium to exceed 120 units; soluble salts/conductivity not to exceed 900 ppm/0.9 mmhos/cm in soil.
- C. Sand: For athletic/sports fields. Silica sand, clean, screened and free of debris. (Mathis Sand, Wright Materials Plant-3, Tel. (361) 387-0293 or approved equal). Also for use with top dressing as required by item 10 above.
- D. Sod: (See schedule for type). Provide premium #1 certified sod grown in a sod nursery on sandy soil, at least 1 yr. old with a heavy top and a strong, well-knit root system, and not more than five percent weeds or foreign grasses. Palleted sod is acceptable for general lawn areas. Large Roll sod (42" width rolls) is required for athletic fields. (King Ranch Turf Grass or approved equal)
- E. Hydromulch Material. Material for hydraulic mulching shall consist of virgin wood fibers manufactured expressly from clean whole wood chips. The chips shall be processed in such a manner as to contain no growth or germination inhibiting factors. Fiber shall not be produced from recycled materials such as sawdust, paper, cardboard, or residue from pulp and pure plants. The wood cellulose fiber mulch shall be dyed green to aid in visual metering during application. The dye shall be biodegradable and not inhibit plant growth. The wood cellulose fibers of the mulch must maintain uniform suspension in water under agitation. Upon application, the moist material shall form a blotter-like mat covering the ground. This mat shall have the characteristics of moisture absorption, percolation, and shall cover and hold seed in contact with the soil. The Contractor shall obtain certifications from suppliers that laboratory, field-testing of their product has been accomplished, and that it meets all of the foregoing requirements pertaining to wood cellulose fiber mulch. Terra-Mulch Terra-Blend with UltraGro or approved equal.
- F. Fertilizer: Starter fertilizer (BCF 15-15-15) shall be used in hydro-mulch mix. The Contractor shall provide a Soil Analysis Report and shall use report to determine quantity and ratio of fertilizer for sustained growth of grass.

- G. Soil and Mulch Tackifier: Tackifier used with mulch shall be organic. Tackifier shall be mixed and applied with the hydromulch at an appropriate rate to stabilize soils and minimize erosion. Tackifier shall be pH stable with fertilizer and shall hydrate and disperse in mixing tank with water and other materials to form homogeneous slurry. Tackifier shall leave loose, chain-like stabilizing film on surface of soil, allow moisture to percolate into soil during seed germination and seedling growth, and break itself down through microbial action. Tackifier shall not inhibit plant germination or growth.
 - 1. Organic Tackifier. Organic tackifier shall be, starch-based tackifier formulated for use with conventional mulches. Active ingredient in tackifier shall be 100 percent derived from plant starch.
 - 2. Dry powder tackifier shall be blended with insolubilizer. After blending and mixing with water, tackifier shall swell, become sticky, and be suitable for use during heavy rain. Tackifier shall be applied at rate of 80 pounds per acre. Emulsion shall cure on surface of soil and become insoluble. Tackifier shall not inhibit plant germination or growth.
- H. Fertilizer: 12-4-8 (N-P-K), formulated for slow-release Nitrogen.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine the site and conditions under which this work is to be performed. Have the installer notify the Contractor in writing, with a copy to SSP Design, if the site is unsatisfactory. Do not begin the work until unsatisfactory conditions have been corrected in a manner acceptable to installer. Beginning of work indicates acceptance of the site as satisfactory by the installer.

3.02 PREPARATION

- A. Topsoil: Refer to Section 02900 'Landscaping' for topsoil amendment.
- B. Site Preparation: Contractors must visit and review site prior to bidding. Compacted soils and sub-soils from construction activities must be ripped and tilled until a loose, friable and free-draining condition is met. All existing weeds, grass, stabilized sub-base material, rubble, excavated soil and other material shall be removed from the site and disposed of by the contractor prior to starting any new landscape work. Soil conditions around entire site must be approved by SSP Design prior to rough and finished grading operations. Contractor shall not install any fill or topsoil in landscape areas prior to site condition approval by SSP Design.

3.03 INSTALLATION – HYDROMULCH / SOD

A. All exterior ground within the limit of contract or any damaged adjacent areas, except surfaces occupied by structures and paving, except areas indicated to be undisturbed, shall be seeded, hydromulched, sodded or planted as shown on drawings. Furnish topsoil (if required or specified in plans/schedules), provide finish grading, prepare seed bed, seed, hydromulch, sod and maintain areas as indicated on the drawings.

- B. Lawn Area Preparations Grade areas to finish grades, filling as needed or removing surplus material. Float all lawn areas to a smooth, uniform grade as indicated on engineers grading plans. All lawn areas shall slope to drain away from structures and planting beds. Where no grades are shown, areas shall have a smooth and continual grade between existing or fixed controls (such as walks, curbs, catch basin, elevational steps or structures) and elevations shown on plans. Contractor to ensure proper drainage around all structures. Adjust grades as necessary to direct water away from structures and planting beds. Report any discrepancies on all drainage issues in writing to SSP Design or the project engineer.
- C. Roll, scarify, rake and level as necessary to obtain true, even lawn surfaces. All finish grades shall meet approval of the SSP, before seeding/hydromulching operations. Loosen soil to a depth of six inches (3") in lawn areas by approved method of scarification and grade to remove edges and depressions. Remove stones or foreign matter over one half inch (1/2") in diameter from the top two inches (2") of soil. Float lawn areas to finish grades as shown on civil plans. Install topsoil over prepared subbase if included in materials schedules or as required to allow for a proper seed bed for germination and strong healthy growth of sod.
- D. Lawn areas should be permitted to settle or should be firmed by rolling before hydromulching or sodding.
- E. Hydromulching shall not be performed in windy weather.
- F. Lawn areas shall be seeded by hydro-mulching evenly with an approved mechanical hydro-mulcher at the rate of a minimum of three (5) pounds per 1,000 square feet. In areas inaccessible to hydro-mulching equipment, the seeded ground shall be lightly raked with flexible rakes and rolled with a water ballast roller. After rolling, seeded areas are to be lightly mulched with wheat straw or approved material.
- G. Lawns shall be maintained by the Contractor for at least 90 days after substantial completion or as long as necessary to establish a uniform stand of the specified grasses, or until final acceptance of lawns, whichever is later.
- H. Water hydromulched / sodded areas to a minimum depth of six inches (6") with a fine spray as necessary to the equivalent of one inch (1") per week. Increase or decrease watering based on season and weather / rainfall amounts.
- I. The surface layer of soil for hydromulched areas must be kept moist during the germination period. Set irrigation controller to short (5 minute) cycles, multiple times per day to keep hydromulch moist but prevent runoff and erosion. Any eroded areas of hydromulch must be regraded and re-hydromulched.
- J. Sod shall be installed to all areas as indicated on plans.
- K. Sod Bed Preparation See A, B, C, D above. All lawn areas are to slope to drain.
- L. Sod shall be laid within 48hrs of being cut or 24 hours after delivery to the project site. Only healthy vigorous growing sod is to be laid. Any stressed or yellowing sod shall be rejected.

- M. Always lay sod across slope and tightly together so as to make a solid area. All rolls or pieces of sod must be butt-jointed with no open joints. Any open joints will require clean sand or topsoil fill and re-leveling and rolling.
- N. Roll all new sod sufficiently to set or press sod into underlying soil and provide a smooth and even finished surface. Mechanical 2 ton roller or equivalent is required.
- O. After sodding has been completed, clean up and thoroughly moisten by sprinkler newly sodded areas.
- P. Make weekly inspections to determine the moisture content of the soil and adjust the watering schedule established by the irrigation system installer to fit conditions
- Q. After grass growth has started, all areas or parts of areas, which fail to show a uniform stand of grass for any reason whatsoever shall be re-hydromulched or sodded in accordance with the plans and as specified herein. Such areas and parts of areas shall be hydromulched or sodded repeatedly until all areas are covered with a full and uniform stand of grass at no additional cost to the Owner.
- R. Watering shall be done in such a manner and as frequently as is deemed necessary by SSP to assure continued growth of healthy grass. All areas of the site shall be watered in such a way as to prevent erosion due to excessive quantities applied over small areas and to avoid damage to the finished surface due to the watering equipment.
- S. Water for the execution and maintenance of this work shall be provided by the Owner at no expense to the Contractor. The Contractor shall, however, furnish his own portable tanks, pumps, hose, pipe, connections, nozzles, and any other equipment required to transport the water from the available outlets and apply it to the seeded area in an approved manner.
- T. Mowing of the seeded, hydromulched or sodded areas shall be initiated when the grass has attained a height of one and one-half to two inches (1-1/2" to 2"). Grass height shall be maintained between one and one and one-half inches $(1 \text{ to } 1\frac{1}{2}")$ at subsequent cutting depending on the time of year. Not more than one third (1/3) of the grass leaf shall be removed at any cutting shall not occur more than seven (7) days apart.
- U. When the amount of grass is heavy, it shall be removed to prevent destruction of the underlying turf. If weeds or other undesirable vegetation threaten to smother or takeover the planted species, such vegetation shall be mowed or, in the case of rank growths, shall be uprooted, raked and removed from the area by methods approved by the SSP.
- V. Protect hydromulched / sodded areas against trespassing and damage while the grass is germinating and/or growing in. Furnish and install fences, signs, barriers or any other necessary temporary protective devices. Damage resulting from trespass, erosion, washout, settlement or other causes shall be repaired by the Contractor at his expense.
- W. Remove all fences, signs, barriers or other temporary protective devices after final acceptable.

3.04 FERTILIZING – GRASS

- A. General lawn areas shall have fertilizer applied in two (2) applications with a thorough watering immediately following each application. The first application shall be one (1) week after the hydro-seeding using a 'starter fertilizer' at manufacturer's recommended rates. The second application shall be done after 30-60 days with an approved turf builder fertilizer at manufacturer's recommended rates and as approved by SSP.
- B. Sports Field areas shall have a minimum of four (4) applications with a thorough watering immediately following each application. The first application shall be one (1) week after the hydro-seeding using a 'starter fertilizer' at manufacturer's recommended rates. Subsequent applications shall be done after 30 days, 60 days and 90 days with a balanced or higher nitrogen fertilizer at manufacturer's recommended rates and as approved by SSP.
- C. Soil analysis and time of year shall be considered with SSP to determine fertilizer type, composition and final application rates. Submit fertilizer type and analysis to SSP for approval before any application. Document fertilizer application with photos and receipts of fertilizer purchases.

3.05 CLEANUP AND PROTECTION

- A. Remove debris from landscaped areas daily and sweep clean adjacent pavements, if soiled by landscape activities.
- B. Protect lawns from any type of damage, theft or vandalism until final acceptance. Install stakes and flagging or temporary fencing if required to keep traffic off newly established lawn areas until final acceptance.

END OF SECTION

SECTION 03010 CONCRETE WORK

PART 1 GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified in this section.

DESCRIPTION OF WORK:

Extent of concrete work shown on drawings.

Concrete paving and walks are specified in Division 2.

Precast concrete is specified in other Division 3 sections.

QUALITY ASSURANCE:

<u>Codes and Standards</u>: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:

ACI 301 "Specifications for Structural Concrete for Buildings".

ACI 318 "Building Code Requirements for Reinforced Concrete."

Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

<u>Concrete Testing Service</u>: The Owner shall employ a testing laboratory to perform material evaluation tests and to design concrete mixes.

<u>Materials and installed work</u> may require testing and retesting, as directed by Architect, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests, including retesting of rejected materials and installed work, shall be done at Contractor's expense.

SUBMITTALS:

<u>Product Data</u>: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry shake finish materials, and others as requested by Architect.

<u>Shop Drawings; Reinforcement</u>: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required at openings through concrete structures.

<u>Laboratory Test Reports</u>: Submit laboratory test reports for concrete materials and mix design test as specified.

PART 2 PRODUCTS

FORM MATERIALS:

Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal framed plywood faced or other acceptable panel type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

<u>Forms for Unexposed Finish Concrete</u>: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

<u>Form Coatings</u>: Provide commercial formulation form coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

REINFORCING MATERIALS:

<u>Reinforcing Bars (Rebar)</u>: ANSI/ASTM A 615, Grade 60, deformed. No. 3 bars may be grade 40.

Welded Wire Fabric (WWF): ANSI/ASTM A 185, welded steel wire fabric.

<u>Supports for Reinforcement</u>: Provide brick bat supports for reinforcement for supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations, unless otherwise acceptable.

For slabs on grade: Use Brick bats (1/2 of full brick) to support slab and beam reinforcing.

<u>For exposed to view concrete</u> surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class I) or stainless steel protected (CRSI, Class 2).

CONCRETE MATERIALS:

Portland Cement: ANSI/ASTM C 150, Type I.

Use one brand of cement throughout project, unless otherwise acceptable to Architect.

<u>Normal Weight Aggregates</u>: ANSI/ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete.

Water: Potable.

<u>Moisture Barrier:</u> Provide moisture barrier cover over prepared base material where indicated. Use only materials which are resistant to decay when tested in accordance with ANSI/ASTM E 154, as follows:

<u>Clear Polyethylene Sheet</u> not less than 6 mils thick.

<u>Chemical Hardener (ChHd Fn)</u>: Colorless aqueous solution containing a blend of magnesium flousilicate and zinc flousilicate combined with a wetting agent, containing not less than 2 lbs. of flousilicates per gal.

<u>Non slip Aggregate Finish (NSAg Fn)</u>: Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non slip finish with emery aggregate containing not less than 40% aluminum oxide and not less than 25% ferric oxide. Use material that is factory graded, packaged, rust proof and non glazing, and is unaffected by freezing, moisture and cleaning materials.

<u>Absorptive Cover</u>: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

Moisture Retaining Cover: One of the following, complying with ANSI/ASTM C 171.

10 mil polyethylene vapor barrier (clear).

<u>Liquid Membrane Forming Curing Compound</u>: (Typical): ASTM C309 Type 1; approved by Asphalt and Vinyl Composition Tile Institute; 30% minimum solids content.

<u>Products</u>: offered by manufacturers to comply with the requirements for membrane forming curing compounds include the following:

"Klearseal:; Setcon Industries.
"Floor Coat"; The Eeuclid Chemical Corp.
"MB 429"; Master Builders
"Kure N Seal 800"; Sonneborn Contech.
"Klorkure 800"; Setcon Industries.
"Clear Seal 800"; W. R. Grace
"Dress and Seal"; L & M Construction Chemicals.
"Sealco 800"; Gifford Hill.

Note: Verify that selected product will not affect bonding of subsequent wall finishes or floor coverings.

PROPORTIONING AND DESIGN OF MIXES:

<u>Prepare design mixes</u> for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.

<u>Submit written reports</u> to Architect of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Architect.

<u>Design mixes</u> to provide normal weight concrete with the following properties unless otherwise noted on the structural drawings, as indicated on drawings and schedules:

All concrete, except curb concrete, shall be flowable concrete comprised of:

1. Not less than 470# (5 sacks) of cement Type I per yard of concrete. (Unless water reducing agent is provided.)

2. Water reducer shall be used equal to WRDA No. 79, 20 oz. per yard by manufacturer by Grace Chemical.

- 3. Air 2% to 5 %.
- 4. 5" max. slump after additive placed in mix.

5. All concrete shall have a minimum compressive 28 day strength of 3,000 PSI. (Unless noted otherwise on construction drawings.)

Design Test cylinders and compression breaks of the above mix shall be submitted to the Architect/Engineer for approval. Should cylinders fail to meet specifications, the cement added shall be increased to satisfy the required strength.

Curb concrete shall be 4 sack per yard minimum cement factor and have a w/c maximum ratio of 0.65 with a minimum 28 day compressive strength of 2,500 PSI. Max slump shall be 3".

CONCRETE MIXES:

<u>Ready Mix Concrete</u>: Comply with requirements of ANSI/ASTM C 94, and as herein specified.

Addition of water to the batch will not be permitted.

During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.

When air temperature is between 85 degrees F (30 degrees C) and 90 degrees F (32 degrees C), reduce mixing and delivery time from 1 1/2 hours to 75 minutes, and when air temperature is above 90 degrees F (32 degrees C), reduce mixing and delivery time to 60 minutes. Ice or other means of cooling shall be added to mix should concrete exceed 95 deg. F.

Admixtures:

<u>Use air entraining</u> in all concrete, unless otherwise shown or indicated. Add air entraining admixture at the manufacturer's prescribed rate to result in concrete at point of placement having air content within the following limits: 2% to 5% air. When air entrainment is used, reduce the maximum water content of the design mixes.

A water reducing additive such as Master Builders' Pozzolith or Gifford Hills' PSI shall be used for all concrete. Such shall be used in strict compliance with manufacturer's recommendations, such as to provide a flowable mix.

Use amounts of admixtures as recommended by the manufacturer for climate conditions prevailing at the time of placing. Adjust quantities of admixtures as required to maintain quality control. All such shall be subject to approval of the Engineer and Architect.

Calcium Chloride: Do not use calcium chloride in concrete, except as otherwise authorized in writing by the Architect. Do not use any admixtures containing calcium chloride where concrete is placed against any galvanized steel, post tension steel or in any mix using high early strength cement.

PART 3 EXECUTION

FORMS:

<u>Design</u>, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position. Use wood forming for the full surfaces of the exterior side of all grade beams.

<u>Design formwork</u> to be readily removable without impact, shock or damage to cast in place concrete surfaces and adjacent materials.

<u>Construct forms</u> to sizes shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

<u>Fabricate forms for easy removal</u> without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

<u>Provide temporary openings</u> where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

<u>Chamfer exposed corners</u> and edges as indicated, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

<u>Provisions for Other Trades</u>: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

<u>Cleaning and Tightening</u>: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

PLACING REINFORCEMENT:

Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

<u>Clean reinforcement</u> of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

<u>Accurately position</u>, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support

reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

<u>Place reinforcement</u> to obtain at least minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

<u>Install welded wire fabric</u> in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

Chuting of concrete in excess of 25' (twenty five feet) of slab perimeter is not approved. "Pumping Placement" of all concrete shall be required of all foundation work beyond 25' (twenty five feet) of perimeter.

JOINTS:

<u>Construction Joints</u>: Locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to Architect.

<u>Provide keyways</u> at least 1 1/2" deep in construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.

<u>Place construction joints</u> perpendicular to the main reinforcement. Continue reinforcement across construction joints.

Joint sealant materials are specified in Division 7 sections of these specifications.

INSTALLATION OF EMBEDDED ITEMS:

<u>General</u>: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast in place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.

<u>Edge Forms and Screed Strips for Slabs</u>: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike off templates or accepted compacting type screeds.

PREPARATION OF FORM SURFACES:

Coat contact surfaces of forms with a form coating compound before reinforcement is placed.

Thin form coating compounds only with thinning agent of type, and in amount, and under conditions of form coating compound manufacturer's directions. Do not allow excess form coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

CONCRETE PLACEMENT:

Contractor shall notify Architect's office 48 hours prior to placement of concrete for on-

site visual inspection by Structural Engineer.

<u>Preplacement Inspection</u>: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

<u>Coordinate</u> the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

General: Comply with ACI 304and as herein specified.

Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

<u>Placing Concrete in Forms</u>: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

<u>Consolidate placed concrete</u> by mechanical vibrating equipment supplemented by hand spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

<u>Do not use vibrators</u> to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

<u>Placing Concrete Slabs</u>: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

<u>Consolidate concrete</u> during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

<u>Bring slab surfaces to correct level</u> with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

Maintain reinforcing in proper position during concrete placement operations.

<u>Cold Weather Placing</u>: Place no concrete when temperature is less than 40 degrees F or 45 degrees F and falling.

Hot Weather Placing: When hot weather conditions exist that would seriously impair

quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

<u>Cover reinforcing steel</u> with water soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

Wet forms thoroughly before placing concrete.

FINISH OF FORMED SURFACES:

<u>Rough Form Finish</u>: For formed concrete surfaces not exposed to view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.

<u>Smooth Form Finish</u>: For formed concrete surfaces exposed to view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, painting or other similar system. This is as cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

<u>Smooth Rubbed Finish</u>: Provide smooth rubbed finish to scheduled concrete surfaces, which have received smooth form finish treatment, not later than one day after form removal.

Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

<u>Related Uniformed Surfaces</u>: At tops of walls, horizontal offsets surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

MONOLITHIC SLAB FINISHES:

<u>Scratch Finish</u>: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.

After placing slabs, plane surface to a tolerance not exceeding 1/2" in 10' when tested with a 10' straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms or rakes.

<u>Float Finish</u>: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand bed terrazzo, and as otherwise indicated.

After screening, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power driven floats, or both. Consolidate
surface with power driven floats, or by hand floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/4" in 10' when tested with a 10' straight edge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

<u>Trowel Finish</u>: Apply trowel finish to monolithic slab surfaces to be exposed to view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thinfilm finish coating system.

After floating, begin first trowel finish operation using a power driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding

1/8" in 10' when tested with a 10' straightedge. Grind smooth surface defects which would telegraph through applied floor covering system.

<u>Non Slip Broom Finish</u>: Apply non slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.

Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

<u>Chemical Hardener Finish</u>: Apply chemical hardener finish to interior concrete floors where indicated. Apply liquid chemical hardener after complete curing and drying of the concrete surface. Dilute liquid hardener with water, and apply in 3 coats; first coat, 1/3 strength; secondcoat, 1/2 strength; third coat, 2/3 strength. Evenly apply each coat, and allow 24 hours for drying between coats.

Apply proprietary chemical hardeners, in accordance with manufacturer's printed instructions.

After final coat of chemical hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

<u>Non slip Aggregate Finish</u>: Apply non slip aggregate finish to concrete stair treads, platforms, ramps, and elsewhere as indicated.

After completion of float finishing, and before starting trowel finish, uniformly spread 25 lbs. of dampened non slip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.

After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose non slip aggregate.

CONCRETE CURING AND PROTECTION:

<u>General</u>: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.

Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

<u>Curing Methods</u>: Perform curing of concrete by moist curing, by moisture retaining cover curing, by curing compound, and by combinations thereof, as herein specified.

Provide moisture curing by following methods.

Keep concrete surface continuously wet by covering with water.

Continuous water fog spray.

Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

Provide moisture cover curing as follows:

Cover concrete surfaces with moisture retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

Provide curing compound to slab as follows:

Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions. Recoat areas immediately after initial application. Maintain continuity of coating and repair damage during curing period. Apply 2 separate coatings of spray cure. Second coat shall be applied in a pattern at 90 deg. to the first coat.

Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

<u>Curing Formed Surfaces</u>: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

<u>Curing Unformed Surfaces</u>: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing compound. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture retaining cover, unless otherwise directed.

REMOVAL OF FORMS:

<u>Formwork not supporting weight of concrete</u>, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F. (10 degrees C) for 24 hours after placing concrete, provided concrete is

sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

<u>Formwork supporting weight of concrete</u>, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of inplace concrete by testing field cured specimens representative of concrete location or members.

<u>Form facing material</u> may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

RE USE OF FORMS:

Clean and repair surfaces of forms to be re used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

MISCELLANEOUS CONCRETE ITEMS:

<u>Filling In</u>: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in place construction. Provide other miscellaneous concrete filling shown or required to complete work.

<u>Equipment Bases and Foundations</u>: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

CONCRETE SURFACE REPAIRS:

<u>Patching Defective Areas</u>: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect.

Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

<u>For exposed to view surfaces</u>, blend white portland cement and standard portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

<u>Repair of Formed Surfaces</u>: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

<u>Repair concealed formed surfaces</u>, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

<u>Repair of Unformed Surfaces</u>: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.

<u>Repair finished unformed surfaces</u> that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non reinforced sections regardless of width, spalling, pop outs, honeycomb, rock pockets, and other objectionable conditions.

<u>Correct high areas</u> in unformed surfaces by grinding, after concrete has cured at least 14 days.

<u>Correct low areas</u> in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.

<u>Repair defective areas</u>, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

<u>Repair isolated random cracks</u> and single holes not over 1" in diameter by dry pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry pack, consisting of one part portland cement to 2 1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

Use epoxy based mortar for structural repairs, where directed by Architect. <u>Repair methods</u> not specified above may be used, subject to acceptance of Architect.

QUALITY CONTROL TESTING DURING CONSTRUCTION:

The Owner will employ a testing laboratory to perform other tests and to submit test reports.

Sampling and testing for quality control during placement of concrete may include the following, as directed by Architect.

Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

<u>Slump</u>: ASTM C 143; the first three trucks will be tested for adequate slump, and every fifth truck thereafter. Those trucks exceeding the maximum 5" slump WILL NOT BE ACCEPTED.

<u>Compression Test Specimen</u>: ASTM C 31; one set of 3 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field cure test specimens are required. All making and handling of test specimens shall be by Laboratory personnel.

<u>Compressive Strength Tests</u>: ASTM C 39; one set for each 50 cu. yds.or fraction thereof, of each concrete class placed in any one day for each 5,000 sq. ft. of surface area placed: 1 specimen tested at 7 days, 1 specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive by more than 500 psi.

<u>Test results</u> will be reported in writing to Architect and Contractor on same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7 day tests and 28 day tests.

<u>Additional Tests</u>: The testing service will make additional tests of in place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION 03010

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

SUMMARY

This section includes the following metal fabrications: Lintels Trench Grate Covers

Miscellaneous framing and supports for the following:

<u>Related Sections</u>: The following sections contain requirements that relate to this section.

DEFINITIONS

SUBMITTALS:

<u>General:</u> Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

<u>Product Data</u>: for products used in miscellaneous metal fabrications, including paint products and grout.

<u>Shop Drawings</u>: Submit shop drawings for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation by other sections.

<u>Samples</u>: representative of materials and finished products as may be requested by Architect.

QUALITY ASSURANCE

<u>Fabricator Qualifications:</u> Firm experienced in successfully producing metal fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

<u>Installer Qualifications</u>: Arrange for installation of metal fabrications specified in this section by same firm that fabricated them.

<u>Qualify welding processes and welding operators</u> in accordance with AWS D1.1 "Structural Welding Code - Steel," D1.3 "Structural Welding Code - Sheet Steel", and D1.2 "Structural Welding Code - Aluminum."

Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

PROJECT CONDITIONS

<u>Field Measurements</u>: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 - PRODUCTS:

FERROUS METALS:

<u>Metal Surfaces, General</u>: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom form surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

- A. Structural-Steel Shapes: ASTM A 572 or ASTM A 992 (Fy=50 ksi)
- B. Structural steel pipe: ASTM A53, standard weight (Schedule 40), black finish.
- C. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500, GR B.
- D. Plates, bars and angles: ASTM A36.
- E. Anchor Rods, Bolts, Nuts: ASTM A 36.
- F. Bolts, Nuts, and Washers: ASTM A 325, Type 1, high-strength heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers, uncoated.
- G. Primer: Lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

For exterior installations and where indicated, provide fabrications with hot-dip galvanized coating.

<u>Uncoated Structural Steel Sheet</u>: Product type (manufacturing method), quality, and grade, as follows:

- A. Cold-Rolled Structural Steel Sheet: ASTM A 611, grade as follows:
- B. Grade A, unless otherwise indicated or required by design loading.
- C. Hot-Rolled Structural Steel Sheet: ASTM A 570, grade as follows:
- D. Grade 30, unless otherwise indicated or required by design loading.

Uncoated Steel Sheet: Commercial quality, product type (method of manufacture) as follows:

- A. Cold Rolled Steel Sheet: ASTM A 366.
- B. Hot Rolled Steel Sheet: ASTM A 569

Galvanized Steel Sheet: Quality as follows:

- A. Structural Quality: ASTM A 446; Grade A, unless another grade required for design loading, and G90 coating designation unless otherwise indicated.
- B. Commercial Quality: ASTM A 526, G90 coating designation unless otherwise indicated.
- C. Type S, Grade A standard weight (schedule 40), unless otherwise indicated, or another grade or weight or both required by structural loads.

Provide Hot Dipped Galvanized finish for exterior installations and where indicated.

Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.

Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

GROUT AND ANCHORING CEMENT

<u>Non-shrink Nonmetallic Grout</u>: ASTM C 1107; recommended by manufacturer for exterior applications.

<u>Available Products</u>: Subject to compliance with requirements, products that may be incorporated in the work include but are not limited to the following:

Products: Subject to compliance with requirements, provide one of the following:

Non-shrink Nonmetallic Grouts:

"Basal Construction Grout"; W. R. Bonsal Co.
"Euco N-S Grout"; Euclid Chemical Co.
"Kemset"; Chem-Masters Corp.
"Masterflow 713"; Master Builders.
"Sealtight 588 Grout"; W. R. Meadows, Inc.
"Sonogrout"; Sonneborn Building Products Div., Rexnord Chemical Products, Inc.
"Five Star Grout"; U. S. Grout Corp.
"Vibropruf #11"; Lambert Corp.

Fasteners:

<u>General</u>: Provide zinc coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.

- A. <u>Bolts and Nuts</u>: Regular Hexagon head type, ASTM A 307, Grade A.
- B. Lag Bolts: Square head type, FS FF-B-561.
- C. Machine Screws: Cadmium plated steel, FS FF-S-92.
- D. Wood Screws: Flat head carbon steel, FS FF-W-92.
- E. Plain Washers: Round, carbon steel, FS FF-W-92.
- F. Drilled- In Expansion Anchors: Expansion anchors complying with FS FF-S-325, Group VIII (anchors, expansion, (non-drilling), Type I(internally threaded tubular expansion anchor); and machine bolts complying with FS FF-B-575, Grade 5.
- G. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required.
- H. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

Paint:

<u>Shop Primer for Ferrous Metal:</u> Manufacturer's or fabricator's standard, fast-curing, METAL FABRICATIONS 05500 - 3 lead-free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure complying with performance requirements of FS TT-P-645.

<u>Galvanizing Repair Paint</u>: High zinc dust content paint for re-galvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD - P- 21035 or SSPC-Paint-20.

<u>Bituminous Paint</u>: Cold-applied asphalt mastic complying SSPC-Paint 12 except containing no asbestos fibers.

Zinc Chromate Primer: FS TT-P-645.

Fabrication:

Fabrication shop shall have a minimum of three years experience in the field of steel fabrication. Steel erector shall have same minimum experience.

Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

Temperature Change (Range): 100 deg F (55.5 deg C).

General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.

Submit shop drawings of all structural steel members. Shop drawings shall include fabrication piece drawings and field erection drawings. Structural construction drawings shall not be photocopied and submitted. Contractor to provide electronic copies for engineering review.

Welding: Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. At exposed connections, finish welds and surfaces smooth with contour of welded surface matching those adjacent. Fabrication shop shall provide AWS welder certifications as requested by owner's engineer.

Fabricate loose lintels from steel angles. Loose lintel angles shall be hot dipped galvanized unless noted other wise.

Fabricate steel pipe columns with steel top plates drilled for connection bolts and welded to pipe with continuous fillet weld same size as pipe wall thickness.

1. Provide base plates as scheduled on construction documents.

Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

Provide for anchorage of type indicated, coordinated with supporting structure. METAL FABRICATIONS 05500 - 4 Fabricate and space anchoring devices to provide adequate support for intended use.

<u>Shop Assembly:</u> Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

<u>Cut, reinforce, drill and tap</u> miscellaneous metal work as indicated to receive finish hardware and similar items.

<u>Fabricate joints</u> which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

ERECTION

Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack.

Fit exposed connections accurately together to form hairline joints.

All bolted moment conection shall have high strength bolts using "Turn-of-Nut" method according to RCSC's specification structural joints using ASTM A325 or A490 Bolts and AISC "Manual of Steel Construction".

A qualified independent inspector shall be hired by the contractor to provide inspection of all bolted and welded connections.

<u>Bicycle Rack:</u> Equal to Park Warehouse, Wide Loop U Bike Rack, Model No. 900br175. Unit to be galvanized with in-ground mounting.

END OF SECTION 05500

SECTION 06100 - ROUGH CARPENTRY

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Definition: Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated. Types of work in this section include rough carpentry for:

Finish carpentry is specified in another section within Division 6.

REFERENCES:

Lumber Standards: Comply with PS 20 70 and with applicable rules of the respective grading and inspecting agencies for species and products indicated.

Plywood Product Standards: Comply with PS 1 (ANSI A 199.1) or, for products not manufactured under PS 1 provision, with applicable APA Performance Standard for type of panel indicated.

SUBMITTALS:

Wood Treatment Data: Submit treatment manufacturer's instructions for proper use of each type of treated material.

Preservative Treatment: For each type specified, include certification by treating plant stating type of preservative retained and conformance with applicable standards.

For water borne treatment, include statement that moisture content of treated materials was reduced to a maximum of 15% prior to shipment to project site.

PRODUCT HANDLING:

Delivery and Storage: Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within stacks.

JOB CONDITIONS:

Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow attachment of other work.

PART 2 PRODUCTS

LUMBER, GENERAL:

Factory mark each piece of lumber with type, grade, mill and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.

Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.

Provide dressed lumber, S4S, unless otherwise indicated.

Provide seasoned lumber with 19% maximum moisture content at time of dressing.

Framing Lumber (2" through 4" thick) (Wd Frm):

For light framing (less than 6" wide), provide "Stud" grade lumber for stud framing and "Standard" grade for other light framing, any species.

For light framing (less than 6" wide), provide the following grade, any species:

For structural framing (6" and wider and from 2" to 4" thick), provide the following grade and species:

Select Structural grade. No. 1 grade. No. 2 grade. No. 3 grade.

Any species of the specified grade. Any species and grade which meets or exceeds the following values:

Fb (minimum extreme fiber stress in bending); 1500 psi. E (minimum modulus of elasticity); 1,500,000 psi.

Exposed Framing Lumber (2" through 4" thick):

Where framing will not be concealed by other work, provide the following grade and species:

Douglas Fir, Appearance Framing (WCLB or WWPA). Southern Pine, Appearance Grade, Kiln Dried (SPIB). Redwood Clear All Heart (RIS). Boards (less than 2" thick).

Exposed Boards: Where boards will be exposed in the finished work, provide the following:

Moisture Content: 19% maximum, "S DRY." Where painted finish is indicated, provide Southern Pine, No. 2 Boards per SPIB, or Douglas Fir Construction Boards (WCLB or WWPA).

Concealed Boards: Where boards will be concealed by other work, provide lumber of 19% maximum moisture content (S DRY) and of following species and grade:

Board Sizes: Provide sizes indicated or, if not indicated (for sheathing, sub flooring and similar uses), provide 1" x 8" boards.

MISCELLANEOUS, LUMBER:

Provide wood for support or attachment of other work including cant strips, bucks, nailers, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown, and as follows:

Moisture content: 15% maximum for lumber items not specified to receive wood preservative treatment.

Grade: Construction Grade light framing size lumber of any species or board size lumber as required. Provide construction grade boards (RIS or WCLB) or No. 2 boards (SPIB or

WWPA).

PLYWOOD (Pwd):

Trademark: Identify each plywood panel with appropriate APA trademark.

Plywood Decking / Sheathing: Refer to Structural.

Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant treated plywood panels with grade designation, APA C-D PLUGGED INT with exterior glue, in thickness indicated, or, if not otherwise indicated, not less than $\frac{1}{2}$ ".

Plywood Exterior Sheathing: Provide fire-retardant treated plywood panels with grade designation, APA C-D plugged exterior with exterior glue in thickness shown.

MISCELLANEOUS MATERIALS:

Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices.

Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.

Where rough carpentry work is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners and anchorages with a hot dip zinc coating (ASTM A 153).

WOOD TREATMENT:

Preservative Treatment: Where lumber or plywood is indicated as "Trt Wd" or "Treated," or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood) and of AWPB Standards listed below. Mark each treated item with the AWPB Quality Mark Requirements.

Pressure treat above ground items with water borne preservatives complying with AWPB LP 2. After treatment, kiln dry to maximum moisture content, respectively of 19% and 15%. Treat indicated items and the following:

Wood cants, nailers, curbs, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers and waterproofing.

Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

Inspect each piece of treated lumber or plywood after drying and discard damaged of defective pieces.

BARRIER MEMBRANE AND FLASHING:

Membrane over plywood roof deck (exterior): Acceptable Product: Sharkskin Ultra SA™ as manufactured by: Kirsch Building Products LLC, 1464 Madera Road, Suite 387, Simi Valley, CA 93065; Tel: (805) 750-0084 Fax: 805-526-1116; www.sharkskin.us.

Provide a self-adhered roof underlayment that has passed the requirements set forth in ICC/ES Report 1708 and Miami/Dade TAS 103.

PART 3 – EXECUTION

INSTALLATION, GENERAL:

Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted.

Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards.

Countersink fasteners on exposed carpentry work and fill holes.

Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.

WOOD GROUNDS, NAILERS, BLOCKING AND SLEEPERS:

Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

Provide permanent grounds of dressed, preservative treated, key beveled lumber not less than 1 1/2" wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

Fire stop concealed spaces with wood blocking not less than 2" thick, if not blocked by other framing members. Provide blocking at each building story level and at ends of joist spans.

Installation of Plywood:

General: Comply with applicable recommendations contained in Form No. E 304, "APA Design/Construction Guide Residential & Commercial," for types of plywood products and applications indicated.

Fastening Methods: Fasten panels as indicated below: Sheathing: Screw to framing. Plywood Backing Panels: Screw to supports.

END OF SECTION 06100

SECTION 06200 - FINISH CARPENTRY

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Definition: Finish carpentry includes carpentry work which is exposed to view, is non structural, and which is not specified as part of other sections.

Types of finish carpentry work in this section include:

Fascias Trim Wall Mounted Plastic Laminate

Rough carpentry is specified in another Division 6 section.

Builders Hardware and wood doors are specified in Division 8 sections.

Architectural woodwork is specified in another Division 6 section.

QUALITY ASSURANCE:

Factory mark each piece of lumber and plywood with type, grade, mill and grading agency identification; except omit marking from surfaces to receive transparent finish, and submit mill certificate that material has been inspected and graded in accordance with requirements if it cannot be marked on a concealed surface.

SUBMITTALS:

Product Data: Submit manufacturer's specifications and installation instructions for each item of factory fabricated siding and paneling.

PRODUCT DELIVERY, STORAGE AND HANDLING:

Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

Do not deliver finish carpentry materials until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, finish carpentry materials must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

JOB CONDITIONS:

Conditioning: Installer shall advise Contractor of temperature and humidity requirements for finish carpentry installation areas. Do not install finish carpentry until required temperature and relative humidity have been stabilized and will be maintained in installation areas.

PART 2 - PRODUCTS

WOOD PRODUCT QUALITY STANDARDS:

Softwood Lumber Standards: Comply with PS 20 and with applicable grading rules of the respective grading and inspecting agency for the species and product indicated.

Plywood Standard: Comply with PS 1/ANSI A199.1.

Hardwood Lumber Standard: Comply with National Hardwood Lumber Association (NHLA) rules.

Hardwood Plywood Standard: Comply with PS 51.

Woodworking Standard: Where indicated for specific products comply with specified provision of the following:

Architectural Woodwork Institute (AWI) "Quality Standards."

Glued -up Lumber Standard: Comply with PS 56.

MATERIALS:

General:

Nominal sizes are indicated, except as shown by detailed dimensions. Provide dressed or worked and dressed lumber, as applicable, manufactured to the actual sizes as required by PS 20 or to actual sizes and pattern as shown, unless otherwise indicated.

Moisture Content of Softwood Lumber: Provide kiln -dried (KD) lumber having moisture content from time of manufacture until time of installation not greater than 6% to 11%.

Moisture Content of Hardwood Lumber: Provide kiln -dried (KD) lumber having moisture content from time of manufacture until time of installation from 6% to 11%.

Lumber for Transparent Finish (Stained or Clear): Use good grade pieces made of Cedar.

Lumber for Painted Finish: Any closed grain hardwood, AWI Section 300, custom grade.

INTERIOR FINISH CARPENTRY:

Shelving: 1" shelves 36" wide or over #1 SYP and ³/₄" for shelves under 36".

Cleats: #1 SYP.

Solid Surfacing: Equal to Wilsonart Solid Surface at countertops and backsplashes as per drawings.

Standards: Meet requirements and recommendations of applicable portions of standards listed.

Federal Specifications: FS equal to Wilson Art

Examining:

Examine surfaces that are to receive Solid Surface. Report unsatisfactory condition.

Do not start installation of Solid Surface until satisfactory conditions have been corrected.

Proceeding with installation of Solid Surface will be constructed as evidence of acceptance of conditions under which work will be done.

Protecting:

Handle Solid Surface and items to avoid injury to person and to avoid damage to materials or to work in place. Satisfactorily repair or remove and replace work that has been damaged.

Protect adjacent surfaces from damage, soiling and adhering of adhesives and extra materials.

Protect Solid Surface from damage by weather and construction. Install necessary protective covering for surfaces that may have traffic during construction period.

Remove protective covering upon completion of project. Remove and replace work that has been damaged.

Delivering and Storing:

Deliver materials to site in manufacturer's original, unopened, labeled containers or packages.

Submit samples for approval of the Architect.

APPLICATION:

Trim shall be plumb and/or level with miter joints and finished as specified earlier. Prefinished trim shall be required.

Application shall not take place sooner than 24 hours of temperatures less than 42 deg F.

Miscellaneous Materials:

Fasteners and Anchorages: Provide nails, screws and other anchoring devices of the type, size, materials and finish required for application indicated to provide secure attachment, concealed where possible, and complying with applicable Federal Specifications.

All interior and exterior nails shall be galvanized.

Where finish carpentry is exposed on exterior or in areas of high relative humidity, provide fasteners and anchorages with a hot-dipped zinc coating (ASTM A 153).

PART 3 - EXECUTION

PREPARATION:

Condition wood materials to the average humidity condition in installation areas prior to installing.

Back prime lumber for painted finish exposed on the exterior or, where indicated, to

moisture and high relative humidity on the interior. Comply with requirements of section on painting within Division 9 for primers and their application.

INSTALLATION:

Discard units of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacturer with respect to surfaces, sizes or patterns.

Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8' -0" for plumb and level countertops; and with 1/16" maximum offset in flush adjoining 1/8" maximum offsets in revealed adjoining surfaces.

Scribe and cut work to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

Anchor finish carpentry work to anchorage devices or blocking built -in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where pre-finished matching fasteners heads are required, use fine finishing nail for exposed nailing, countersunk and filled flush with finished surface, and matching final finish where transparent is indicated.

MILLWORK AND TRIM:

Exterior and interior millwork and trim shall conform to design and details shown. Where practical, work shall be finished and assembled at the mill. All mill work and trim shall be furnished smooth and free from machine and tool marks that will show through the finish. All nail heads shall be set to receive putty.

Doors and other movable parts shall be accurately fitted with proper clearances and left in perfect working order. Passage doors shall have a minimum clearance of 1/8" at sides and top, and doors and hardware shall be fitted to template so that they may be interchanged from opening to opening. All refitting necessary due to swelling shrinking, assembly or installation shall be done by this Contractor, for a period of one year after completion and acceptance of the building.

When dressing or cutting has been done, these surfaces shall be refinished. The work shall be left clean and free from warp, twist, open joints or other defects.

Metal thresholds: Fit and set metal thresholds in mastic.

LOCATION OF FINISH HARDWARE:

Locate hardware for door and door frames as follows unless shown otherwise on the drawings:

Center doorknobs 38" above floor. Offset screen door latches to clear door locksets.

Center door pulls 42" above floor and push plates 48" above floors.

INSTALLATION OF WINDOWS:

Install windows and operating sash closed and locked, and set plumb, true, and centered in openings; securely anchored in place, using approved manufacturers

anchors specifically designed for use in the openings detailed.

Check all windows for smooth operation and proper function and adjust as required, prior to acceptance by the Architect.

ADJUSTMENT, CLEANING, FINISHING AND PROTECTION:

Repair damaged and defective finish carpentry work wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.

Refer to Division 9 sections for final finishing of installed finish carpentry work.

Protection: Installer of finish carpentry work shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

END OF SECTION 06200

SECTION 06400 - ARCHITECTURAL WOODWORK

<u> PART 1 - GENERAL</u>

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Extent of each type of architectural woodwork is indicated on drawings and in schedules.

Types of architectural woodwork include the following: Shelving Millwork Countertops Toilet Partitions

Finish carpentry is specified in another section of Division 6.

QUALITY ASSURANCE:

AWI Quality Marking: Mark each assembled unit of architectural woodwork with manufacturer's identification and grade mark evidencing compliance with indicated AWI quality grade. Locate grade mark on surfaces which will not be exposed after installation. For other items requiring field assembly, a certification of compliance may be substituted for marking of individual pieces.

Arrange for architectural woodwork with sequence matched wood veneers to be produced by a single firm.

REFERENCES:

AWI Quality Standard: Comply with applicable requirements of "Architectural Woodwork Quality Standards" published by the Architectural Woodwork Institute (AWI), excets otherwise indicated.

SUBMITTALS:

Product Data: Submit manufacturer's specifications and installation instructions for each item of factory fabricated woodwork.

Certification: Include certification that fire -retardant treated materials comply with governing regulations.

Quality Certification: Submit Manufacturer's (Fabricator's) certification, stating that fabricated work complies with quality grades and other requirements indicated.

Shop Drawings: Submit shop drawings showing location of each item, dimensioned plans and elevations, large scale details, attachment devices and other components. Submit shop drawings for the following:

Framed openings and lights, including trim. Shelving

PRODUCT DELIVERY, STORAGE AND HANDLING:

Protect woodwork during transit, delivery, storage and handling to prevent damage,

soiling and deterioration.

Do not deliver woodwork, until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas. If, due to unforeseen circumstances, woodwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

JOB CONDITIONS:

Conditioning: Woodwork Manufacturer and Installer shall advise Contractor of temperature and humidity requirements for woodwork installation and storage areas. Do not install woodwork until required temperature and relative humidity have been stabilized and will be maintained in installation areas.

Maintain temperature and humidity in installation area as required to maintain moisture content of installed woodwork within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period.

The fabricator of woodwork shall determine optimum moisture content and required temperature and humidity condition.

PART 2 PRODUCTS

General: Except as otherwise indicated, comply with following requirements for architectural woodwork not specifically indicated as prefabricated or pre-finished standard products.

Wood Moisture Content: Provide kiln dried (KD) lumber with an average content range of 6% to 11% for interior work. Maintain temperature and relative humidity during fabrication, storage and finishing operations so that moisture content values for woodwork at time of installation do not exceed the following:

Interior Wood Finish: 5% - 10% for mild regions (as defined by AWI).

Plywood: Closed grain hardwood plywood with exterior glue complying with requirements for specified woodwork grade.

Plastic Laminate: Comply with NEMA LD-3 for type, thickness, color, pattern and finish as indicated for each application, or if not indicated, as selected by Architect from manufacturer's standard products as well as the following;

Wilsonart -	All Available Colors, including Premium Colors
Formica -	All Available Colors, including Premium Colors
Nevamar-	All Available Colors, including Premium Colors

Quality Standards: For following types of architectural woodwork; comply with indicated standards as applicable:

Standing and Running Trim: AWI Section 300. Casework and Countertops: AWI Section 400. Shelving: AWI Section 600. Miscellaneous Work: AWI Section 700. Exterior Frames: AWI Section 900.

Design and Construction Features: Comply with details shown for profile and

construction of architectural woodwork, and, where not otherwise shown, comply with applicable Quality Standards, with alternate details as Fabricator's option.

Pre -Cut Openings: Fabricate architectural woodwork with pre -cut openings, where possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items. Locate openings accurately and use templates or roughing -in diagrams for proper size and shape. Smooth edges of cutoffs and, where located in countertops and similar exposures seal edges of cutouts with a water -resistant coating.

Measurements: Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain field measurements and verify dimensions and shop drawing details as required for accurate fit.

Where sequence of measuring substrates before fabrication would delay the project, proceed with fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of woodwork for accurate fit.

INTERIOR ARCHITECTURAL WOODWORK: Core: Plywood. Particle core panels will not be accepted.

Construction: Reveal overlay.

Exposed Surfaces: Provide high pressure laminate in grades indicated for the following types of surfaces:

Horizontal Surfaces: GP -50 (0.050" nominal thickness). Post Formed Surfaces: PF -42 (0.042" nominal thickness). Vertical Surfaces: GP -28 (0.028" nominal thickness).

Except as otherwise indicated, provide separate plastic laminate countertops (installed over closed grain plywood substrate) to comply with requirements for casework for plastic laminate finish. Provide with coved backsplash. Note at science lab countertops, provide epoxy resin tops, black in color.

Fabricate exposed edges of casework, including edges of doors and drawers when open, with matching plastic laminate, except as otherwise indicated.

Shelves: 1" thick, reversible, plastic laminate finish all sides and all edges.

General: These requirements do not apply to shelving which is either integral with or indicated as "casework"; comply with casework requirements for those units of shelving.

Grade: Custom.

FINISH FOR ARCHITECTURAL WOODWORK:

General: The priming and pre-finishing (if any) of architectural woodwork required to be performed at the shop or factory is specified as work of this section. Refer to Division 9 sections for final finishing of installed architectural woodwork.

At the Contractor's option, he may use plastic laminate interior finish in lieu of painted surfaces.

Preparations for Finish: Comply with AWI Quality Standards, Section 1500, for sanding,

filling countersunk fasteners, back priming and similar preparations for finishing of architectural woodwork, as applicable to each unit of work.

CABINET HARDWARE AND ACCESSORY MATERIALS:

General: Provide cabinet hardware and accessory materials associated with architectural woodwork, except for units which are specified as "door hardware" in other sections of these specifications.

Hardware Standards: Except as otherwise indicated, comply with ANSI A156.9 " American National Standard for Cabinet Hardware".

Quality Level: Type 2 (institutional), unless otherwise indicated.

Quality Certification: Where available, provide cabinet hardware bearing the BHMA certification label, affixed either to hardware or its packaging, showing compliance with BHMA.

Cabinet Hardware Standard 201.

Cabinet Hardware: Provide all cabinet hardware required for proper installation and operation, whether listed below or not.

Metal Shelf Standards and Brackets: Provide one of the following: No. 87 Standards and No. 187 Brackets; Knape & Vogt Mfg. Co. Finish: Nickel-plated.

Pivoted Hinges: model no. 872 Face Frame Hinge by Grass America

Finish for Butts and Hinges: Stain nickel-plated.

Cabinet Door Pulls: Surface-Mounted: Stanley 4478 ALD

Door Pull Finish: Satin Chrome

Magnetic Cabinet Catches: Provide one of the following: Aluminum, satin finish, No.916, Knape & Vogt. Aluminum, satin finish, No.46 ALD, Standley Hardware Div.

Drawer Slides: No. 1300 Knape & Vogt Mfg. Co.

Locks: Master Lock - Five (5) pin tumbler at all drawers and doors. Typical

Cabinet Door Hardware: Provide hinges, catches and pulls of types indicated, to accommodate each door size and style.

Drawer Hardware: Provide slides and pulls of types indicated, to accommodate each drawer size and style.

Equip each drawer with side-mounted, full-extension, ball-bearing, nylon roller drawer slides with load capacity of 75 lbs. per pair.

Locks: provide standard pin-type or disc-type (5 pins or discs) tumbler locks, keyed alike in each room, at all base and wall cabinets unless noted otherwise.

Shelf Supports: Where shelving is indicated as "adjustable:, provide slotted-type standards and brackets of type needed to properly support shelves with uniform 40-lb per sq. ft. loading.

Closet Bars: Telescoping steel or brass tubing, with forged end brackets; size and wall thickness as required to support full continuous hanging of clothing.

Exposed Hardware Finish: Provide exposed hardware with BHMA Code 626 satin chromium plate finish (US26D). Where not available, provide either satin aluminum or satin stainless steel finish.

PART 3 - EXECUTION

PREPARATION:

Condition woodwork to average prevailing humidity conditions in installation areas prior to installing.

Deliver concrete inserts and similar anchoring devices to be built into substrates, well in advance of time substrates are to be built.

Prior to installation of architectural woodwork, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

INSTALLATION:

Install woodwork plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8' -0" for plumb and level (including countertops); and with 1/16" maximum offset in flush adjoining surfaces, 1/8" maximum offsets in revealed adjoining surfaces.

Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

Standing and Running Trim: Install with minimum number of joints possible, using full length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns, miter at corners and comply with referenced Quality Standards for joinery.

Anchor woodwork to anchors or blocking built -in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where pre-finished matching fasteners heads are required, use fine finishing nails for exposing nailing, countersunk and filled flush with woodwork, and matching final finish where transparent finish is indicated.

Wood Storage Shelving: Complete the assembly of units and install in the areas indicated, including hardware and accessories as indicated.

ADJUSTMENT, CLEANING, FINISHING AND PROTECTION:

Repair damaged and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair replace woodwork. Adjust joinery for uniform appearance.

Clean woodwork on exposed and semi -exposed surfaces. Touch up shop applied finishes restoring damaged or soiled areas.

Protection: Installer of architectural woodwork shall advise Contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

END OF SECTION 06400

SECTION 07200 - INSULATION

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Extent of insulation work is shown on drawings and indicated by provisions of this section.

Applications of insulation specified in this section include the following:

Blanket-type building insulation.

Roof Insulation.

Cavity Wall Insulation for Single Wythe Masonry Walls

QUALITY ASSURANCE:

Thermal Conductivity: Thicknesses indicated are for thermal conductivity (k-value at 75 degrees F or 24 degrees C) specified for each material. Provide adjusted thicknesses as directed for equivalent use of material having a different thermal conductivity. Where insulation is identified by "R" value, provide thickness required to achieve indicated value.

Fire and Insurance Ratings: Comply with fire resistance, flammability and insurance ratings indicated, and comply with regulations as interpreted by governing authorities.

Federal Specifications: Where compliance with FS standard is indicated, specified requirements for marking individual boards/batts/blankets are waived, provided packages of units are labeled to show compliance.

SUBMITTALS:

Product Data: Submit manufacturer's product specifications and installation instructions for each type of insulation and vapor barrier material required.

PRODUCT HANDLING:

General Protection: Protect insulations from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

Protection for plastic insulation:

Do not expose to sunlight, except to extent necessary for period of installation and concealment.

Protect against ignition at all times. Do not deliver plastic insulating materials to project site ahead of installation time. Complete installation and

INSULATION 03/07 07200 - 1

PART 2 - PRODUCTS

MATERIALS:

Mineral/Glass Fiber Blanket/Batt Insulation (M/GFBIns): Inorganic (nonasbestos) fibers formed with hinders into resilient flexible blankets or semirigid batts; FS HHI521, Type as indicate, densities of not less than 0.5 lb. per cu. ft. for glass fiber units and not less than 2.5 lb. per cu. ft. for mineral wool units, kvalue of 0.27; manufacturer's standard lengths and widths as required to coordinate with spaces to be insulated; types as follows:

Provide Type I - to be used above ceiling system, exterior and interior partitions, "AcoustaTherm Batts, by Certainteed or equal with the following performance; Kraft faced, Fungi-resistance (ASTM C 1338), Flame spread index of 5 or less, Smoke developed index of 0. R-value to be 19, when 6-1/4"

in thickness is provided.

Available Manufacturer's:

CertainTeed Products Corp.; Valley Forge, PA. Clecon Inc.; Cleveland, OH. Manville Bldg. Materials Corp.; Denver, Co. Mizell Bros. Co.; Atlanta, GA. Owens Corning Fiberglass Corp.; Toledo, OH.

Provide Type III: Foam-in-place cavity wall insulation, with R-value including 8" cmu, 14.29 at 60lb. Density. The foamed -in-place is to be placed in the walls per manufacturer's specifications. The material shall be applied in such a manner as to assure complete cavity fill. The product shall be applied with a liquid ratios at the mixing gun being within the manufacturer's specified range. A cubic foot of the fresh foam shall weigh between 2lb. 80z. And 3lb. 6oz. After the installation of the material, allow two weeks for curing before painting the walls.

The installation of Thermco foam insulation shall be contracted only by a firm which is certified and/ or approved by the manufacturer of the insulation.

After the foam is installed and cured, walls shall be protected from excessive moisture (rain) for 24 hours.

AVAILABLE MANUFACTURER'S

PolyMaster - 1-800-580-3626 Core-Fill 500 - 828-322-6512 Thermco - 888-385-3626

PART 3 - EXECUTION

INSPECTION AND PREPARATION:

Installer must examine substrates and conditions under which insulation work is to be performed and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with insulation work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

Clean substrates of substances harmful to insulations or vapor barriers, including removal of projections which might puncture vapor retarders.

INSTALLATION

GENERAL:

Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.

Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.

Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

CAVITY - WALL AND MASONRY-CELL INSULATION:

On units of plastic insulation, install small pads of adhesive spaced approximately 1'-0" o.c. both ways on inside face, as recommended by manufacturer. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside width of masonry or other construction as shown.

Wedge insulation from outside wythe of construction with small fragments of masonry materials spaced 2' -0" o.c. both ways.

GENERAL BUILDING INSULATION:

Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

Set vapor retarder faced units with vapor retarder to warm side of construction, except as otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.

Set reflective foil-faced units accurately with air space in front of foil as shown. Provide not less than 0.75" air space where possible.

Lap edges of sheets of vapor barrier not less than 4" so as to provide complete coverage of protected areas.

PROTECTION:

General: Protect installed insulation and vapor retarders from harmful weather

exposures and from possible physical abuses, where possible by non-delayed installation of concealing work or, where that is not possible, by temporary covering or enclosure. Installer shall advise Contractor of exposure hazards, including possible sources of deterioration and fire hazards.

CLEAN-UP:

Remove and dispose of excess insulation, wrappings and other waste materials.

END OF SECTION 07200

SECTION 07410 - PREFORMED ROOFING AND SIDING

<u> PART 1 - GENERAL</u>

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Extent of each type of preformed roofing and siding is indicated on the drawings and by provisions of this section. Provide exposed flashing gutters and trim to match. Preformed roofing/siding is hereby defined to include panels which are structurally capable of spanning between supports spaced as indicated.

The types of panels required include the following: Formed sheet panels, intended for lapped seam installation.

Formed sheet panels, intended for lapped seam

QUALITY ASSURANCE:

Field Measurements: Where possible, prior to fabrication of prefabricated panels, take field measurements of structure or substrates to receive panel system. Allow for trimming panel units where final dimensions cannot be established prior to fabrication.

SUBMITTALS:

Product Data: Submit manufacturer's product specifications, standard details, certified product test results, installation instructions and general recommendations, as applicable to materials and finishes for each component and for total system of preformed panels.

Metal roof system must be tested in accordance with ASTM E 1592-95 for negative loading. Determine panel bending and clips-to-panel strength by testing in accordance with ASTM E 1592-95 procedures.

Samples: Submit 2 samples 12" square, of each exposed finish material.

Shop Drawings: Submit small scale layouts of panels on walls and roofs, and large scale details of edge conditions, joints, corners, custom profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory and field assembly work.

Submit documentation panel assemblies have been tested in compliance with Structural Engineer Design Pressures and Texas Department of Insurance Guidelines.

WARRANTY:

Owner shall receive one (1) warranty from manufacturer of roof panels covering all of the following criteria. Multiple warranties are not acceptable.

1. Manufacturer's 15 + 15 year watertight warranty, including coverage for all trim, flashings, and penetrations associated with the roof area.

2. 20 year coverage on finish including checking, crazing, peeling, chalking, fading and/or adhesion.

3. 20 year material coverage.

4. Warranty shall commence on date of substantial completion or final payment, whichever is agreed by contract.

The Contractor, in writing, will guarantee the job to manufacturer for two (2) years from the date of acceptance by the Owner and the Roofing System Manufacturer.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

Available Manufacturers: Subject to compliance with requirements, manufacturers offering preformed roofing and siding products which may be incorporated in the work include, but are not limited to the following:

METAL SIDING:

- (A) Roof Panels: to be equal to MBCI DoubleLok panels. Pre-finished metal 24gauge hot dipped galvanized steel ASTM A446-85. Finish shall be Galvalume Plus. Provide all trims, closures and accessories for proper installation.
- (B) Wall Panels: to be equal to MBCI PBC panels. Pre-finished metal 24-gauge hot dipped galvanized steel ASTM A446-85. Finish shall be Kynar 500 Fluorocarbon at all trim and accessories. Provide all trims, closures and accessories for proper installation.
- (C) Metal gutter and Downspouts: to be pre-finished metal. Finish shall be Kynar 500 Fluorocarbon at all trim and accessories. Match finish at all trims, accessories exposed to view.

SHEET MATERIALS:

Steel for Painting/Coating: Hot dip coated steel sheet, ASTM A446, Grade A except where higher strength required for performance, G90 zinc coating, surface treated for maximum coating performance.

METAL FINISHES:

General: Apply coatings either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Protect coating promptly after application and cure, by application of strippable film or removable adhesive cover, and retain until installation has been completed. Provide colors or color matches as indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

Flouropolymer Coating: Full strength 70% "Kynar 500" coating baked on for 15 minutes at 450 degrees F. (232 degree C), in a dry film thickness of 1.0 mil, 30% reflective gloss (ASTM D523), over min. 0.2 mil baked on modified epoxy primer.

The Contractor, in writing, will guarantee the job to manufacturer for two (2) years from the date of acceptance by the Owner and the Roofing System Manufacturer.

MISCELLANEOUS MATERIALS:

Internal Panel Framing: Manufacturer's standard, as required for 100 MPH wind loading.

Fasteners: Manufacturer's standard non-corrosive types, with exterior heads gasketed.

Seam Lock: Wall Panels are required to have optional seam lock feature to comply with wind loading requirements.

Accessories: All exposed fascia, metal trim shall match metal roof color. Except as

indicated as work of another specification section, provide components required for a complete roofing/siding system, including trim, copings, fascias, gravel stops, mullions, sills, corner units, ridge closures, clips, seam covers, battens, flashings, gutters, louvers, sealants, gaskets, fillers, closure strips and similar items. Match materials/finishes of preformed panels.

Membrane over Plywood Substrate: Acceptable Product: Sharkskin Ultra SA[™] as manufactured by: Kirsch Building Products LLC, 1464 Madera Road, Suite 387, Simi Valley, CA 93065; Tel: (805) 750-0084 Fax: 805-526-1116; www.sharkskin.us.

Provide a self-adhered roof underlayment that has passed the requirements set forth in ICC/ES Report 1708 and Miami/Dade TAS 103.

PANEL FABRICATION; PERFORMANCES:

General: Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, and as required to fulfill indicated performance requirements which have been demonstrated by factory testing. Comply with indicated profiles and dimensional requirements, and with structural requirements. Provide only full-length sheets.

Metal Gages: Thicknesses shall be 24 gage.

Required Performances: Fabricate panels and other components of roof/wall system for the following installed as indicated performances:

Water Penetration: No significant, uncontrolled leakage at 4 lbs. per sq. ft. pressure with spray test.

Air Infiltration: 0.02 cfm per sq. ft. for gross roof/wall areas, with 4 lbs. per sq. ft. differential pressure.

Apply bituminous coating or other permanent separation materials on concealed panel surfaces where panels would otherwise be in direct contact with substrate materials which are non-compatible or could result in corrosion or deterioration of either material or finishes.

Condensation: Fabricate panels for control of condensation, including proper inclusion of seals and provisions for breathing, venting, weeping and draining.

PART 3 - EXECUTION

INSTALLATION:

General: Comply with panel fabricator's and material manufacturers' instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the work securely in place, with provisions for thermal/structural movement. Metal roof panels must be installed in accordance with UL 90 Construction method.

Install panels with concealed fasteners.

Installation tolerances: Shim and align panel units within installed tolerance of 1/4: in 20' 0" on level/plumb/slope and location/line as indicated, and within 1/8" offset of adjoining faces and of alignment of matching profiles.

Joint Sealers: Install gaskets, joint fillers and sealants where indicated and where required for weatherproof performance of panel systems. Provide types of gaskets and sealants/fillers indicated or, if not otherwise indicated, types recommended by panel manufacturer.

Refer to other sections of these specifications for product and installation requirements applicable to indicated joint sealers.

Joint Sealers: Refer to other sections of these specifications for post installation requirements on joint sealers; not work of this section.

CLEANING AND PROTECTION:

Damaged Units: Replace panels and other components of the work which have been damaged or have deteriorated beyond successful repair by means of finish touch up or similar minor repair procedures.

Cleaning: Remove temporary protective coverings and strippable films (if any) as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer, and maintain in a clean condition during construction.

END OF SECTION 07410

SECTION 07460 – CEMENTITIOUS SIDING AND PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiber cement lap siding, panels, shingle, trim, fascia, molding and accessories; James Hardie HZ10 Engineered for Climate Siding.

B. Factory-finished fiber cement lap siding, panels, shingle, trim, fascia, molding and accessories; James Hardie HZ10 Engineered for Climate Siding.

1.2 RELATED SECTIONS

- A. Section 06100 Rough Carpentry.
- B. Section 07200 Insulation.
- 1.3 REFERENCES

A. AS D3359 - Standard Test Method for Measuring Adhesion by Tape Test, Tool and Tape.

B. AS E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

- 1. Preparation instructions and recommendations.
- 2. Storage and handling requirements and recommendations.
- 3. Installation methods.

C. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cementitious siding materials which are outside the scope of the standard details and specifications provided by the manufacturer.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 4 by 6 inches (100 by 150 mm), representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Minimum of 2 years' experience with installation of similar products.

B. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

- 1. Finish areas designated by Architect.
- 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
- 3. Remodel mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.8 WARRANTY

- A. Product Warranty: Limited, non-pro-rated product warranty.
 1. Hardie soffit HZ5 panels for 30 years.
- B. Finish Warranty: Limited product warranty against manufacturing finish defects.

1. When used for its intended purpose, properly installed and maintained according to Hardie's published installation instructions, James Hardie's Color Plus finish with Color Plus Technology, for a period of 15 years from the date of purchase: will not peel; will not crack; and will not chip. Finish warranty includes the coverage for labor and material.

C. Workmanship Warranty: Application limited warranty for 2 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: James Hardie Building Products, Inc., which is located at: 231 S. La Salle St. Suite 2000; Chicago, IL 60604; Toll Free Tel: 877-236-7526.

B. Substitutions: Not permitted.

C. Requests for approval of equal substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 SIDING AND TRIM

- A. Soffit Panels: Hardie Soffit HZ5 Non-Vented Soffit Panel, as manufactured by James Hardie Building Products, Inc.
- 1. Factory sealed on 5 sides.
- 2. Thickness: 1/4 inch (6 mm).
- 3. Type: Textured Cedarmill, 24 inches (610 mm) by 8 feet (2438 mm).
- B. Vented Soffit Panels: Hardie Soffit HZ5 Vented Panels. as manufactured by James Hardie Building Products, Inc.
 - 1. Net Free Ventilation: 5 sq inches of net free ventilation per linear foot (10583 sq mm per linear meter).

- 2. Factory sealed on 5 sides.
- 3. Thickness: 1/4 inch (6 mm).
- 4. Type: Textured Cedarmill vented, 24 inches (610 mm) by 8 feet (2438 mm).

5.

- C. Hardie Textured Panels as manufactured by James Hardie Building Products, Inc. A non-combustible fiber-cement panel.
 - 1. Product Composition: Grade II, Type A, fiber-cement sheets as defined by ASTM C1186, manufactured by the Hatschek process and cured by high pressure steam autoclaving.
 - 2. Florida State Product Approval FL13223
 - 3. Intertek Product Listing.
 - 4. Code Compliance:
 - a. International Building Code (IBC)
 - 1) Section 1404.10: 2009, 2012, and 2015
 - 2) Section 1403.10: 2018
 - b. International Residential Code (IRC):
 - 1) Table R703.3(1): 2009, 2012, 2015, and 2018
 - 2) Section R703.10.1 as ASTM C 1186 Grade II, Type A Fiber Cement: 2009, 2012, 2015, and 2018
 - c. Florida Building Code (FBC):
 - 1) Section 1404.10: 2017 and 2020
 - 2) Section 1405.16 as ASTM C 1186 Grade II, Type A Fiber Cement.
 - d. Wind Design:
 - Manufacturer's readily available design load and exposure category tables are derived from testing in accordance with ASTM E 330.
 - 2) Wind speed design coefficient assumptions per Analytical Method in ASCE 7.
 - 5. Fire Characteristics:
 - a. Tested in Accordance with ASTM E136: Classified as non-combustible.
 - b. May be used in ASTM E119 fire resistance rated assemblies as listed by Warnock Hersey.
 - c. Class A Material: Per FBC 2017 and 2020, and 2018 IBC Section 803.1.1 Surface Burning Characteristics when tested in accordance with ASTM E84:
 - 1) Flame Spread Index : 0. Smoke Developed Index: 0.
 - 6. Type: Hardie Textured Knockdown Panel 4 by 8 feet (1219 by 2438 mm).
 - 7. Type: Hardie Textured Knockdown Panel 4 by 10 feet (1219 by 3048 mm).
 - 8. Type: Hardie Textured Knockdown Panel 4 by 12 feet (1219 by 3658 mm).
 - 9. Product Dimensions:
 - a. Thickness: 0.3125 inches (8 mm)
 - b. Length: 96 inches (02438 mm)
 - c. Length: 120 inches (3048 mm)
 - d. Length: 144 inches (3658 mm)
 - e. Width: 48 inches (1219 mm)
 - f. Vertical Joint: Shiplap.
 - 10. Physical Properties:
 - a. Test Method ASTM C1185: Passed
 - 1) Dimensional Tolerances
 - 2) Length: Plus or minus 0.5 percent or plus or minus 1/4 inch
 - 3) Width: Plus or minus 0.5 percent or plus or minus 1/4 inch
 - 4) Thickness: Plus or minus 0.04 inch
 - 5) Squareness: less than1/32 inches per ft of length
- 6) Edge Straightness: Less than 1/32 inches per ft of length
- 7) Density: Less than 83 pounds per sq ft.
- 8) Water Tightness: No drop formation; Pass
- 9) Flexural strength:
 - a) Wet conditioned, psi: greater than1015 psi; Pass
 - b) Equilibrium conditioned, psi: Greater than 1450 psi; Pass
- 10) Warm Water Resistance, Observations: No structural alteration; Pass
- 11) Heat / Rain Resistance:
 - a) Physical Observations Mass: No structural alteration; Pass
 - b) Loss Percentage: Less than or equal to 3.0 percent; Pass.
 - c) Freeze/Thaw, percent strength retention: Greater than or equal to 80 percent; Pass.
- b. Fire Characteristics:
 - 1) ASTM E84: Surface Burning Characteristics
 - a) Flame Spread Index (FSI) Smoke: 0.
 - b) Developed Index (SDI): 0.
 - c) Fuel Contributed: 0.
 - d) International Building Code: A.
 - 2) ASTM E136: Non-combustibility: Pass.
- D. Trim:
 - 1. Hardie Trim HZ5 boards and Hardie Trim HZ boards as manufactured by James Hardie Building Products, Inc.
 - 2. Hardie Trim HZ5 Fascia boards as manufactured by James Hardie Building Products, Inc.

2.3 FASTENERS

- A. Wood Framing Fasteners:
 - 1. Saltwater resistant.
 - 2. Complies with ICC-ES report and TDI Product Evaluation

2.4 WEATHER BARRIER

- A. Weather Barrier: James Hardie HardieWrap and HardieWrap Flashing and Seam Tapes.
- B. Code Compliance Requirement for Weather Barrier:
 - 1. Thickness, 11 mil sheet.
 - 2. Breathability in accordance with ASTM E96.
 - 3. Tear strength in accordance with ASTM D1117.
 - 4. Water resistance in accordance with AATCC127.
 - 5. Air Penetration in accordance with TAPPI T460.
 - 6. HardieWrap Weather Barrier ICC-ES Evaluation Report ESR-2258
- 2.5 FINISHES
 - A. Factory Primer: Provide factory applied universal primer.
 - 1. Primer: Factory primed by James Hardie.
 - 2. Topcoat: Refer to Section 09900 Painting
- PART 3 EXECUTION
 - 3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If framing preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Nominal 2-inch by 4-inch (51 m by 102 mm) wood framing selected for minimal shrinkage and complying with local building codes, including the use of water-resistive barriers or vapor barriers where required. Minimum 1-1/2 inches (38 mm) face and straight, true, of uniform dimensions and properly aligned.

1. Install water-resistive barriers and claddings to dry surfaces.

2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.

3. Protect siding from other trades.

D. Minimum 16-gauge Z-clips 16 inches maximum on center metal framing complying with local building codes, including the use of water-resistive barriers and/or vapor barriers where required. Minimum 1-1/2 inches (38 mm) face and straight, true, of uniform dimensions and properly aligned.

1. Install water-resistive barriers and claddings to dry surfaces.

2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.

3. Protect siding from other trades.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Install a water-resistive barrier is required in accordance with local building code requirements.

D. The water-resistive barrier must be appropriately installed with penetration and junction flashing in accordance with local building code requirements.

E. Install Engineered for Climate HardieWrap weather barrier in accordance with local building code requirements.

F. Use HardieWrap Seam Tape and joint and laps.

G. Install HardieWrap flashing and HardieWrap Flex Flashing.

3.3 INSTALLATION - HARDIEPLANK HZ10 LAP SIDING WITH LOCK JOINT SYSTEM

A. Install materials in strict accordance with manufacturer's installation instructions.

B. Starting: Install a minimum 1/4 inch (6 mm) thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1-1/4 inches (32 mm) wide laps at the top. The bottom edge of the first plank overlaps the starter strip.

C. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.

D. Align vertical joints of the planks over framing members.

E. Butt joints must not fall within 4 inches (102 mm) of a stud. Do not nail within 2 inches (51 mm) of the end of planks.

F. Maintain clearance between siding and adjacent finished grade.

G. Locate splices at least one stud cavity away from window and door openings.

H. For proper fastener selection and fastening schedules for various wind load requirements and framing options, refer to the Technical Data Sheet at www.aspyredesign.com.

I. Face nail to sheathing.

J. Locate splices at least 12 inches (305 mm) away from window and door openings.

3.4 INSTALLATION – HARDIEPANEL

A. Fastening Method: Countersunk and filled.

B. Place fasteners no closer than 3/4 inch (9.5 mm) from panel edges and 2 inches (51 mm) from panel corners.

C. Use fasteners as specified in the James Hardie Tech Data sheet and in the Hardie Reveal Panel Installation Instruction.

D. Install panel using 1/2 inch (13 mm) spacers at horizontal joints. Leave bottom edge of panel above all horizontal trims exposed, no caulking shall be placed at this overlap of Horizontal Reveal Trim. Factory primed edge shall always be used.

E. Install a kickout flashing to deflect water away from the siding at the roof intersection.

F. Install a self-adhering membrane on the wall before the subfascia and trim boards are nailed in place, and then install the kickout.

G. Allow minimum vertical clearance between the bottom edge of siding and any other material in strict accordance with the manufacturer's installation instructions and as determined by James Hardie Zone.

H. Maintain clearance between siding and adjacent finished grade.

I. Specific framing and fastener requirements - refer to the applicable building code compliance reports.

3.5 INSTALLATION - HARDIETRIM HZ10 BOARDS

A. Install materials in strict accordance with manufacturer's installation instructions. Install flashing around all wall openings.

B. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum 3/4 inch (19 mm) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.

C. Place fasteners no closer than 3/4 inch (19 mm) and no further than 2 inches (51 mm) from side edge of trim board and no closer than 1 inch (25 mm) from end. Fasten maximum 16 inches (406 mm) on center.

D. Maintain clearance between trim and adjacent finished grade.

E. Trim inside corner with a single board trim both side of corner.

F. Outside Corner Board Attach Trim on both sides of corner with 16 gage corrosion resistant finish nail 1/2 inch (13 mm) from edge spaced 16 inches (406 mm) apart, weather cut each end spaced minimum 12 inches (305 mm) apart.

- G. Allow 1/8-inch gap between trim and siding.
- H. Seal gap with high quality, paint-able caulk.
- I. Shim frieze board as required to align with corner trim.
- J. Fasten through overlapping boards. Do not nail between lap joints.

K. Overlay siding with single board of outside corner board then align second corner board to outside edge of first corner board. Do not fasten Hardie Trim boards to Hardie Trim boards.

- L. Shim frieze board as required to align with corner trim.
- M. Install Hardie Trim Fascia boards to rafter tails or to sub fascia.

3.6 FINISHING

A. Finish unprimed siding with a minimum one coat high quality, alkali resistant primer and one coat of either, 100 percent acrylic or latex or oil based, exterior grade topcoats or two coats high quality alkali resistant 100 percent acrylic or latex, exterior grade topcoat within 90 days of installation. Follow paint manufacturer's written product recommendation and written application instructions.

B. Finish factory primed siding with a minimum of one coat of high-quality 100 percent acrylic or latex or oil based exterior grade paint within 180 days of installation. Follow paint manufacturer's written product recommendation and written application instructions.

3.7 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07600 - SHEET METAL FLASHING AND TRIM

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the Conditions of the Contract and Division 01 Specification Sections apply to this section.

1.2 SUMMARY

- A. Provide all labor, equipment, and materials to fabricate and install the following.
 - 1. Edge strip and flashing.
 - 2. Fascia and trim.
 - 3. Coping cap at parapets.
 - 4. Fascia and edge metal.
- B. Related Work Specified Elsewhere:
 - 1. Division 06 Rough Carpentry
 - 2. Division 07 Modified Bituminous Membrane Roofing
 - 3. Division 07 Roof Accessories
 - 4. Division 07 Roof & Deck Insulation
 - 5. Division 07 Manufactured Metal Roof Panels

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 2. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- B. American National Standards Institute and Single Ply Roofing Institute (ANSI/SPRI)
 - 1. ANSI/SPRI ES-1 Testing and Certification Listing of Shop Fabricated Edge Metal
- C. Warnock Hersey International, Inc., Middleton, WI (WH)

- D. Factory Mutual Research Corporation (FMRC)
- E. Underwriters Laboratories (UL)
- F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
 - 1. Latest Edition Architectural Sheet Metal Manual
 - 2. Roofing and Waterproofing Manual
- G. National Roofing Contractors Association (NRCA)
- H. American Society of Civil Engineers (ASCE)
 - 1. ASCE 7-05 Minimum Design Loads for Buildings and Other Structures.

1.4 SUBMITTALS FOR REVIEW

- A. Product Data:
 - 1. Provide manufacturer's specification data sheets for each product.
 - 2. Metal material characteristics and installation recommendations.
 - 3. Submit color chart prior to material ordering and/or fabrication so that equivalent colors to those specified can be approved.
- B. Samples: Submit two (2) samples, illustrating typical metal edge, coping, gutters, fascia extenders for material and finish.
- C. Shop Drawings
 - 1. For manufactured and shop fabricated gravel stops, fascia, scuppers, and all other sheet metal fabrications.
 - 2. Indicate material profile, jointing pattern, jointing details, fastening methods, flashing, terminations, and installation details.
 - 3. Indicate type, gauge and finish of metal.
- D. Specimen Warranty: Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the Manufacturer and the Owner.

1.5 SUBMITTALS FOR INFORMATION

A. Design Loads: Any material submitted must be accompanied by a report signed and sealed by a professional engineer licensed in the

state of Texas. This report shall show that the submitted equal meets the wind uplift and perimeter attachment requirements according to ASCE 7-05 and ANSI/SPRI ES-1. Submitals without licensed engineer approval will be rejected for non-conformance.

- B. A letter from an officer of the manufacturing company certifying that the materials furnished for this project are the same as represented in tests and supporting data.
- C. Mill production reports certifying that the steel thicknesses are within allowable tolerances of the nominal or minimum thickness or gauge specified.
- D. Certification of work progress inspection. Refer to Quality Assurance Article below.
- E. Certifications:
 - 1. Submit certification that the perimeter/edge metal products being used on this project have been tested according to <u>ANSI/SPRI ES-1 criteria</u>. <u>Certification submitted must be</u> provided by either NRCA, Independent Test Agency or the perimeter/edge metal manufacturer.

1.6 QUALITY ASSURANCE

- A. Engage an experienced roofing contractor specializing in sheet metal flashing work with a minimum of five (5) years experience.
- B. Maintain a full-time supervisor/foreman who is on the job-site at all times during installation. Foreman must have a minimum of five (5) years experience with the installation of similar system to that specified.
- C. Upon request fabricator/installer shall submit work experience and evidence of financial responsibility. The Owner's representative reserves the right to inspect fabrication facilities in determining qualifications.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original, unopened containers or packages with labels intact and legible.
- B. Stack pre-formed and pre-finished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials which may cause discoloration or staining.

1.8 PROJECT CONDITIONS

A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage requirements for pre-formed metal edge system.

1.9 DESIGN AND PERFORMANCE CRITERIA

A. Wind Uplift Pressures: Metal edge system must meet minimum design load pressures as determined by ASCE 7. Provide completed calculations to show ANSI/SPRI ES-1 test results meet the minimum wind uplift pressures.

- B. Thermal expansion and contraction:
 - Completed metal edge flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.

1.10 WARRANTIES

- A. Owner shall receive one (1) warranty from manufacturer covering all of the following criteria. Multiple warranties are not acceptable.
 - Pre-finished aluminum material shall require a written twenty (20)-year non-prorated warranty covering fade, chalking and film integrity. The material shall not show a color change greater than 5 NBS color units per ASTM D2244 or chalking excess of 8 units per ASTM D659. If either occurs material shall be replaced per warranty, at no cost to the Owner.
 - 2. Changes: Changes or alterations in the edge metal system without prior written consent from the manufacturer shall render the system unacceptable for a warranty.
 - 3. Warranty shall commence on date of substantial completion or final payment, whichever is agreed by contract.
 - 4. The Contractor shall provide the Owner with a notarized written warranty assuring that all sheet metal work including caulking and fasteners to be watertight and secure for a period of (2) two years from the date of final acceptance of the building. Warranty shall include all materials and workmanship required to repair any leaks that develop and make good any damage to other work or equipment caused by such leaks or the repairs thereof.

PART 2 — PRODUCTS

2.1 PRODUCTS, GENERAL

A. Refer to Division 01 Section "Common Product Requirements."

B. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.

2.3 ACCEPTABLE FABRICATORS

- A. Any fabricator which has been certified by the NRCA (National Roofing Contractors Association) to fabricate their ANSI/SPRI ES-1 tested profiles on their Gravel-Stop, Metal Edge, Fascia and Coping Cap products.
- B. Provide a product carrying a signed and sealed Performance Test Report from a testing company for ANSI/SPRI ES-1 on their Gravel-Stop, Metal Edge, Fascia and Coping Cap products.
- C. Any fabricator with a Gravel-Stop, Metal Edge, Fascia and Coping Cap products that has been tested in accordance with ANSI/SPRI ES-1 standards. Proof of this testing must be provided via a report signed and sealed by a qualified third party testing agency. This report shall show that the submitted equal meets the wind uplift and perimeter attachment requirements according to ASCE 7-05 and ANSI/SPRI ES-1. Substitution requests submitted without licensed engineer approval will be rejected for non-conformance

2.4 MATERIALS

- A. Materials:
 - 1. Exposed base metal material:
 - a. Aluminum, ASTM B209, alloy 3105-H14, in thickness of .032" nom. or .040" nom.
 - 2. Unexposed base metal material:
 - a. Aluminum, ASTM B209, alloy 3105-H14, in thickness of .032" nom. or .040" nom.
 - 3. Minimum gauge of steel or thickness of Aluminum to be specified in accordance with Architectural Sheet Metal Manual, Sheet Metal and Air Conditioning Contractor's National Association, Inc. recommendations.
- B. Finishes:
 - 1. Exposed surfaces for coated panels:
 - a. Steel Finishes: fluorocarbon finish. Epoxy primer baked both sides, .2-.25 mils thickness as approved by finish coat manufacturer.

Weathering finish as referred by National Coil Coaters Association (NCCA).

PROPERTY	TEST METHOD	FLUOROCARBON*
Pencil Hardness	ASTM D3363 NCCA II-2	HB-H
Bend	ASTM D-4145 NCCA II-19	О-Т
Cross-Hatch Adhesion	ASTM D3359	no loss of adhesion
Gloss (60° angle)	ASTM D523	25+/-5%
Reverse Impact	ASTM D2794	no cracking or loss of adhesion
Nominal Thickness	ASTM D1005	
Primer Topcoat		0.2 mils 0.8 mils
TOTAL		1.0 mils

- * Subject to minimum quantity requirements
- b. Color as selected by Architect. Refer to Specification Section 07410.
- 2. Exposed and unexposed surfaces for mill finish flashing, fascia, and coping cap, shall be as shipped from the mill.
- 3. Exposed and unexposed surfaces for anodized aluminum flashing, fascia, and coping cap, shall be as shipped from mill.

2.4 RELATED MATERIALS AND ACCESSORIES

- A. Metal Primer: Zinc chromate type.
- B. Plastic Cement: ASTM D 4586
- C. Sealant: Tuff-Stuff One part polyurethane sealant.
- D. Underlayment: Refer to Section 07410 for additional underlayment. ASTM D2178, No15 asphalt saturated roofing felt.
- E. Slip Sheet: Rosin sized building paper.
- F. Fasteners:
 - 1. Corrosion resistant screw fastener as recommended by metal manufacturer. Finish exposed fasteners same as flashing metal.

- 2. Fastening shall conform to Factory Mutual requirements or as stated on section details, whichever is more stringent.
- G. Gutter and Downspout Anchorage Devices: Material as specified for system.

PART 3 — EXECUTION

- 3.1 EXECUTION, GENERAL
 - A. Refer to Division 07 Section Common Work Results for Thermal and Moisture Protection.

3.2 PROTECTION

A. Isolate metal products from dissimilar metals, masonry or concrete with bituminous paint, tape, or slip sheet. Use gasketed fasteners where required to prevent corrosive reactions.

3.3 GENERAL

- A. Secure fascia to wood nailers at the bottom edge with a continuous cleat.
- B. Fastening of metal to walls and wood blocking shall comply with building code standards.
- C. All accessories or other items essential to the completeness of sheet metal installation, whether specifically indicated or not, shall be provided and of the same material as item to which applied.
- D. Allow sufficient clearances for expansion and contraction of linear metal components. Secure metal using fasteners as required by the system. Exposed face fastening will be rejected.

3.4 INSPECTION

- A. Verify that curbs are solidly set and nailing strips located.
- B. Perform field measurements prior to fabrication.
- C. Coordinate work with work of other trades.
- D. Verify that substrate is dry, clean and free of foreign matter.
- E. Commencement of installation shall be considered acceptance of existing conditions.
- 3.5 SHOP-FABRICATED SHEET METAL
 - A. Metal work shall be shop fabricated to configurations and forms in accordance with recognized sheet metal practices.

- B. Hem exposed edges.
- C. Angle bottom edges of exposed vertical surfaces to form drip.
- D. Lap corners with adjoining pieces fastened and set in sealant.
- E. Form joints for gravel stop fascia system, coping cap with a 3/8" opening between sections. Back the opening with an internal drainage plate formed to the profile of fascia piece.
- F. Install sheet metal to comply with referenced ANSI/SPRI, SMACNA and NRCA standards.

3.7 CLEANING

- A. Clean installed work in accordance with the manufacturer's instructions.
- B. Replace damaged work than cannot be restored by normal cleaning methods.

3.8 CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated. Comply with requirements of authorities having jurisdiction

3.09 FINAL INSPECTION

- A. At completion of installation and associated work, meet with Contractor, Architect, installer, installer of associated work, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.
- B. Inspect work and flashing of roof penetrations, walls, curbs and other equipment. List all items requiring correction or completion and furnish copy of list to each party in attendance.
- C. Repair or replace deteriorated or defective work found at time above inspection as required to a produce an installation which is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- D. Notify the Contractor upon completion of corrections.
- E. Following the final inspection, provide written notice of acceptance of the installation from the roofing system manufacturer.
- F. Immediately correct roof leakage during construction. If the Contractor does not respond within twenty-four (24) hours, the Owner will exercise rights to correct the Work under the terms of the Conditions of the Contract.

END OF SECTION

SECTION 07900 - JOINT SEALERS

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Extent of each form and type of joint sealer is indicated on drawings and by provisions of this section.

Refer to Division 8 sections glazing requirements; not work of this section.

Refer to sections of Division 15 and 16 for joint sealers in mechanical and electrical work; not work of this section.

General Performance: Except as otherwise indicated, joint sealers are required to establish and maintain airtight and waterproof continuous seals on a permanent basis, within recognized limitations of wear and as indicated for each application. Failures of installed sealers to comply with this requirement will be recognized as failures of materials and workmanship.

SUBMITTALS:

Product Data: Submit manufacturer's product specifications, handling/installation/curing instructions, and performance tested data sheets for each elastomeric product required.

JOB CONDITIONS:

Weather Conditions: Do not proceed with installation of liquid sealants under unfavorable weather conditions. Install elastomeric sealants when temperature is in lower third of temperature range recommended by manufacturer for installation.

PART 2 - PRODUCTS

MATERIALS:

General Sealer Requirements: Provide colors indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors. Select materials for compatibility with joint surfaces and other indicated exposures, and except as otherwise indicated select modules of elasticity and hardness or grade recommended by manufacturer for each application indicated. Where exposed to foot traffic, select non-tracking materials of sufficient strength and hardness to withstand stiletto heel traffic without damage or deterioration of sealer system.

Sealant: (with expansion and compression capability of plus or minus 50%).

Silpruf Silicone weatherproofing sealant: General Electric

790 Building Sealant: Down Corning

Caulking:

NP -2 Sonneborn. Polyurethane Install at all locations where notes as "caulk" or required to provide a neat joint.

Expansion Joint Sealer:

ACMA Seal: ACME Highway Products Corp., Buffalo, N.Y. 14207

System: Series "J", Style No. 2-602, 1-3/4" wide x 2" high. Install with manufacturer's ACMA Lubricant Adhesive.

Wall Penetration Sealant:

FireBarrier Silicone Sealant - 3M[™] Fire Barrier Silicone Sealant 2000+ or approve equal.

Fire Barrier Foam Sealant - 3M[™] Fire Barrier Rated Foam FIP 1-Step or approve equal.

Foam Joint Filters:

Expanded Polyethylene Joint Filler (ExPe -JF): Provide flexible, compressible, closed - cell, polyethylene of not less than 10 psi compression deflection (25%) except provide higher compression deflection strength as may be necessary to withstand installation forces and provide proper support for sealants; surface water absorption of not more than 0.1 lbs. per sq. ft.

MISCELLANEOUS MATERIALS:

Sealant backer Rod (S -Br): Provide compressible rod stock of polyethylene foam, polyurethane foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended by sealant manufacturer for backup of an compatibility with sealant. Where used with hot -applied sealant, provide heat -resistant type which will not be deteriorated by sealant application temperature as indicated.

PART 3 - EXECUTION

INSPECTION:

Installer must examine substrates, (joint surfaces) and conditions under which joint sealer work is to be performed, and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with joint sealer work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

JOINT PREPARATION:

Clean joint surfaces immediately before installation of gaskets, sealant or caulking compounds. Remove dirt, insecure coatings, moisture and other substances which could interfere with seal of gasket or bond of sealant or caulking compound. Etch concrete and masonry join surfaces as recommended by sealant manufacturer. Roughen vitreous and glazed joint surfaces as recommended by sealant manufacturer.

Prime or seal joint surfaces where indicated, and where recommended by sealant manufacturer. Confine primer/sealer to areas of sealant bond; do not allow spillage or migration onto adjoining surfaces.

INSTALLATION:

Install at exterior doors, glass frames (both interior and exterior of frames), exterior louvers, windows, exterior joints in walls and other locations where indicated or required to provide weather tight joints. Indicated for floor or wall assembly in which penetration occurs.

Install in accordance with manufacturer's recommendations.

Produce beads of proper width and depth. Tool as recommended by manufacturer.

Remove surplus materials.

Study drawings and furnish and install proper materials at each point where called for on the drawings plus all other points essential to continued integrity of the watertight barrier.

CURE AND PROTECTION

Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Advise the Contractor of procedures required for cure and protection of joint sealer during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of substantial completion. Cure and protect sealants in a manner which will minimize increases in modules of elasticity and other accelerated aging effects. Replace or restore sealant which are damaged or deteriorated during construction period.

END OF SECTION 07900

SECTION 08100 - STEEL DOORS AND FRAMES

<u> PART 1 - GENERAL</u>

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Extent of standard steel doors and frames is indicated and scheduled on drawings.

Custom hollow metal work is specified in other Division 8 sections. Builder's hardware is specified elsewhere in Division 8.

QUALITY ASSURANCE:

Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI 100) and as herein specified.

Provide Hurricane Resistant Steel Doors and Frames Equal to: Steel Craft Mfg. Co. H-Series Doors at all exterior door openings.

Manufacturer: Provide standard steel doors and frames by a single firm specializing in production of this type of work. Acceptable Manufacturer's:

Texas Door Products Ceco Corp. Republic Builders Prod. Corp. Tex Steel Corp. Pearland Industries Deansteel

SUBMITTALS:

<u>Product Data</u>: Submit manufacturer's specifications for fabrication and installation, including data substantiating that products comply with requirements.

<u>Shop Drawings</u>: Submit for fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.

<u>Label Construction Certification</u>: Submit manufacturer's certification for oversize fire rated doors and frames that each assembly has been constructed with materials and methods equivalent to requirements for labeled construction.

DELIVERY, STORAGE AND HANDLING:

Deliver hollow metal work in cartons or crated to provide protection during transit and job storage. Provide additional sealed plastic wrapping for factory finished doors.

Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

Store doors and frames at building site under cover. Place units on wood sills at least 4" high, or otherwise store on floors in manner that will prevent rust and damage. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4" spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

MATERIALS:

<u>Hot Rolled Steel Sheets and Strip</u>: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.

<u>Cold Rolled Steel Sheets</u>: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

Supports and Anchors: Fabricate of not less than 18 gage galvanized sheet steel.

<u>Inserts, Bolts and Fasteners</u>: Manufacturer's standard units, except hot dip galvanized items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

Shop Applied Paint:

<u>Primer</u>: Rust inhibitive enamel or paint, either air drying or baking, suitable as a base for specified finish paints.

FABRICATION, GENERAL:

Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at project site.

Fabricate exposed faces of doors and panels, including stiles and rails of non-flush units, from only cold rolled steel.

Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold rolled or hot rolled steel (at fabricator's option).

Finish Hardware Preparation:

Prepare doors and frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and template provided by hardware supplier. Comply with applicable requirements of ANSI A 115 series specifications for door and frame preparation for hardware. Exterior doors shall be fabricated and assembled using frame, hinge, and locking hardware as indicated on third party test report.

Reinforce doors and frames to receive surface applied hardware. Drilling and tapping for surface applied finish hardware may be done at project site.

Locate finish hardware as indicated on final shop drawings or, if not shown, in accordance with "Recommended Locations for Builder's Hardware," published by Door and Hardware Institute.

Shop Painting:

Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.

Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.

Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

STANDARD STEEL DOORS:

Provide metal doors of types and styles indicated on drawings or schedules.

	<u>1 3/4 0001S</u>
Stiles	16 ga.
Panels	16 ga.
Hinge Tap Plate	9 ga.
Hinges	1 1/2 pair 4 1/2 x 4 1/2
	full mortise template typ
Lock reinforcement	3/32" steel
Lock Set	See Hardware Schedule
Door Closer Reinforcement	9 ga.

For fire rated openings, provide tightly fitted, spring loaded, automatic closing louvers with operable blades, equipped with fusible links, arranged so that metal overlaps metal at every joint.

STANDARD STEEL FRAMES:

Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, of types and styles as shown on drawings and schedules. Conceal fastenings, unless otherwise indicated.

Frames shall be 16 gauge Fabricate frames with metered corners, knocked down not acceptable.

<u>Door Silencers</u>: Except on weatherstripped frames, drill stops to receive 2 silencers on strike jambs of single swing frames and 3 silencers on heads of double swing frames.

<u>Glazing Stops:</u> 16 ga. steel channel with pre drilled holes for flat heads of double sink screws.

<u>Plaster Guards:</u> Provide 26 gauge steel plaster guards or mortar boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation.

<u>Fire Resistant Frames</u>: Provide 1-hr rated doors in partitions shown on plans and as scheduled.

PART 3 - EXECUTION

INSPECTION:

Installer must examine substrate and conditions under which steel doors and frames are to be installed and must notify Contractor in writing of any conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

INSTALLATION:

<u>General</u>: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.

Placing frames:

Comply with provisions of SDI 105 "Recommended Erection Instructions for Steel Frames", unless otherwise indicated.

Except for frames located at in place concrete or masonry and at drywall installations, place frames prior to construction at enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.

In masonry construction, locate 3 wall anchors per jamb at hinge and strike levels. Building in of anchors and grouting of frames is specified in Division 4.

At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.

Install fire rate frames in accordance with NFPA STD. No. 80.

In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In open steel stud partitions, place studs in wall anchor notches and wire tie. In closed steel stud partitions, attach wall anchors to studs with tapping screws.

Door Installation:

Fit hollow metal doors accurately in frames, within clearances specified in SDI 100.

Place fire rated doors with clearances as specified in NFPA Standard No. 80.

ADJUST AND CLEAN:

<u>Prime Coat Touch up</u>: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air drying primer.

<u>Protection Removal</u>: Immediately prior to final inspection, remove protective plastic wrappings from pre-finished doors.

<u>Final Adjustments</u>: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION 08100

SECTION 08300 SPECIAL DOORS

PART 1 GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified in this section.

DESCRIPTION OF WORK:

Special doors required for this work include but are not limited to, Overhead operating doors.

Non-insulated doors are required.

Provide complete operating door assemblies including door curtains, guides, counterbalance mechanism, hardware, operators, and installation accessories.

QUALITY ASSURANCE:

Furnish each door as a complete unit produced by one manufacturer, including hardware, accessories, mounting and installation components.

Insert and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry for the installation of the units. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

See concrete and masonry sections of these specifications for installation of inserts and anchorage devices.

SUBMITALLS:

Product Data: Submit manufacturer's product data, roughing-in diagrams, and installation instructions for each type and size of door. Include operating instructions and maintenance information.

Shop Drawings: Submit shop drawings for special components and installations which are not fully dimensioned or detailed on manufacturer's data sheets. Provide documentation for compliance with TDI, where applicable.

PART 2 PRODUCTS

MATERIALS:

General: Special doors shall be the product of the manufacturer indicated and shall be the type, model and finish upon which the design is based. Equivalent products of other manufacturers will be considered provided approval is obtained from the Architect prior to bidding.

Door Types:

Section Door: Description: Shall be equal to Overhead Door Corp. 525 series with all accessories related to this model.

- Air Infiltration Package to comply with IECC 2018
- Lexan glazing
- Size as noted on the drawings
- Options: Face Mount
- Operation: Manual, Push-up
- Locking: Key operated cylinder lock on side with panic lock
- release. Provide cylinder lock.
- Full weatherstripping

Manufacturer's: Overhead Door Corporation Cornell

All other manufacturers for rolling doors and rolling grilles need to be approved by Architects office, prior to bidding.

PART 3 - EXECUTION

INSTALLATION:

Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment support in accordance with final shop drawings, manufacturer's instructions, and as specified herein.

Upon completion of installation including work by other trades, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion and fitting weathertight for entire perimeter.

END OF SECTION 08300

SECTION 08343-STANDARD FIBERGLASS RESIN TRANSFER MOLDED DOOR FRAMES

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - A. RTM Fiberglass Door Frames
 - B. Door Hardware
- 1.2 RELATED SECTIONS
 - A. Section 08700 Door Hardware
- 1.3 REFERENCES
 - A. ASTM D 635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
 - B. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
 - C. Laminate properties
 - 1. ASTM D 882 Tensile strength
 - 2. ASTM D 790 Flexural strength
 - 3. ASTM D 2583 Barcol Hardness
 - 4. ASTM D 256 Impact resistance
 - 5. ASTM D 792 Density/specific gravity of laminate
 - D. Core Properties
 - 1. ASTM C 177 Thermal properties
 - 2. ASTM D 1622 Density/specific gravity
 - 3. ASTM D E 84 Surface burning characteristics
 - 4. ASTM 1886 and 1996 Large Missile Impact Test
 - 5. ASTM E330 Static Air Pressure Structural Performance Test.
- 1.4 SYSTEM DESCRIPTION
 - A. Design Requirements:
 - 1. Design door frame assemblies to resist failure from corrosion in an environment of saltwater corrosion.
 - 2. Design door frame assemblies to have minimum fiberglass content 25 percent by weight.
 - B. Performance Requirements:
 - 1. Door frame assemblies: Maximum flame spread 25 in accordance with ASTM E 84, self-extinguishing in accordance with ASTM D 635.
 - 2. Door frame assemblies: FDA accepted
 - 3. Door frame assemblies: USDA accepted
 - C. TDI Requirements:
 - 1. Exterior doors to meet TDI requirements. Refer to Structural for Design Wind Pressures.
- 1.5 SUBMITTALS
 - A. Submit under provisions of Section 01300

- B. Product Data: Manufacturer's printed product data indicating characteristics of products specified in this section
- C. Tested Assembly Report for compliance with TDI Windstorm Certification requirements.
- D. Shop Drawings:
 - 1. Plans: Indicate location of each door frame opening assembly in project
 - 2. Elevations: Dimensioned elevation of each type of door frame opening assembly in project, indicate sizes and locations of door hardware, if specified
 - 3. Details: Installation details of each type installation condition in project
 - 4. Schedule: Indicate each door frame opening assembly in project, cross-reference to plans, elevations, and details
- E. Verification Samples: Two (2) samples to verify custom color match to color chip furnished by architect
- F. Manufacturer's Instructions: Printed installation instructions for door frame opening assemblies
- G. Warranty Documents: Manufacturer's standard warranty documents, executed by manufacturer's representative, countersigned by contractor
- 1.6 QUALITY ASSURANCE
 - A. Manufacturer Qualifications: Manufacturer: Minimum twenty (20) years documented experience producing products specified in this section.
- 1.7 DELIVERY, STORAGE, AND HANDLING
 - A. Packing, Shipping, Handling, and Unloading:
 - 1. Deliver door frames, factory-drilled and knocked down.
 - 2. <u>Package frame assemblies in completely enclosed heavy weight</u> cartons or wood crates having wood perimeters, label with the following information:
 - a. Manufacturer's name
 - b. Architect/Engineer-designated Project Number
 - c. Tag location in accordance with door schedule
 - d. Door type, color, and weight
 - B. Acceptance at Site: Accept only sealed, crated, and labeled door opening assemblies at site.
 - C. Storage and Protection: Store door assemblies in factory packaging in dry area, store on edge and protect from damage.
- 1.8 WARRANTY
 - A. Manufacturer's Warranty: Manufacturer's 10-year warranty against failure due to corrosion from specified environment.

PART 2 PRODUCTS

MANUFACTURERS

A. Chem-Pruf Door Co., Ltd., P.O. Box 4560, Brownsville, TX 78523. ASD.

Telephone 800-444-6924, Fax 956-544-7943.

B. Prior Approved Equal.

2.2 MATERIALS

All material used and consumed by Chem-Pruf® in the manufacture of our products are of the highest quality to assure the end product meets Chem-Pruf's® specifications.

- A. Polyurethane Foam: Minimum density 4 pounds per cubic foot, maximum flame spread 25 in accordance with ASTM E 84.
- B. Resins: Formulated for specified environment, maximum flame spread 25 in accordance with ASTM E 84, self-extinguishing in accordance with ASTM D 635
- C. Anchors: Manufacturer's standard stainless-steel anchors
- D. Bonding Materials: Manufacturer's standard frame-to-opening bonding system
- E. Joint Sealer: Silicone sealant, specified in Section 07900

2.3 MANUFACTURED UNITS

- A. Fiberglass RTM Door Frames:
 - 1. Construction: One-piece molded cross-section with molded stop, minimum 25 mil gel coat, minimum two (2) layers randomfiberglass mat, saturated with resins polyurethane foam core.
 - 2. Sizes: For door sizes and frame depths indicated on drawings
 - 3. Finish: Smooth semi-gloss surface
 - 4. Color: Custom color to match color chip furnished by architect.
- B. Door Hardware: Specified Section 08700
- 2.4 FABRICATION
 - A. Fiberglass Reinforced Plastic (FRP) Doors: All Chem-Pruf's® workmanship is to be of the highest quality in order to meet Chem-Pruf's® quality control requirements.
 - B. Fiberglass RTM Door Frames
 - 1. Resin transfer in mold of exact wall opening size, with gel coat. Glass mat layers to form solid fiberglass outer surface
 - 2. Formulate gel coat for environment and integral color specified
 - 3. Form structure of fiberglass components
 - 4. Form mortise for lock strike, and recess for strike plate in lock jamb, at time of molding
 - 5. Embed reinforcement for hinges and other indicated hardware in fiberglass matrix, provide for hinge leaf recesses in hinge jamb at time of molding

PART 3 EXECUTION

- A. Verification of conditions:
 - 1. Openings are correctly prepared to receive doors frames
 - 2. Openings are correct size and depth in accordance with shop drawings
- B. Installer's Examination:
 - 1. Have installer examine conditions under which construction activities of this section are to be performed and submit written report if conditions are unacceptable

- 2. Transmit two copies of installer's report to architect within 24 hours of receipt
- 3. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited
- 4. Beginning construction activities of this section indicates installer's acceptance of conditions

3.2 INSTALLATION

- A. Install door frame opening assemblies in accordance with shop drawings and manufacturer's printed installation instructions, using installation methods and materials specified in installation instructions
- B. Field alteration of doors frames to accommodate field conditions is strictly prohibited
- C. Site tolerances: Maintain plumb and level tolerance specified in manufacturer's printed installation instructions

3.3 ADJUSTING

- A. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instructions
- 3.4 CLEANING
- A. Clean surfaces of door frame opening assemblies and sight exposed hardware in accordance with respective manufacturer's maintenance instructions

3.5 PROTECTION OF INSTALLED PRODUCTS

Protect door frame opening assemblies and door hardware from damage by subsequent construction activities until final inspection.

SECTION 08700 - BUILDERS HARDWARE

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division - 1 Specification sections, apply to the work of this section.

DESCRIPTION OF WORK:

Definition: "Builders Hardware" includes items known commercially as builders' hardware which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame. Types of items in this section include (but are not necessarily limited to):

Hinges Pivots Lock cylinders and keys Lock and latch sets Bolts Exit devices Push/pull units Sliding door equipment Closures Overhead Holders Miscellaneous door control devices

QUALITY ASSURANCE:

Manufacturer: Obtain each kind of hardware (latch and lock sets, hinges, closures, etc.) from only one manufacturer, although several may be indicated as offering products complying with requirements.

Supplier: A recognized builders hardware supplier who has been furnishing hardware in the project's vicinity for a period of not less than 2 years, and who is, or has in employment, an experienced hardware consultant who is available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Owner, Architect and Contractor.

SUBMITTALS:

Product Data: Submit manufacturers' technical information for each item of hardware. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finish. Transmit copy of applicable data to Installer.

Hardware Schedule: Submit final hardware schedule in the manner and format specified, complying with the actual construction progress schedule requirements. Hardware schedules are intended for coordination of work.

Final Hardware Schedule: Based on builders hardware indicated, organize hardware schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

Type, style, function, size and finish of each hardware item. Name and manufacturer of each item. Fastenings and other pertinent information.

Location of hardware set cross - referenced to indications on Drawings

both on floor plans and in door and frame schedule. Explanation of all abbreviations, symbols, codes, etc. contained in schedule. Mounting locations for hardware. Door and frame sizes and materials. Keying information.

Submittal Sequence: Submit schedule at earliest possible data particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by builders' hardware, and other information essential to the coordinated review of hardware schedule.

Keying Schedule: Submit separate detailed schedule indicating clearly how the Owner's final instructions on keying of locks has been fulfilled.

PRODUCT HANDLING:

Packaging of hardware, on a set by set basis, is the responsibility of the supplier. As materials received by the hardware supplier from the various manufacturers, sort and repackage in containers marked with the hardware set number. Two or more identical sets may be packed in the same container.

Inventory hardware jointly with representatives of the hardware supplier and the hardware installer until each is satisfied that the count is correct.

Provide secure lock-up for hardware delivered to the project, but not yet installed. Control handling installation of hardware items which are not immediately replaceable, so that the completion of the work will not be delayed by hardware losses, both before and after installation.

JOB CONDITIONS:

Coordination: Coordinate hardware with other work. Tag each item or package separately, with identification related to the final hardware schedule, and include basic installation instructions in the package. Furnish hardware items of proper design for use on doors and frames of the thicknesses, profile, swing, security and similar requirements indicated, as necessary for proper installation and function. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation.

Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory - prepared for the installation of hardware. Upon request, check the shop drawings of such other work, to confirm that adequate provisions are made for the proper installation of hardware.

PART 2 - PRODUCTS

SCHEDULED HARDWARE:

Requirements for design, grade, function, finish, size and other distinctive qualities of each type of builders hardware is indicated in the Builders Hardware Data Sheet and Hardware Schedule at the end of this section. Products are identified by using hardware designation numbers of the following.

Manufacturer's product designations: One or more manufacturers are listed for each hardware type required. An asterisk (*) after a manufacturer's name indicates whose product designation is used in the Hardware Schedule for purposes of establishing minimum requirements. Provide product designated, or, where more than one manufacturer is listed, the comparable product of one of the other manufacturers which comply with requirements including those specified elsewhere in this section.

MATERIALS AND FABRICATION:

<u>General:</u>

Hand of door: The drawings show the direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation an operation of the door movement as shown.

Base Metals: Produce hardware units of the basic metal and forming method indicated, using the manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially recognized) quality than specified for the applicable hardware units by FS FF-H-106, FS FF-g-111, FS FF-E-116 and FS FF-H-121. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.

Fasteners: Manufacture hardware to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.

Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws Finish exposed(under any condition) screws to match the hardware finish or , if exposed in surfaces of other work, to match the finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive, painted finish.

Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard units of the type specified are available with concealed fasteners. Do not use through bolts for installation where the bolt head or the nut on the opposite face is exposed in other work, except where it is not feasible to adequately reinforce the work.

LOCK CYLINDERS AND KEYING:

Cylinders: Suppliers to provide interchangeable core rim cylinders at all locksets, deadbolt and panic hardware, where required for proper operation.

General: Supplier shall prepare the keying schedule according to the Owner's Keying Program and meet with Owner to finalize keying requirements and obtain final instructions in writing.

Keying System: Grandmaster key the locks to the campus, with a new master key for this project.

HARDWARE FINISHES:

Provide matching finishes for hardware units at each door or opening, to the greatest extent possible, and except as otherwise indicated. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming

process is different for individual units of hardware exposed at the same door or opening. In general, match items to the manufacturer's standard finish for the latch and lock set (or push-pull units if no latch-lock sets) for color and texture.

Provide finishes which match those established by EEMA or, if none established, match the Architect's sample.

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 for the applicable units of hardware by referenced standards.

Provide protective lacquer coating on all exposed hardware finishes of brass, bronze and aluminum, except as otherwise indicated.

The designations used in schedules and elsewhere to indicate hardware finishes are those listed in "Materials & Finishes Standard 1301" by EEMA, including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

PART 3 - EXECUTION

INSTALLATION:

Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware" by the NEEA, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.

Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware to a surface which will later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division 9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.

Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

Drill and countersink units which have not been factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

ADJUST AND CLEAN:

Adjust and clean each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy, return to the work during the week prior to acceptance or occupancy to make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

MANUFACTURERS

Butts	Hager	Hagr
Locksets	Schlage Lock Co.	Schl
Exit Device	Von Duprin	Von
Closers	LCN	LCN
Mullions	Von Duprin	Von
Stops	Hager	Hagr
Silencers	Hager	Hagr
Thresholds	Hager	Hagr
Weatherstripping	Hager	Hagr

Keys & Keying;

All locks, cylinders and deadbolts shall be Master Keyed as required by the Owner to the Existing Grand Master Key System. Provide cylinders to all locksets, exit devices, etc. whether noted or not. Furnish two (2) keys per locking device.

All exterior hinges will be stainless steel.

<u>Schedule A at doors no.1</u>		
Commercial Gate Latch	LLMKABT	D&D LokkLatch
Schedule B at doors no. 2		
1.5 pair butts	BB1191 x 4.5 x 4.5 x 630 x NRP	Hagr
Indicator	B571 x 626	Schl
Lockset	ND53PD x SPA x 626	Schl
Door Closer	7570T	LCN
weatherstripping	891 x SV x 36" x 2@ 84" x SMS	Hagr
threshold	520 x SV x 36" x SMS	Hagr
door bottom	770 x SV x 36" x SMS	Hagr
door drip	810S x 40" x SMS	Hagr
wall stop	236w x 630	Hagr
kick plates	8400 x 12" x 34" x 630	lves
LockGuard	LG1 x 630	lves
Schedule C at doors no 3		
1.5 pair butts	BB1101 x 4 5 x 4 5 x 630 x NRP	Haar
Lockset		Schl
Door Closer	7570T	L C.N
weatherstripping	891 x SV x 36" x 2@ 84" x SMS	Hadr
threshold	520 x SV x 36" x SMS	Hagr
door bottom	770 x SV x 36" x SMS	Hagr
door drip	810S x 40" x SMS	Hagr
wall stop	236w x 630	Hagr
kick plates	8400 x 12" x 34" x 630	lves
LockGuard	LG1 x 630	lves
-		
Schedule D at doors no. 4		
cylinder lock	20-757-626	Schl
Schedule F at doors no 56	3	
1.5 pair butts	<u>-</u> BB1191 x 4 5 x 4 5 x 630 x NRP	Haor
exit device	991 x 626 x 30"	Von
floor stop	243F x 626	Haar
licel clob		ilagi

door closer	7570T	LCN
threshold	520 x SV x 36" x SMS	Hagr
weatherstripping	891 SV x 36" x 2@ 84" x SMS	Hagr
door bottom	770 SV x 34" x SMS	Hagr
door drip	810S x 40" x SMS	Hagr
kick plates	190S x 12" x 34" x 626	Nort

Schedule F at doors no. 7

1.5 pair Butts	BB1191 x 4.5 x 4.5 x 652 x 2"ws	Hagr
Indicator	B571 x 626	Schl
Lockset	ND53PD x SPA x 626	Schl
Wall Stop	236w x 626	Hagr
Silencers	307D	Hagr

Schedule G at doors no. 8

1.5 pair butts	BB1191 x 4.5 x 4.5 x 630 x NRP	Hagr
exit device	99L x 626 x 30"	Von
floor stop	243F x 626	Hagr
door closer	7570T	LCN
threshold	520 x SV x 36" x SMS	Hagr
weatherstripping	891 SV x 36" x 2@ 84" x SMS	Hagr
kick plates	190S x 12" x 34" x 626	Nort

SECTION 08800 - GLASS AND GLAZING

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

<u>Definitions</u>: "Glass" includes prime glass, processed glass, and fabricated glass products. "Glazing" includes glass installation and materials used to install glass. Types of work in this section include glass and glazing for:

Window wall/store front construction, safety or tempered glass.

Entrances and other doors, laminated safety.

"Glass Products" is hereby defined to include glazing plastics.

Packaged mirror units are specified as "specialties" in another section.

QUALITY ASSURANCE:

Prime Glass Manufacturer: One of the following for each type/color/pattern of glass:

ASG Industries, Inc. C E Glass Division Ford Glass Company PPG Industries, Inc.

Prime Glass Standard: FS DD G 451

Heat Treated Glass Standard: FS DD G 1403

Safety Glass Standard: CPSC 16 CFR 1201.

The contractor shall submit shop drawings and test reports indicating the proposed window and exterior door assemblies meet the noted project design wind pressure requirements as defined by the Structural Engineer and impact requirements for TDI certification.

SUBMITTALS:

JOB CONDITIONS:

Pre Installation: Meet with Glazier and other trades affected by glass installation, prior to beginning of installation. Do not perform work under adverse weather or job conditions. Install liquid sealants when temperatures are within lower or middle third of temperature range recommended by manufacturer.

PART 2 - PRODUCTS

GLASS PRODUCTS:

INSULATED GLASS UNITS:

Manufacturer is used in this section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced standards.

- 1. Oldcastle Glass®
- 2. Guardian Industries
- 3. Pilkington
- 4. PPG Industries
- 5. ACH Float Glass

Materials

Impact resistant hurricane-resistant, insulated Solarban® 72 glass laminated with three lites of Starphire® glass

Reflective aqua-blue exterior appearance.

1. Solarcool (2) Azuria + Clear by Vitro Architectural Glass.

2. Performance Values: VLT 24 percent; SHGC 0.25; shading coefficient 0.29; exterior reflectance 20 percent; U-value winter 0.47; U-value summer 0.50.

3. Insulating Glass Unit Construction: 1/4 inch (6 mm) Azuria glass, Solarcool on second surface (2) + 1/2 inch (13 mm) air space + 1/4 inch (6 mm) Clear glass.

FABRICATED GLASS UNITS: At all interior door lites and interior windows

Laminated Safety Glass (Lmn-G-Sft): Laminate 2 sheets of clear float glass with a 30mil film of polyvinyl buteral, by manufacturer's standard heat-plus-pressure process with dirt, air pockets and foreign substances excluded; 1/4" thick if not otherwise indicated. <u>Color: Clear</u>

PROCESSED GLASS:

Tempered Glass, Tempered Glass Mirrors: Provide prime glass of color and type indicated, which has not been heat treated to strengthen glass in bending to not less than 4.5 times annealed strength. Tempered glass is to be provided at all glass areas opening onto corridors and hallways.

GLAZING SEALANTS AND COMPONENTS:

<u>General:</u> Provide color of exposed sealant/compound indicated or if not otherwise indicated, as selected by Architect from manufacturer's standard colors, or black if no color is so selected. Comply with manufacturer's recommendations for selection of hardness, depending upon the locations of each application, conditions at time of installations, and performance requirements as indicated. Select materials and variations or modifications, carefully for compatibility with surfaces contacted in the installation.

Butyl Rubber Glazing Sealant (BUR GS): Compound of polymerized butyl rubber and inert fillers, solvent based, 75% solids, complying with FS TT S 001657; tack free in 24 hrs. paintable, non-staining.

Preformed Butyl Rubber Glazing Sealant (PBuR GS): Compound of polymerized butyl rubber and inert fillers, with or without polyisobutylene modification, solvent based, 95% GLASS AND GLAZING 08800 -2

solids, formed and coiled on release paper; tack free in 24 hrs., paintable, non-staining; plain, pre-shimmed or reinforced as required for proper installation and setting of glass.

Oleo Resinous Glazing Compound (OR GC): Oil based glazing compound; nonstaining and non-bleeding; provide proper type as required for either channel or face glazing; comply with FS TT G 410 for face glazing compound.

GLAZING GASKETS:

Structural Rubber Glazing Gaskets (StR GG): Neoprene extrusions fabricated into frames with molded corner units and zipper lock strips; comply with ASTM C 542.

Molded Neoprene Glazing Gaskets: (MN GG): Molded or extruded neoprene gaskets of the profile and hardness required for water tight construction; comply with ASTM D 2000 designation 2BC 415 to 3BC 620, black.

<u>MISCELLANEOUS GLAZING MATERIALS:</u> Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

Setting Blocks: Neoprene or EPDM, 70 90 durometer hardness, with proven compatibility with sealants used.

Spacers: Neoprene or EPDM, 40 50 durometer hardness with proven compatibility with sealants used.

PART 3 EXECUTION

STANDARDS AND PERFORMANCE:

Watertight and airtight installation of each glass product is required, except as otherwise shown. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors), without failure including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the work.

Protect glass from edge damage during handling and installation, and subsequent operation of glazed components of the work. During installation, discard units with significant edge damage or other imperfections.

Glazing channel dimensions as shown are intended to provide for necessary bite on glass, minimum edge clearance, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by job conditions at time of installation.

Comply with combined recommendations and technical reports by manufacturers of glass and glazing products as used in each glazing channel, and with recommendations of Flat Glass Marketing Association "Glazing Manual", except where more stringent requirements are indicated.

PREPARATION FOR GLAZING:

Clean glazing channel and other framing members immediately before glazing. Remove coatings which are not firmly bonded to substrate. Remove lacquer from metal surfaces where elastomeric sealants are used.
Apply primer or sealant to joint surfaces where recommended by sealant manufacturer.

GLAZING:

Install setting blocks of proper size in sill rabbet, located 1/4th of glass width from each corner. Set blocks in thin course of hell bead compound, if any.

Provide spacers inside and out, of proper size and spacing, for glass sizes larger than 50 united inches, except where gaskets or pre-shimmed tapes are used for glazing. Provide 1/8" minimum bite of spacers on glass and use thickness equal to sealant width, except with sealant tape use thickness slightly less than final compressed thickness of tape.

<u>Set units of glass</u> in each series with uniformity of pattern, draw, bow and similar characteristics.

<u>Voids and Filler Rods:</u> Prevent exudation of sealant or compound by forming voids or installing filler rods in channel at heel of jambs and head (do not leave voids in still channels), except as otherwise indicated and depending on light size, thickness and type of glass, and complying with manufacturer's recommendations.

<u>Force sealants into channels</u> to eliminate voids and to ensure complete "wetting" or bond of sealant to glass and channel surfaces.

<u>Tool exposed surfaces</u> of glazing liquids and compounds to provide a substantial "wash" away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

Clean and trim excess glazing materials from glass and stops or frames promptly after installation, and eliminate stains and discolorations.

<u>Where wedge shaped gaskets are driven</u> into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when installation is subjected to movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel bead.

<u>Gasket Glazing:</u> Miter out and bond ends together at corners where gaskets are used for channel glazing, so that gaskets will not pull away from corners and result in voids or leaks in glazing system.

<u>Structural Gasket Glazing:</u> Cut zipper strips slightly long, to ensure tight closure. Lubricate zipper strip and use special tool to install zipper. Do not lubricate glazing channel or anchorage rabbed. Comply with details as shown and manufacturer's instructions, including the possible use of liquid sealants and weep holes.

CURE PROTECTION AND CLEANING:

<u>Protect exterior glass from breakage</u> immediately upon installation by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass. Remove nonpermanent labels and clean surfaces. Cure sealants for high early strength and durability.

Remove and replace glass which is broken, chipped, cracked, abraded or damaged in GLASS AND GLAZING 08800 -4

other ways during construction period, including natural causes, accidents and vandalism.

Wash and polish glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Comply with glass product manufacturer's recommendations for final cleaning.

SECTION 08900 - FIBERGLASS RESIN TRANSFER MOLDED WALL WINDOW FRAMES

PART 1 - GENERAL

- 1.01 SUMMARY
 - A. This Section Includes The Following:
 - 1. Fiberglass Resin Transfer Molded Fixed Wall Windows

1.02 RELATED SECTIONS

- A. Related Sections Include The Following:
 - 1. Division 0 Bidding and Contract Requirements
 - 2. Division 1 General Requirements
 - 3. Division 8 Glazing

1.03 QUALITY ASSURANCE

Test certification by an independent and accredited laboratory is required for the properties listed in this Quality Assurance section. Reports shall be made available upon request for each of the standards and certifications described below.

- A. Reference Standards
 - 1. Window Frame Properties
 - a) ASTM D635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position..
 - b) ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. Laminate Properties
 - a) ASTM D 638 Tensile Strength Properties of Plastic
 - b) ASTM D 790 Flexural Strength Properties of Plastic
 - c) ASTM D 2583 Indention Hardness of Plastics
 - d) ASTM D 256 Izod Pendulum Impact Resistance
 - e) ASTM D 792 Density/Specific Gravity Of Plastics
 - f) ASTM D 1761 Mechanical Properties of Fasteners
 - 3. Core Properties
 - a) ASTM C 177 Thermal Properties of Materials
 - b) ASTM D 1622 Density and Specific Gravity
 - c) ASTM E 84 Surface Burning Characteristics of Materials
- B. Qualifications
 - 1. Manufacturer Qualifications: A company specialized in the manufacture of fiberglass reinforced plastic (FRP) products with a minimum of 30 years documented experience and that is able to produce substantiated records of multiple installations where products have been in continuous service without issue for the warranted period of 25 years or longer.
 - 2. Installer Qualifications: An experienced installer who has completed fiberglass window frame installations similar in material, design, and extent to those indicated and whose work

has resulted in construction with a record of successful in-service performance.

1.04 SUBMITTALS

- A. Product Technical Data Including:
 - 1. Acknowledgment that products submitted meet requirements of standards referenced.
 - 2. Manufacturer shall provide certificate of compliance with current local and federal regulations as it applies to the manufacturing process.
 - 3. Manufacturer's installation instructions.
 - 4. Schedule of wall window frames indicating the specific reference numbers used on the owner's project documents, window type, frame style, size and glazing requirements..
 - 5. Certification of manufacturer's qualifications.
- B. Submittal Drawings for Customer Approval Shall be Submitted Prior to Manufacture and Will Include the Following Information and Formatting:
 - 1. Summary schedule indicating the specific reference numbers as used on owner's drawings, with columns noting window type, frame style, size and glazing requirements.
 - 2. Dimensioned elevation of each type of wall window frame
 - 3. Drawing depicting head, jamb and sill for each type of wall window frame.
 - 4. Individual part drawing and specifications for each FRP part or product.
 - 5. Construction and mounting detail for each frame type.
- C. Samples:
 - 1. Provide one complete manufactured sample which represents all aspects of the typical manufacturing process, including molded in gelcoat color. One edge should expose the interior of the window frame depicting the unique characteristics of its construction.
- D. Operation and Maintenance Manual
 - 1. Include recommended methods and frequency for maintaining optimum condition of fiberglass frames.
 - 2. Include one set of final as built drawings with the same requirements as mentioned in Section B above.
 - 3. Include certificate of warranty for window frames listing specific registration numbers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Each window frame shall be delivered individually crated for protection from damage in cardboard containers, clearly marked with project information, tag location and specific reference number as shown on drawings and shipping information. Each crate shall contain all fasteners necessary for installation as well as complete installation instructions.
 - 1. Window assemblies up to 4' x 8' will ship factory assembled. Larger sizes will be shipped knocked down.
 - 2. Accept only sealed, crated and labeled wall window assemblies at site.

- 3. Windows shall be stored in the original container on edge, out of inclement weather for protection against the elements.
- 4. Handle window frames pursuant to the manufacturer's recommendations as posted on outside of crate.

1.06 WARRANTY

A. All fiberglass window frames have a lifetime guarantee against failure due to corrosion. Additionally, fiberglass window frames are guaranteed for ten years against failure due to materials and workmanship, including warp, separation or delamination, and expansion of the core.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

- A. Chem-Pruf Door Co., Ltd., P.O. Box 4560 Brownsville, Texas 78523 Phone: 1-800-444-6924-7943, Fax: 956-544-7943, Website: <u>www.chem-pruf.com</u>
- B. Substitutions may be considered provided manufacturer can comply with the specifications as written herein and said products are manufactured in the United States of America. Requests for substitution must be submitted in writing no less then 10 days prior to bid date. Substitution request to include a physical sample and written documentation that product will meet the specific manufacturing methods as highlighted below.

2.02 WINDOW FRAMES

- A. <u>Frames</u> shall be fiberglass and manufactured using the resin transfer method creating one solid piece (no voids) with complete uniformity in color and size. Beginning with a minimum 25 mil gelcoat layer molded in and a minimum of two layers of continuous strand fiberglass mat saturated with resin, the frame will be of one-piece construction with molded stop. All frame profiles shall have a core material of 2 psf polyurethane foam. Pultruded fiberglass frames will not be accepted.
- B. <u>Finish</u> of frame shall be identical to the door with 25 mil resin-rich gelcoat of the specified color integrally molded in at time of manufacture. To achieve optimum surface characteristics, the gelcoat shall be cured within a temperature range of 120F to 170F creating an impermeable outer surface, uniform color throughout, and a permanent homogeneous bond with the resin/fiberglass substrate beneath. Only the highest quality gelcoat will be used to ensure enduring color and physical properties. Paint and/or post application of gelcoat result in poor mechanical fusion and will be deemed unacceptable for this application. The finish of the window frame must be field repairable without compromising the integrity of the original uniform composite structure, function or physical strength.
- C. <u>Jamb/Header</u> connection shall be mitered for tight fit. Optional seamless one piece frame construction as indicated on the project schedules and related details.

- D. <u>Internal Reinforcement</u> shall be continuous within the structure to allow for mounting of specified hardware. Reinforcing material shall be a dense matrix of cloth glass fibers and premium resin with a minimum hinge screw holding value of 1000 lbs per screw. All reinforcing materials shall be completely encapsulated. Documented strength of frame screw holding value after third insert must be submitted. Dissimilar materials, such as steel, will be deemed unacceptable as reinforcement for hardware attachment.
- E. <u>Mortises</u> for hardware shall be accurately machined by CNC to hold dimensions to +/- 0.010 inch in all three axis.

PART 3 – EXECUTION

3.01 INSTALLATION CONDITIONS

- A. Verification of Conditions
 - 1. Verify openings are correctly prepared to receive frames.
 - 2. Verify openings are correct size and depth in accordance with submittal drawings.
- B. Installer's Examination
 - 1. Installer shall examine conditions under which construction activities of this section are to be performed and submit a written report to general contractor if conditions are unacceptable.
 - 2. General Contractor shall submit two copies of the installer's report to the architect within 24 hours of receipt.
 - 3. Installer shall not proceed with installation until all unacceptable conditions have been corrected.

3.02 INSTALLATION

- A. Window frames shall be delivered at job site individually crated. Each crate to be clearly marked with the specific opening information for quick and easy identification.
- B. Install window frame assemblies in accordance with shop drawings and manufacturer's printed installation instructions, using installation methods and materials specified in installation instructions.
- C. Field alteration of window frames to accommodate field conditions is strictly prohibited.
- D. Site tolerances: Maintain plumb and level tolerance specified in manufacturer's printed installation instructions.

3.03 CLEANING

A. Clean all surfaces in accordance with respective manufacturer's maintenance instructions.

3.04 PROTECTION OF INSTALLED PRODUCTS

A. Protect window frame assemblies from damage by subsequent construction activities until final inspection.

SECTION 09900 PAINTING

PART 1 GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work in this section.

DESCRIPTION OF WORK:

Extent of painting work is indicated on drawings and schedules, and as herein specified.

<u>Work includes</u> painting and finishing of interior and exterior exposed items and surfaces throughout Project, except as otherwise indicated.

<u>Surface preparation</u>, priming and coats or paint specified are in addition to shop priming and surface treatment specified under other sections of work.

<u>"Paint"</u> as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

<u>Paint exposed surfaces</u> whether or not colors are designated in "schedules", except where natural finish of material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas. If color or finish is not designated, Architect will select these from standard colors available for materials systems specified.

<u>Pre Finished Items:</u> Unless otherwise indicated, do not include painting when factory finishing or installer finishing is specified for such items as (but not limited to) metal toilet enclosures, pre-finished partition systems, acoustic materials, architectural woodwork and casework, finished mechanical and electrical equipment, including light fixtures, switchgear and distribution cabinets, elevator entrance frames, doors and equipment.

<u>Concealed Surfaces</u>: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, foundation spaces, furred areas, utility tunnels, pipe spaces, duct shafts and elevator shafts.

<u>Finished Metal Surfaces</u>: Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.

<u>Operating Parts</u>: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts will not require finish painting.

Do not paint over any code required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

SUBMITTALS:

Product Data: Submit manufacturer's technical information including Paint label analysis

and application instructions for each material proposed for use.

<u>Samples</u>: Submit samples for Architect's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.

<u>On 12" x 12" hardboard</u>, provide two samples of each color and material, with texture to simulate actual conditions. Resubmit samples as requested by Architect until acceptable sheen, color, and texture is achieved.

<u>On actual wood surfaces</u>, provide two 4" x 8" samples of natural and stained wood finish. Label and identify each as to location and application.

<u>On concrete masonry</u>, provide two 4" square samples of masonry for each type of finish and color, defining filler, prime and finish coat.

DELIVERY AND STORAGE:

<u>Deliver materials</u> to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:

Name or title of material. Fed. Spec. number, if applicable. Manufacturer's stock number and date of manufacture. Manufacturer's name. Contents by volume, for major pigment and vehicle constituents. Thinning instructions. Application instructions. Color name and number.

JOB CONDITIONS:

<u>Apply water base paints</u> only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C), unless otherwise permitted by paint manufacturer's printed instructions.

<u>Apply solvent thinned paints</u> only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F (7 degrees C) and 95 degrees F (35 degrees C), unless otherwise permitted by paint manufacturer's printed instructions.

<u>Do not paint</u> in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions.

Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

PART 2 PRODUCTS

COLORS AND FINISHES:

<u>Paint colors</u>, surface treatments, and finishes, are indicated in "schedules" of the contract documents.

Prior to beginning work, Architect will furnish color chips for surfaces to be painted.

Use representative colors when preparing samples for review.

MANUFACTURERS: for interior paint system only;

Sherwin Williams Technical Coatings Inc. Jones Blair Pittsburgh Paint

For exterior paint system: Tnemec (no substitutes for this product)

<u>Color Pigments</u>: Pure, non-fading, applicable types to suit substrates and service indicated.

<u>Paint Coordination</u>: Provide finish coats which are compatible with prime paints used. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information on characteristics of finish materials proposed for use, to ensure compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Architect in writing of any anticipated problems using specified coating systems with substrates primed by others.

MATERIALS:

<u>Material Quality</u>: Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best grade product will not be acceptable.

EXTERIOR PAINT SYSTEMS (EPS):

Provide following paint systems for various substrates, as indicated.

Exterior CMU:

IPS2: 1st Coat - Tnemec 130 Envirofill – 60-85 SFPG 2nd Coat - Tnemec 157 Enviro-Crete – 99-111 SFPG

EXPOSED STRUCTURAL STEEL AND ACCESSORIES

Surface Preparation: Abrasive blast as per manufacturer's guidelines, a minimum 1.5 mil angular anchor profile..

Coating System:

First Coat:	Tnemec Series 27WB Typoxy	4.0 - 6.0 dry mils
Second Coat:	Tnemec Series 27WB Typoxy	4.0 - 6.0 dry mils
Finish Coat:	Tnemec Series 66 HI-Build Epoxoline	4.0 - 6.0 dry mils

INTERIOR PAINT SYSTEMS:

Provide following paint systems for various substrates, as indicated.

Interior CMU Walls:

- IPS2: 1st Coat PROMAR Interior/Exterior Block Filler
 - 2nd Coat Pro Industrical High Performance Epoxy
 - 3rd Coat Pro Industrical High Performance Epoxy

Exposed Concrete Floor: surface prep standard SSPC-SP13

IPS2: 1st Coat - H&C CLEARPROTECT High-Performance Industrial Clear Coat 2nd Coat - H&C CLEARPROTECT High-Performance Industrial Clear Coat

PART 3 EXECUTION

INSPECTION:

Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been correct in a manner acceptable to Applicator.

Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.

Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

SURFACE PREPARATION:

<u>General</u>: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.

Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish painted or provide surface applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.

Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly painted surfaces.

<u>Cementitious Materials</u>: Prepare cementitious surfaces of concrete, concrete block to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze as required. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

Clean concrete floor surfaces scheduled to be painted with a commercial solution or muriatic acid, or another etching cleaner. Flush floor with clean water to neutralize acid and allow to dry before painting.

<u>Wood</u>: Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sandpaper smooth when dried.

Prime, stain, or seal wood required to be job painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling. When transparent finish is required, use spar varnish for back-priming.

Back-prime paneling on interior partitions only where masonry or other wet wall construction occurs on backside.

Seal tops, bottoms, and cut outs of unprimed wood doors with a heavy coat of varnish or equivalent sealer immediately upon delivery to job.

<u>Ferrous Metals</u>: Clean ferrous surfaces, which are not galvanized, or shop coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.

<u>Touch up shop applied prime coats</u> wherever damaged or bare, where required by other sections of these specifications. Clean and touch up with same type shop primer.

<u>Galvanized Surfaces</u>: Clean free of oil and surface contaminants with non-petroleumbased solvent.

MATERIALS PREPARATION:

Mix and prepare painting materials in accordance with manufacturer's directions.

<u>Maintain containers</u> used in mixing and application of paint in a clean condition, free of foreign materials and residue. Store materials not in actual use in tightly covered containers.

<u>Stir materials</u> before application to produce a mixture of uniform density and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

APPLICATION:

<u>General</u>: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

Paint surfaces behind permanently fixed equipment or furniture with prime coat only before final installation of equipment.

Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.

Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless otherwise indicated. Sand lightly between each succeeding enamel or varnish coat.

Omit first coat (primer) on metal surfaces which have been shop primed and touch up painted, unless otherwise indicated.

<u>Scheduling Painting</u>: Apply first coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firms, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

<u>Minimum Coating Thickness</u>: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer.

<u>Prime Coats</u>: Apply prime coat of material, which is required to be painted or finished, and which has not been prime coated by others.

Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn through or other defects due to insufficient sealing.

<u>Stipple Enamel Finish</u>: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.

<u>Pigmented (Opaque) Finishes</u>: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

<u>Transparent (Clear) Finish</u>: Use multiple coats to produce glass smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats, unless otherwise indicated.

<u>Completed Work</u>: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

FIELD QUALITY CONTROL:

The right is reserved by Owner to invoke the following material testing procedure at any time, and any number of times during period of field painting:

Engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.

Testing laboratory will perform appropriate tests for any or all of following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.

If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove non complying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

CLEAN UP AND PROTECTION:

<u>Clean Up</u>: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each workday. Upon completion of painting work, clean window glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using car not to scratch or otherwise damage finished surfaces.

<u>Protection</u>: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations. At completion of work of other trades, touch up and restore all damaged or defaced painted surfaces.

SECTION 104400 SPECIALTY SIGNS

PART 1 GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified in this section.

DESCRIPTION OF WORK:

Extent of specialty signs is shown on drawings.

Forms of specialty signs required include the following:

Interior Panel signs Cast metal plaques Exterior Metal signs Address Numbers Project Job Sign

QUALITY ASSURANCE:

<u>Uniformity of Manufacturer</u>: For each sign form and graphic image process indicated, furnish products of a single manufacturer.

SUBMITTALS:

<u>Product Data</u>: Submit manufacturer's technical data and installation instructions for each type of sign required.

<u>Samples</u>: Submit samples of each sign form and material showing finishes, colors, surface textures and qualities of manufacture and design of each sign component, including graphics.

<u>Shop Drawings</u>: Submit shop drawings for fabrication and erection of specialty signs. Include plans, elevations, and large-scale details of sign wording and lettering layout. Show anchorages and accessory items. Furnish location template drawings for items supported or anchored to permanent construction.

PART 2 PRODUCTS

ACCEPTABLE MANUFACTURERS:

Panel Signage

Manufacturers of Rooms Signs and Address Numbers: Basis of Design: Corpus Christi Stamp Works Bayuk Graphic Systems, Inc. MULTI-graphics, Inc.

Manufacturers of Plaques Basis of Design: A.R.K. Ramos The Southwell Company.

Manufacturers of Plaques Basis of Design: A.R.K. Ramos The Southwell Company.

MATERIALS:

<u>Plastic Laminate</u>: Provide high pressure plastic laminate engraving stock with face and

core plies in contrasting colors, in finishes and color combinations indicated. Manufacturer standard colors.

FABRICATION OF PANEL SIGNS:

Fabricate panels signs to comply with the requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes and details of construction. Provide and install, one per door.

Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed condition within a tolerance of plus or minus 1/16" measured diagonally from corner to corner.

<u>Panel Signs</u>: Fabricate unframed panel signs with edges mechanically and smoothly finished to conform to following requirements:

A. Character Proportion. Letters and numbers on signs should have a width to height ratio between 3:5 and 1:1 and a stroke width to height ratio between 1:5 to 1:10 utilizing an uppercase "X" for measurement.

B. Color Contrast. Characters and symbols shall contrast with their background.

C. Tactile Characters and Symbols. Characters, symbols, or pictographs on signs required to be tactile, shall be raised 1/32 inch minimum. Letters and numbers refer to plans for text height at specific locations. Font: Helvetica 721.

- D. Interior Signs (Named Spaces):
 - A. Provide a sign at each door to each room of the building.
 - B. Include braille message as required by ADA.
 - C. Size: 6"x3"
 - D. Provide the room number followed by the name of the space
- E. Exterior Signs:

A. Provide weather rated exterior sign at each of the following doors on the exterior of the building:

- 1. Mechanical Rooms
- B. Include braille message as required by ADA.
- C. Size: 6"x3"
- D. Provide the room number followed by the name of the space
- F. Restroom Signs:
 - A. Provide a sign at each restroom door.
 - B. Include braille message as required by ADA.

C. Size: 6" x 8" (Pictogram should be 6"x6". Restroom type should be in 2"x8" space)

CAST METAL PLAQUES:

Fabricate cast plaques to comply with requirements indicated below for metal, border style, background texture and finish, and on drawings for thickness, size, shape and copy. Produce castings free from pits, scale, and sand holes or other defects. Hand tool and buff borders and raised copy to produce manufacturer's standard satin polished finish. Refer to "Finish" article of other finish requirements.

Quantity: One (1) Size: 30"W x 20"H x 3/4" D (with Cameron county logo & Parks and Recreation logo)

Metal: Bronze.

Fonts: Times New Roman (Refer to drawings for plaque layout. Revisions to verbiage on plaque will be verified and made by Owner before final approval) Texture: Letherette

Finish: BR-400 Dark Oxidized background with Satin Bronze raised areas Mounting: Concealed (Verify location for anchoring type)

Refer to drawings for location and spacing. Coordinate power supply with Electrical drawings.

PROJECT JOB SIGN:

Provide for (1) - 4x8 Plywood Sheets with Owner directed signage to be used on Project Job Sign. Provide for possible project renderings and school logos and images. Mount on 4x4 post or as required to stand for duration of project. Location on site to be provided by Owner.

METAL SIGNS:

General: Provide and install handicap metal signs, stop signs and directions signs as indicated in drawings.

Materials: Aluminum.

Mounting Pole shall be aluminum .125 wall thickness and five feet in height above finished sidewalk elevation.

FINISHES:

Colors and Surface Textures: For exposed sign materials which require selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not otherwise indicated, as selected by the Architect from the manufacturer's standards.

<u>Metal Finishes</u>: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations.

Aluminum Finishes:

Baked Enamel Finish: Provide finish AA M4xC12C42Rlx (manufacturer's standard non directional mechanical finish including sanding and filing; cleaning with inhibited chemicals; conversion coated with an acid chromate fluoride phosphate treatment; and painted with organic coating specified below).

Bronze Finishes:

<u>Natural Satin Finish:</u> NAAMM-M31-06x (fine satin directional textured mechanical finish with clear organic coating specified below).

<u>Clear Organic Coating</u>: Manufacturer's standard clear coating.

PART 3 EXECUTION:

INSTALLATION:

<u>General</u>: Locate sign units and accessories where shown or scheduled, using mounting methods of type described and in compliance with the manufacturer's instructions, unless otherwise indicated.

<u>Install sign units</u> level, plumb and at the height indicated, with sign surfaces free from distortion or other defects of appearance.

Panel Signs:

Wall Mounted Units: Attach panel signs to wall surfaces using the methods indicated below:

Interior:

Vinyl Tape Mounting (VTM): Use double sided foam tape, or thickness indicated, to mount signs to smooth non porous surfaces. Do not use for vinyl covered or rough surfaces.

Where mounted on glass provide additional blank sign on inside of glass to conceal mounting tape.

Exterior:

Mechanically fasten securely to substrate. Fastener should be appropriate for substrate.

Metal Letters and Numbers:

Mount letters and numbers as follows: use standard fastening methods recommended by manufacturer for letter form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy weight paper template to establish letter spacing and to locate holes for fasteners.

Flush Mounting (FM): Mount letters either backs in contact with wall surface.

<u>Cast Metal Plaques:</u> Mount cast plaques using the manufacturer's standard fastening methods recommended by manufacturer for type of wall surface indicated.

<u>Concealed Mounting</u>: Mount the plaques by inserting threaded studs into tapped lugs on the back of the plaque. Set in predrilled holes filled with quick setting cement.

CLEANING AND PROTECTION:

At completion of the installation, clean soiled sign surface in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

SECTION 10520 - FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 - GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

<u>Definition</u>: "Fire extinguishers" as used in this section refers to units which can be hand carried, unless otherwise specified.

Types of products required include:

Fire extinguishers. Fire extinguisher cabinets.

QUALITY ASSURANCE:

Provide portable fire extinguishers, cabinets and accessories by one manufacturer, unless otherwise acceptable to Architect.

SUBMITTALS:

Product Data: Submit manufacturer's technical data and installation instructions for all portable fire extinguishers required. Where color selections by Architect are required include color charts showing full range of manufacturer's standard colors and designs available.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS:

J. L. Industries. Larsen's Mfg. Co.

FIRE EXTINGUISHERS:

<u>General</u>: Provide fire extinguishers for each extinguisher cabinet and other locations indicated, in colors and finishes selected by Architect from manufacturer's standard which comply with requirements of governing authority.

<u>Fill and service extinguishers</u> to comply with requirements of governing authorities and manufacturer's requirement.

<u>Multi Purpose Dry Chemical Type</u>: UL rated 4 A: 60 BC, 10 lb. nominal capacity, in enameled steel container for Class A, Class B and Class C fires.

FIRE EXTINGUISHER CABINETS:

<u>General</u>: Provide fire extinguisher cabinets (FECB) where indicated, of suitable size for housing fire extinguishers of types and capacities indicated.

<u>Construction</u>: Manufacturer's standard enameled steel box, with trim, frame, door and hardware to suit cabinet type, trim style, and door style indicated. Weld all joints and grind smooth. Miter and weld perimeter door frames.

<u>Cabinet Type</u>: Suitable for mounting conditions indicated, of the following types:

<u>Semi Recessed</u>: Cabinet box (tub) fully recessed in walls of sufficient depth to suit style of trim indicated.

<u>Trim Style</u>: Fabricate trim in one piece with corners mitered, welded and ground smooth. <u>Exposed Trim</u>: One piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

<u>Rolled Edge Trim:</u> Rounded edges with backbend depth as follows: Depth: 2 1/2".

Trim Metal: of same metal as door.

<u>Door Material and Construction</u>: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.

Door Style: Equal to JL Vertical Duo

Duo Panel: Tempered glass, 1/8" thick, unless otherwise indicated.

Additional Features: Red Vertical FE letters

<u>Door Hardware</u>: Provide manufacturer's standard door operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam action latch, or door pull, exposed or concealed, and friction latch. Provide concealed or continuous type hinge permitting door to open 180 degrees. FACTORY FINISHING OF FIRE EXTINGUISHER CABINETS

<u>General</u>: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations except as otherwise indicated. Apply finishes in factory after products are assembled. Protect cabinets with plastic or paper covering, prior to shipment.

Aluminum Finishes:

Provide #180 clear anodized door and frame.

PART 3 - EXECUTION

INSTALLATION:

<u>Install items</u> included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.

Prepare recesses in walls for fire extinguisher cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.

Where exact location of bracket mounted fire extinguishers is not indicated, locate as directed by Architect.

IDENTIFICATION:

<u>Identify</u> existence of fire extinguisher in cabinet with lettering spelling "FIRE EXTINGUISHER" painted on door by silk screen process. Provide lettering on door as indicated, or if not indicated, as selected by Architect from Manufacturer's standard letter sizes, styles, colors and layouts.

SECTION 10800 TOILET ACCESSORIES

PART 1 GENERAL

RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

DESCRIPTION OF WORK:

Extent of each type of toilet accessory is indicated on drawings and schedules.

Types of toilet accessories required include the following:

Sanitary napkin disposal units. Grab bars. Mirrors.

QUALITY ASSURANCE:

Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry; coordinate delivery with other work to avoid delay.

Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units.

Products: Provide products of same manufacturer for each type of accessory unit and for units exposed in same areas, unless otherwise acceptable to Architect.

SUBMITTALS:

Product Data: Submit manufacturer's technical data and installation instructions for each toilet accessory.

Setting Drawings: Provide setting drawings, templates, instructions, and directions for installation of anchorage devices in other work.

PART 2 PRODUCTS:

<u>ACCEPTABLE MANUFACTURERS:</u> Bobrick Washroom Equipment, Inc. Bradley Corporation

<u>MATERIALS, GENERAL:</u> Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 22 gage minimum, unless otherwise indicated.

Mirror Glass: FS DD G 451, Type I, Class 1, Quality q2, 1/4" thick, with silver coating, copper protective coating, and non metallic paint coating complying with FS DD M 411. Galvanized Steel Mounting Devices: ASTM A 386, hot dip galvanized after fabrication.

Fasteners: Screws, bolts, and other devices of same material as accessory unit or of galvanized steel where concealed.

FABRICATION:

General: Stamped names or labels on exposed faces of toilet accessory units are not permitted, except where otherwise indicated; unobtrusive labels on surfaces not exposed to view are acceptable. Where locks are required for a particular type of toilet accessory, provide same keying throughout project. Furnish two keys for each lock.

Surface Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

- **Handicap Mirror**: Equal to Bobrick model no. B-165 2448, Framed Mirror. Provide one unit at each lavatory.
- Hot Air Dryer: Equal to Bobrick model no. B-770, refer to drawings for locations.
- **Grab Bar**: Equal to Bobrick model no. B-66806 series x 42" long, provide at each handicap water closet location.
- **Grab Bar**: Equal to Bobrick model no. B-66806 series x 36" long, provide at each handicap water closet location.
- Wall Mounted Napkin Dispenser: Equal to Bobrick model no. B-353
- **Soap Dispenser**: Equal to Bobrick model no. B-2111, provide one unit at each lavatory.
- **Toilet Paper Dispenser**: Equal to Bobrick model no. B-274, provide one unit at each water closet location.
- **Coat Hook:** Equal to Bobrick model no. B-2116, provide one unit at each water closet location.
- Towel Hook: Equal to Bobrick model no B/76717, provide one unit at each shower stall.
- Shower Seat: Equal to Bobrick model no. B-5181.
- **Vinyl Shower Curtains:** Equal to Bobrick model no. 204-3. See plans for locations and sizes.
- Shower Rod 36"/60": Equal to Bobrick model no. B-6047. See Plans for locations.
- **Shower Hooks:** Equal to Bobrick model no. B204-1. See plans for locations.
- **Recessed Soap Dish:** Equal to Bobrick model no. B-4380. See plans for locations.
- **Continuous Grab Bar (Shower**): -30" x 60" x 30",1-1/2" O.D. G.B, peened, with snap on flanges. (Field Verify Dimensions)
- **Continuous Grab Bar (Shower**): -36" x 36" x 36",1-1/2" O.D. G.B, peened, with snap on flanges. (Field Verify Dimensions)
- Changing Station: Equal to Bobrick model no. KB200, provide one unit at each toilet

PART 3 - EXECUTION

INSTALLATION:

Install toilet accessory units in accordance with manufacturers' instructions, using fasteners which are appropriate to substrate and recommended by manufacturer of unit. Install units plumb and level, firmly anchored in locations and at heights indicated. General Contractor to provide for solid 2x wood blocking at toilet accessories mounted at gypsum drywall partitions.

ADJUSTING AND CLEANING:

Adjust toilet accessories for proper operation and verify that mechanisms function smoothly.

Clean and polish all exposed surfaces after removing protective coatings.

TECHNICAL SPECIFICATIONS FOR OLMITO RV PARK

PHASE 1

CITY OF OLMITO CAMERON COUNTY, TEXAS

PREPARED FOR: CAMERON COUNTY







A M B I O T E C G R O U P

TBPE FIRM No. F-4126 TBPLS REG No. 10005300

5420 PAREDES LINE ROAD BROWNSVILLE, TEXAS 78526 PHONE (956) 548-9333 FAX (956) 548-9399 ACE # 3681

NOVEMBER 2023

TABLE OF CONTENTSTECHNICAL SPECIFICATIONS

01 32 33 - Construction Photos and Videos	
01 45 29 - Testing Laboratory Services	
01 50 00 - Temporary Facilities and Controls	$\dots \dots $
01 55 26 - Traffic Control and Regulation	01 55 26 – 1 through 3
01 57 23 - Storm Water Pollution Prevention Plan	01 57 23 – 1 through 2
02 41 00 – Demolition	
03 30 00 - Cast-in-Place Concrete / Concrete for Utility Construction	
31 06 20.16 - Backfill Mat'ls Schedule - Utility Backfill Materials	
31 10 00 - Site Clearing - Preparation of Site	
31 23 00 - Earthwork, Excavation, Fill, Grading	
31 23 16.13 - Trench Safety Systems	
31 23 16.16 - Excavation & Backfill for Minor Structures	
31 23 19 - Dewatering - Control of Ground Water and Surface Water	
31 23 33 - Trenching & Backfilling - Excavation and Backfill for Utilities	
31 32 13.16 - Cement Stabilized Sand	
31 32 13.19 - Lime Treatment for Subgrade	
31 32 19.16 – Geotextile	
31 34 19.13 - Geogrid Soil Reinforcement	
32 01 00 - Pavement Repair and Resurfacing	
32 11 23 – Aggregate Base Courses	
32 11 23.1 – Caliche Type A Grade 2	
32 12 16 - Asphalt Paving	
32 13 13 - Concrete Pavement	
32 16 00 - Concrete Curb and Gutter, Driveways, and Sidewalks	32 16 00 - 1 through 4
32 17 23.13 - Painted Pavement Markings	
32 31 13 - Chain Link Fences and Gates	
33 11 00 – Water Mains	
33 12 13 – Water Tap and Service Line Installation	
33 12 13.10 – Water Service Connections	
33 12 16 – Water Utility Distribution Valves	
33 12 16.13 – Tapping Sleeves and Valves	
33 12 33 – Valve Boxes, Meter Boxes and Meter Vaults	
33 13 00 – Disinfection of Water Lines	
33 30 00 - Sanitary Sewerage Utilities - Sanitary Sewer Pipework	
33 32 00 – Sanitary Sewer Lift Station	
33 39 13 - Frames, Grates, Rings & Covers	
40 05 16 – Gate Valves	
00100 – Preparing Right-Of-Way	00100 - 1 through 2
01562 – Tree & Plant Protection	
02448 – Pipe and Casing Augering	
02513 – Wet Connections	
02520 – Fire Hydrants	
02533 - Acceptance Testing for Sanitary Sewers	

SECTION 01 32 33

CONSTRUCTION PHOTOGRAPHS AND VIDEO

PART 1 - GENERAL

1.01 PHOTOGRAPHY

- A. CONTRACTOR shall be responsible for the production of pre-construction, duringconstruction (construction progress) and post-construction photographs as provided herein. OWNER's Representative may also designate additional subjects for photographs in addition to the general guidelines identified below.
- B. All photographs must be produced by a competent photographer and shall be digital color photography of commercial quality. All CONTRACTOR-generated photographs must be stored in a .jpeg file format. Each photograph shall be submitted in CD disc format. Each photo shall be marked with the name of the Contract, name of CONTRACTOR, description and location of view and identity of photographer.
- C. Each photograph submittal must include a Photo Log that includes the name and number of Contract, name of CONTRACTOR, the name of the photographer, company of the photographer, photograph number, the date of the photograph and the filename that the camera assigns to the photo (e.g. MVC-001.jpg). In addition, appropriate descriptive information to properly identify the location of view must be entered into the Photo Log to assist in maintaining a concise project record (e.g. Sta. 2+00 Line A or location of Tie-In point at Sta. 46+00).
- D. All pre-construction photographs must be submitted prior to the CONTRACTOR beginning any Work that may cause site disturbance. All construction progress photographs shall be submitted with the monthly progress payment. All post-construction photographs shall be submitted prior to release of final payment to the CONTRACTOR.
 - 1. Pre-construction photographs must be taken at sufficient intervals to be able to fully document the pre-construction conditions of the Work, but in no case less than 100 feet along the street, right-of-way or water/wastewater line route before commencement of Work. Each photograph location shall be taken from a minimum of two (2) views (one forward station view and one backward station view along the street or pipeline route) within the limits of construction. Particular attention must be devoted to pre-existing damage to streets, curbs, sidewalks, driveways, signs, mailboxes, etc. for which the CONTRACTOR could be blamed following construction. An identification marker such as houses, businesses, signs, property numbers, mail boxes, landscaping, etc. must be included in each view to properly confirm its location for ease of later

identification. At a minimum, photographs must be taken of the following views:

- the entire street (full width and length)
- all curbs (both sides of street) all pre-existing curb damage not called for replacement within the Work must be documented, including major cracks
- all driveways, steps, and curbs (both sides of street)
- fence and gate conditions
- trees, ornamental shrubs, plantings/planter boxes and evidence of irrigation features
- other privately owned features that might be disturbed by the construction
- prominent utility features, such as: guy wires, poles, signs, valves, meters, pull boxes, etc.
- streams and stream banks within the limits of construction
- other significant or prominent features in order to protect the OWNER and CONTRACTOR following construction (e.g. close up photographs of preexisting broken curbs, cracked/failed pavement, damaged adjacent retaining walls, etc.)
- views of structures in areas where CONTRACTOR will be working within five (5) feet of said structure
- other views as requested by the OWNER
- 2. For street, right-of-way and/or pipeline alignment documentation, construction progress photographs shall be taken from a minimum of two (2) views (one forward station view and one backward station view along the street and/or pipeline route, and one front view and one side view for fittings and appurtenances of pipeline projects) within the limits of construction. Additional photographs shall be taken at stations of significant features and, for pipeline projects at dead ends, tees, bends, valves, manholes, connections, at locations of concrete placement, at stations which will potentially affect adjacent property owners, and at other such times and locations as requested by the OWNER.
- E. Construction progress photographs of the same views taken during preconstruction photography must be taken during the progress of the Work and shall be submitted monthly with the CONTRACTOR's monthly progress payments. Post-construction photographs must be taken of the same views taken during preconstruction photography to fully document the completed project. Postconstruction photographs must be taken after cleanup and site restoration, and must be submitted prior to release of final payment.

1.02 PRE-CONSTRUCTION VIDEO

A. For all horizontal projects (streets and water & wastewater lines) the CONTRACTOR shall also document by video, within the limits of construction, all pre-existing site conditions / elements as documented in above.

- B. The video documentation shall provide a clear and continuous view of the project alignment and everything within the limits of construction.
- C. The video shall not be taken from inside a vehicle that is moving. The video shall be taken standing within the limits of construction, as applicable.
- D. The pre-construction video shall be digital and submitted to the OWNER in DVD disc format prior to the occurrence of any site disturbance.
- E. Post-construction video must be taken after cleanup and site restoration, and must be submitted prior to release of final payment.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

SECTION 01 45 29

TESTING LABORATORY SERVICES

PART 1 GENERAL

- 1.1 SECTION INCLUDES
 - 1. Testing laboratory services and Contractor responsibilities related to those services.

1.2 REFERENCES

- 1. ASTM C 1077 Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- 2. ASTM D 3666 Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.
- 3. ASTM D 3740 Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- 4. ASTM E 329 Specification for Minimum Requirements for Agencies Engaged the Testing and/or Inspection of Materials Used in Construction.
- 5. ISO/TEC Guide 25 General Requirements for the Competence of Calibration and Testing Laboratories.
- 1.3 SELECTION AND PAYMENT
 - 1. The Owner will select, employ, and pay for services of an independent testing laboratory to perform inspection and testing as required.
 - 2. When required, the Contractor shall employ and pay for services of an independent testing laboratory or laboratories to perform inspection and testing identified in "Products" sections of the individual Specification.
 - 3. Employment of a testing laboratory by the Owner shall not relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.
 - 4. The Contractor will have the cost of retesting deducted from the estimate for payment whenever failed work must be removed and replaced and retested.

1.4 QUALIFICATION OF LABORATORY

- 1. Meet laboratory requirements of ASTM E 329 and applicable requirements of ASTM C 1077, ASTM D 3666, and ASTM D 3740.
- 2. Meet the ISO/TEC Guide 25 conditions for accreditation by the American Association for Laboratory Accreditation (A2LA) in specific fields of testing required in individual Specification sections.
- 3. Where a laboratory subcontracts any part of the testing services, such work shall be placed with a laboratory complying with the requirements of this Section.

1.5 LABORATORY REPORTS

- 1. The testing laboratory shall provide and distribute copies of laboratory reports to the following: the Owner, the Engineer, and the Contractor. Other copies of the reports may be required to be submitted to other parties. The testing laboratory will be informed of any other persons that required laboratory reports.
- 2. One copy of each laboratory report distributed or faxed to the Contractor shall be kept at the site field office for the duration of the project.
- 3. Before close of business on the working day following test completion and review, reports which indicate failing test results shall be transmitted immediately via fax from the testing laboratory to the Owner, Contractor, and Engineer.
- 1.6 LIMITS ON TESTING LABORATORY AUTHORITY
 - 1. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Laboratory may not approve or accept any portion of the Work.
 - 3. Laboratory may not assume any duties of the Contractor.
 - 4. Laboratory has no authority to stop the Work. The laboratory's representative shall immediately inform the Engineer and the Owner of any conflicts with the Contractor or Contractor's construction methods.

1.7 CONTRACTOR RESPONSIBILITIES

- 1. Provide safe access to the Work and to applicable facilities (e.g. manufacturers, suppliers) for the Owner, Engineer, and testing laboratory personnel.
- 2. Provide to the testing laboratory a copy of the construction schedule and a copy of each update to the construction schedule.

- 3. Notify the Engineer and the testing laboratory during normal working hours of the day previous, but not less than 18 hours prior notice, to the expected time for operations requiring inspection and testing services. If the Contractor fails to make timely prior notification, then the Contractor shall not proceed with the operations requiring inspection and testing services.
- 4. Notify the Engineer 24 hours in advance if the Specification requires the presence of the Engineer for sampling or testing.
- 5. Request and monitor testing as required to provide timely results and to avoid delay to the Work. Provide samples to the laboratory in sufficient time to allow the required test to be performed in accordance with specified test methods before the intended use of the material.
- 6. Cooperate with laboratory personnel in collecting samples on site. Provide incidental labor and facilities for safe access to the Work to be tested; to obtain and handle samples at the site or at source of products to be tested; and to facilitate tests and inspections including storage and curing of test samples.

PART 2 PRODUCTS - Not Used

PART 3 E X E C U T I O N

3.01.1 CONDUCTING TESTING

- 1 Laboratory sampling and testing specified in individual Specification sections shall conform to the latest issues of ASTM standards, TxDOT methods, or other recognized test standards as approved by the Engineer.
- 2. The requirements of this section shall also apply to those tests for approval of materials, for mix designs, and for quality control of materials as performed by the testing laboratories employed by the Contractor.

Section 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- 1. Temporary facilities and the necessary controls for the project including utilities, telephone, sanitary facilities, field office, storage sheds and building, safety requirements, first aid equipment, fire protection, security measures, protection of the Work and property, access roads and parking, environmental controls, disposal of trash, debris, and excavated material, pest and rodent control, water runoff and erosion control.
- 2. The facilities and controls specified in this section are considered minimum for the Project. The Contractor may provide additional facilities and controls for the proper execution of the Work and to meet Contractor's responsibilities for protection of persons and property.

1.2 CONTRACTOR'S RESPONSIBILITY

- 1. Comply with applicable requirements specified in other sections of the Specifications.
 - 1. Maintain and operate temporary facilities and systems to assure continuous service.
 - 2. Modify and extend systems as Work progress requires.
 - 3. Completely remove temporary materials and equipment when their use is no longer required.
 - 4. Restore existing facilities used for temporary services to specified or to original condition.

1.3 TEMPORARY UTILITIES

- 1. Obtaining Temporary Service:
 - 1. Make arrangements with utility service companies for temporary services.
 - 2. Abide by rules and regulations of the utility service companies or authorities having jurisdiction.

- 3. Be responsible for utility service costs until the Work is substantially complete. Included are fuel, power, light, heat, and other utility services necessary for execution, completion, testing, and initial operation of the Work.
- 2. Water:
 - 1. Provide water required for and in connection with Work to be performed and for specified tests of piping, equipment, devices, or for other use as required for proper completion of the Work.
 - 2. For water to be drawn from public fire hydrants, obtain special permit or license from the proper Utility officials. A deposit based on rates established by latest ordinance will be required.
 - 3. Provide and maintain an adequate supply of potable water for domestic consumption by Contractor personnel and the Owner or his Representatives.
- 3. Electricity and Lighting:
 - 1. Provide electric powered service as required for the Work, including testing of Work. Provide power for lighting, operation of the Contractor's equipment, or for any other use by Contractor.
 - 2. Electric power service includes temporary power service or generator to maintain plant operations during any scheduled shutdown.
 - 3. Minimum lighting level shall be 5 foot-candles for open areas; 10-foot-candles for stairs and shops. Provide a minimum of one 300-watt lamp for each 20 square feet in work area.
- 4. Temporary Heat and Ventilation:
 - 1. Provide temporary heat as necessary for protection or completion of the Work.
 - 2. Provide temporary heat and ventilation to assure safe working conditions; maintain enclosed areas at a minimum of 50 degrees F.
- 5. Telephone:
 - 1. Provide emergency telephone service at the Contractor's office for use by Contractor personnel and others performing work or furnishing services at the site.
 - 2. Provide a separate phone line and instrument in the field office, if used, for the Owner or his representatives. Cost for local calls and other project-related calls made by the Inspector shall be paid for by the Contractor.

6. Sanitary Facilities:

- 1. Provide and maintain sanitary facilities for persons on the job site; comply with the regulations of State and local departments of health.
- 2. Enforce the use of sanitary facilities by construction personnel at the job site. Such facilities shall be enclosed. Pit-type toilets will not be permitted. No discharge will be allowed from these facilities. Collect and store sewage and waste so as not to cause a nuisance or health problem; have sewer and waste hauled off-site and properly disposed in accordance with City and County regulations.
- 3. Locate toilets near the Work site and secluded from view insofar as possible. Keep toilets clean and supplied throughout the course of the Work.

1.4 FIELD OFFICE

- 1. Furnish and Locate:
 - 1. Furnish, install and maintain a field office for the use of the Owner and his representatives. Provide sufficient room for project meetings. Locate the office at the Site in a place approved by the Owner.
 - 2. Provide office space ready for occupancy, 10 days after date fixed in Notice to Proceed.
 - 3. Construct two all-weather, hard surfaced parking spaces, suitable for weather and duration of Project, for use by the Contractor and the Owner or his representatives. Provide an all-weather surfaced walk between the parking spaces and the office.
- 2. Minimum Construction:
 - 1. Structurally sound foundation and superstructure.
 - 2. Completely weather tight with insulated roof and walls.
 - 3. Exterior finish and interior finish acceptable to the Owner.
 - 4. Stairs or walkway with handrail and entrance platform (4' x 4') with a mud scraper at door.
 - 5. Resilient floor covering.
 - 6. Screened windows with an area equal to approximately 10 percent of floor area sufficient for light, view, and ventilation. Provide windows with operable sash.

- 7. Secure lockable exterior doors with dead bolt cylinder locks.
- 3. Minimum Services:
 - 1. Exterior light at entrance.
 - 2. Interior lighting of 50 foot-candles at desktop height.
 - 3. Automatic heating to maintain 65 degrees F in winter.
 - 4. Automatic cooling to maintain 75 degrees F in summer.
 - 5. Electric power service.
 - 6. Four electric wall outlets.
 - 7. Separate telephone service.
 - 8. Chilled drinking water.
 - 9. Separate sanitary facilities with one water closet and one lavatory and medicine cabinet.
 - 10. Plumbing and sewers as required, protected from freezing.
- 4. Minimum Furnishings:
 - 1. Two 5-drawer desks.
 - 2. Two swivel desk chairs.
 - 3. One drafting table with built-in drawer, drafting stool, and light.
 - 4. One plan rack to hold eight racks of drawings.
 - 5. Two 4-drawer legal file cabinets.
 - 6. Book shelving and bookcase with a minimum of 15 feet of shelf space.
 - 7. Two waste baskets.
 - 8. One tack board 30 inches by 36 inches.
 - 9. Fire extinguishers.
 - 10. Identifying exterior sign acceptable to the Owner.

- 11. First aid kit.
- 12. Six protective helmets (hard hats) for use by visitors.
- 13. Conference table and chairs to accommodate 15 persons.
- 14. Fax machine.
- 15. Other furnishings at Contractor's option.
- 5. Maintenance:
 - 1. Schedule continuous maintenance of office, walkways, and services; cleaned not less than once per week;
 - 2. Provide soap, paper towels, cleansers, janitorial service and appurtenances;
 - 3. Immediately repair any damage, leaks or defective service.
- 6. Provide adequate space for one set of Contract Documents in the office for ready reference.
- 1.5 STORAGE SHEDS AND BUILDINGS
 - 1. Provide adequately ventilated, watertight storage facilities with floor above ground level for materials and equipment susceptible to weather damage.
 - 2. Storage of materials not susceptible to weather damage may be on blocks off the ground.
 - 3. Store materials in a neat and orderly manner. Place materials and equipment to permit easy access for identification, inspection and inventory.
 - 4. Fill and grade site for temporary structures to provide drainage away from temporary and existing buildings.
- 1.6 SAFETY REQUIREMENTS
- 1.7
 - 1. Submit and follow a safety program in accordance with Document 00700 General Conditions, Paragraph 10.1. Include in the safety program documented response to trench safety requirements as specified in Section 31 23 16.13 Trench Safety Systems.
 - 2. Conduct operations in strict accord with applicable Federal, State and local safety codes and statutes and with good construction practice. The Contractor is fully

responsible and obligated to establish and maintain procedures for safety of all work, personnel and equipment involved in the Project.

- 3. Observe and comply with Texas Occupational Safety Act (Art. 5182a, V.C.S.) and with all safety and health standards promulgated by Secretary of Labor under Section 107 of Contract Work Hours and Standards Act, published in 29 CFR Part 1926 and adopted by Secretary of Labor as occupational safety and health standards under the Williams-Steiger Occupational Safety and Health Act of 1970, and to any other legislation enacted for safety and health of Contractor employees. Such safety and health standards apply to subcontractors and their employees as well as to the Contractor and its employees.
- 4. Observance of and compliance with the regulations shall be solely and without qualification the responsibility of the Contractor without reliance or superintendence of or direction by the Owner or his representative. Immediately advise the Owner and engineer of investigation or inspection by Federal Safety and Health inspectors of the Contractor or subcontractor's work or place of work on the job site under this Contract, and after such investigation or inspection, advise the Owner and engineer of the results. Submit one copy of accident reports to Owner within 10 days of occurrence.
- 5. Protect areas occupied by workmen using the best available devices for detection of lethal and combustible gases. Test such devices frequently to assure their functional capability. Constantly observe infiltration of liquids into the Work area for visual or odor evidences of contamination, immediate take appropriate steps to seal off entry of contaminated liquids to the Work area.
- 6. Safety measures, including but not limited to safety personnel, first-aid equipment, ventilating equipment and safety equipment, in the specifications and shown on the Drawings are obligations of the Contractor.
- 7. Maintain required coordination with the City's Police and Fire Departments during the entire period covered by the Contract.

1.8 FIRST AID EQUIPMENT

- 1. Provide a first aid kit throughout the construction period. List telephone numbers for physicians, hospitals, and ambulance services in each first aid kit.
- 2. Have at least one person thoroughly trained in first aid procedures present on the site whenever Work is in progress.
1.9 FIRE PROTECTION

1. Conform to specified fire protection and prevention requirements established by Federal, State, or local governmental agencies and as provided in Contractor's Safety Program.

1.10 SECURITY MEASURES

- 1. Protect all Work materials, equipment, and property from loss, theft, damage, and vandalism. Contractor's duty to protect property includes public property, and property of the Owner and his representatives used in connection with the performance of the Contract.
- 2. If existing fencing or barriers are breached or removed for purposes of construction. Provide and maintain temporary security fencing equal to existing.

1.11 PROTECTION OF PUBLIC UTILITIES

- 1. Prevent damage to existing public utilities during construction. These utilities are shown on the Drawings at their approximate locations. Give owners of these utilities at least 48 hours notice before commencing Work in the area, for locating the utilities during construction, and for making adjustments or relocation of the utilities when they conflict with the proposed Work.
- 2. Utilize the Utility Coordinating Committee One Call System, telephone number, (713) 223-4567, which must be called 48 hours in advance. The toll free telephone number is 1-800-669-8344, Texas One Call System.

1.12 PROTECTION OF THE WORK AND PROPERTY

- 1. Preventive Actions:
 - 1. Take precautions, provide programs, and take actions necessary to protect the Work and public and private property from damage.
 - 2. Take action to prevent damage, injury or loss, including, but not be limited to, the following:
 - 1. Store apparatus, materials, supplies, and equipment in an orderly, safe manner that will not unduly interfere with progress of the Work or the Work of any other contractor, any utility service company, or the City's operations.
 - 2. Provide suitable storage for materials which are subject to damage by exposure to weather, theft, breakage, or otherwise.

- 3. Place upon the Work or any part thereof only such loads as are consistent with the safety of that portion of the Work.
- 4. Frequently clean up refuse, rubbish, scrap materials, and debris caused by construction operations, keeping the Project site safe and orderly.
- 5. Provide safe barricades and guard rails around openings, for scaffolding, for temporary stairs and ramps, around excavations, elevated walkways, and other hazardous areas.
- 3. Obtain written consent from proper parties before entering or occupying with workers, tools, materials or equipment, privately-owned land except on easements provided for construction.
- 4. Assume full responsibility for the preservation of public and private property on or adjacent to the site. If any direct or indirect damage is done by or on account of any act, omission, neglect, or misconduct in execution of the Work by the Contractor, it shall be restored by the Contractor to a condition equal to or better than that existing before the damage was done.
- 2. Barricades and Warning Signals: Where Work is performed on or adjacent to any roadway, right-of-way, or public place, furnish and erect barricades, fences, lights, warning signs, and danger signals; provide watchmen; and take other precautionary measures for the protection of persons or property and protection of the Work. Use barricades painted to be visible at night. From sunset to sunrise, furnish and maintain at least one light at each barricade. Erect sufficient barricades to keep vehicles from being driven on or into Work under construction. Furnish watchmen in sufficient numbers to protect the Work. Maintain barricades, signs, and lights, and provide watchmen until the Project is accepted by the Owner, engineer, and building officials.
- 3. Tree and Plant Protection: Conform to requirements of Section 01562 Tree and Plant Protection.
- 4. Protection of Existing Structures:
 - 1. Underground Structures:
 - 1. Underground structures are defined to include, but not be limited to, sewer, water, gas, and other piping, and manholes, chambers, electrical and signal conduits, tunnels, and other existing subsurface installations located within or adjacent to the limits of the Work.
 - 2. Known underground structures, including water, sewer, electric, and telephone service connections are shown on the Drawings. This information is shown for the assistance of the Contractor in accordance with the best information available, but is not guaranteed to be correct or complete.

- 3. Explore ahead of trenching and excavation work and uncover obstructing underground structures sufficiently to determine their location, to prevent damage to them and to prevent interruption of utility services. Restore to original condition damages to underground structure at no additional cost to the Owner.
- 4. Necessary changes in location of the Work may be made by the Engineer to avoid unanticipated underground structures.
- 5. If permanent relocation of an underground structure or other subsurface installations is required and not otherwise provided for in the Contract Documents, the Engineer will direct Contractor in writing to perform the Work, which shall be paid for under the provisions for change orders in the Contract Document General Conditions.
- 2. Surface Structures: Surface structures are defined as existing buildings, structures and other constructed installations above the ground surface. Included with such structures are their foundations or any extension below the surface. Surface structures include, but are not limited to buildings, tanks, walls, bridges, roads, dams, channels, open drainage, piping, poles, wires, posts, signs, markers, curbs, walks, guard cables, fencing, and other facilities that are visible above the ground surface.
- 3. Protection of Underground and Surface Structures:
 - 1. Support in place and protect from direct or indirect injury underground and surface structures located within or adjacent to the limits of the Work. Install such supports carefully and as required by the party owning or controlling such structure. Before installing structure supports, Contractor shall satisfy the Engineer that the methods and procedures to be used have been approved by the owner of the structure.
 - 2. Avoid moving or in any way changing the property of public utilities or private service corporations without prior written consent of a responsible official of that service or public utility. Representatives of these utilities reserve the right to enter within the limits of this project for the purpose of maintaining their properties, or of making such changes or repairs to their property that may be considered necessary by performance of this Contract.
 - 3. Notify the owners and/or operators of utilities and pipelines of the nature of construction operations to be performed and the date or dates on which those operations will be performed. When construction operations are required in the immediate vicinity of existing structures, pipelines, or utilities, give a minimum of 5 working days advance notice. Probe and flag the location of underground utilities prior to

commencement of excavation. Keep flags in place until construction operation reach and uncover the utility.

- 4. Assume risks attending the presence or proximity of underground and surface structures within or adjacent to the limits to the Work including but not limited to damage and expense for direct or indirect injury caused by his Work to any structure. Immediately repair damage caused, to the satisfaction of the owner of the damaged structure.
- 5. Protection of Installed Products:
 - 1. Provide protection of installed products to prevent damage from subsequent operations. Remove protection facilities when no longer needed, prior to completion of Work.
 - 2. Control traffic to prevent damage to equipment, materials, and surfaces.
 - 3. Provide coverings to protect equipment and materials from damage. Cover projections, wall corners, jambs, sills, and exposed sides of openings in areas used for traffic and for passage of materials in subsequent work.

1.13 ROADS AND PARKING

- 1. Prevent interference with traffic and public operations on existing roads.
- 2. Designate temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking. Locate as approved by the Owner.
- 3. Minimize use by construction traffic of existing streets and driveways.
- 4. Do not allow heavy vehicles or construction equipment in existing parking areas.

1.14 ENVIRONMENTAL CONTROLS

- 1. Provide and maintain methods, equipment, and temporary construction as necessary for controls over environmental conditions at the construction site and adjacent areas.
- 2. Comply with statutes, regulations, and ordinances which relate to the proposed Work for the prevention of environmental pollution and preservation of natural resources, including but not limited to the National Environmental Policy Act of 1969, PL 91-190, Executive Order 11514.
- 3. The Owner recognizes that the site has considerable natural value and that construction of projects should have minimum impact to the surrounding environment. The Contractor shall adopt construction procedures that do not cause unnecessary excavation and filling of the terrain, indiscriminate destruction of vegetation, air or stream pollution, nor the harassment or destruction of wildlife.

- 4. Recognize and adhere to the environmental requirements of the Project. Disturbed areas shall be strictly limited to boundaries established by the Contract Documents. Particularly avoid pollution of "on-site" streams, sewers, wells, or other water sources.
- 5. Burning of rubbish, debris or waste materials is not permitted.
- 1.15 POLLUTION CONTROL
 - 1. Provide methods, means, and facilities required to prevent contamination of soil, water or atmosphere by discharge of noxious substances from construction operations.
 - 2. Provide equipment and personnel to perform emergency measures required to contain any spillage, and to remove contaminated soils or liquids. Excavate and dispose of any contaminated earth off-site, and replace with suitable compacted fill and topsoil.
 - 3. Take special measures to prevent harmful substances from entering public waters. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams, or in sanitary or storm sewers.
 - 4. Provide systems for control of atmospheric pollutants.
 - 1. Prevent toxic concentrations of chemicals.
 - 2. Prevent harmful dispersal of pollutants into the atmosphere.
 - 5. Use equipment during construction that conforms to current Federal, State, and local laws and regulations.
- 1.16 PEST AND RODENT CONTROL
 - 1. Provide rodent and pest control as necessary to prevent infestation of construction or storage areas.
 - 2. Employ methods and use materials which will not adversely affect conditions at the site or on adjoining properties.
- 1.17 NOISE CONTROL
 - 1. Provide vehicles, equipment, and construction activities that minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards and City Ordinances and in no case will noise levels be permitted which interfere with other work or create a nuisance in the surrounding residential neighborhoods.
 - 2. Conduct construction operations during daylight hours except as approved by Owner and Engineer.

3. Select construction equipment to operate with minimum noise and vibration. If in the opinion of the City, Owner or Engineer, objectionable noise or vibration is produced by equipment, rectify such conditions without additional cost to the Owner. The Sound Power Level (PWL) of any equipment shall not exceed 85 dbA (re: 10⁻¹² watts) measured 5 feet from the piece of equipment, or the levels prescribed by City Ordinances, whichever is lower Explicit equipment noise requirements are specified with equipment specifications.

1.18 DUST CONTROL

- 1. Control objectionable dust caused by operation of vehicles and equipment. Apply water or use other methods, subject to approval of the City, Owner and Engineer, which will control the amount of dust generated.
- 1.19 WATER RUNOFF AND EROSION CONTROL
 - 1. Where required, the Contractor shall comply with the National Pollutant Discharge Elimination system (NPDES) permit as stated in the Federal Register, Vol.57, and No.175.
 - 2. In addition to the NPDES requirements the Contractor shall:
 - 1. Provide methods to control surface water, runoff, subsurface water, and water from excavations and structures to prevent damage to the Work, the site, or adjoining properties.
 - 2. Control fill, grading and ditching to direct water away from excavations, pits, tunnels, and other construction areas; and to direct drainage to proper runoff courses so as to prevent any erosion, sedimentation or damage.
 - 3. Provide, operate, and maintain equipment and facilities of adequate size to control surface water.
 - 4. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site or to adjoining areas and in conformance with environmental requirements.
 - 5. Retain existing drainage patterns external to the construction site by constructing temporary earth berms, sedimentation basins, retaining areas, and temporary ground cover as needed to control conditions.
 - 6. Plan and execute construction and earthwork by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
 - 1. Keep to a minimum the area of bare soil exposed at one time.
 - 2. Provide temporary control measures, such as berms, dikes, and drains.

- 7. Construct fills and waste areas by selective placement to eliminate surface silts or clays which will erode.
- 8. Inspect earthwork periodically to detect any evidence of the start of erosion. Apply corrective measures as required to control erosion.
- PART 2 P R O D U C T S Not Used
- PART 3 E X E C U T I O N Not Used

END OF SECTION

Section 01 55 26 TRAFFIC CONTROL AND REGULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- 1. Requirements for signs, signals, control devices, flares, lights and traffic signals, as well as construction parking control, designated haul routes and bridging of trenches and excavations.
- 2. Requirement for and qualifications of flagmen.

1.02 SUBMITTALS

- 1. The contractor shall submit prior to the beginning of work a Traffic Control Plan responsive to the Texas Manual on Uniform Traffic Control Devices (TMUTCD) and sealed by a Registered Professional Engineer.
- 2. For both the traffic control plan and flagmen use, submit schedules of values within 30 days following the Notice to Proceed.
- 3. Make submittals in accordance with Section 01 33 00 Submittal Procedures.

1.03 UNIT PRICES

No payment will be made for Traffic Control and Regulation. Costs associated with this item are subsidiary to other items.

PART 2 PRODUCTS

- 2.01 SIGNS, SIGNALS, AND DEVICES
 - 1. Comply with Texas State Manual on Uniform Traffic Control Devices.
 - 2. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.

PART 3 EXECUTION

- 3.01 PUBLIC ROADS
 - 1. Abide by laws and regulations of governing authorities when using public roads. If the Contractor's work requires that public roads be temporarily impeded or closed, approvals shall be obtained from governing authorities and permits paid for before starting any work. Coordinate activities with the City, County, and Owner.

- 2. Contractor shall maintain at all times a 10-foot-wide all-weather lane adjacent to work areas which shall be kept free of construction equipment and debris and shall be for the use of emergency vehicles, or as otherwise provided in the traffic control plan.
- 3. Contractor shall not obstruct the normal flow of traffic from 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. on designated major arterials or as directed by the City and County.
- 4. Contractor shall maintain local driveway access to residential and commercial properties adjacent to work areas at all times.
- 5. Cleanliness of Surrounding Streets: Keep streets used for entering or leaving the job area free of excavated material, debris, and any foreign material resulting from construction operations.

3.02 CONSTRUCTION PARKING CONTROL

- 1. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and County and City's operations.
- 2. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.
- 3. Prevent parking on or adjacent to access roads or in non-designated areas.

3.03 FLARES AND LIGHTS

1. Provide flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.04 HAUL ROUTES

- 1. Utilize haul routes designated by authorities or shown on the Drawings for construction traffic.
- 2. Confine construction traffic to designated haul routes.
- 3. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

3.05 TRAFFIC SIGNS AND SIGNALS

- 1. Install traffic control devices at approaches to the site and on site, at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
- 2. Install and operate traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control and areas affected by Contractor's operations.

3. Relocate traffic signs and signals as Work progresses to maintain effective traffic control.

3.06 BRIDGING TRENCHES AND EXCAVATIONS

- 1. Whenever necessary, bridge trenches and excavation to permit an unobstructed flow of traffic.
- 2. Secure bridging against displacement by using adjustable cleats, angles, bolts or other devices whenever bridge is installed:
 - a. On an existing bus route;
 - b. When more than five percent of daily traffic is comprised of commercial or truck traffic;
 - c. When more than two separate plates are used for the bridge; or
 - d. When bridge is to be used for more than five consecutive days.
- 3. Install bridging to operate with minimum noise.
- 4. Adequately shore the trench or excavation to support bridge and traffic.
- 5. Extend steel plates used for bridging a minimum of one foot beyond edges of trench or excavation. Use temporary paving materials (premix) to feather edges of plates to minimize wheel impact on secured bridging.
- 6. Use steel plates of sufficient thickness to support H-20 loading truck or lane that produces maximum stress.
- 3.07 REMOVAL
 - 1. Remove equipment and devices when no longer required.
 - 2. Repair damage caused by installation.
 - 3. Remove post settings to a depth of 2 feet.

PART 4 PAYMENT

- 4.02 UNIT PRICES
 - A. Unless indicated in the Unit Prices Section (1.03) as a pay item, no separate payment will be made for work performed under this Section. Include cost of work performed under this Section in pay items of which this work is a component.

END OF SECTION

SECTION 01 57 23

STORM WATER POLLUTION CONTROL AND PREVENTION PLAN - TPDES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. This Section describes the required documentation to be prepared and signed by the Contractor before conducting construction operations, in accordance with the terms and conditions of the General Permit Number TXR150000 for discharges of storm water runoff from small construction sites.
- B. <u>The Contractor shall be responsible for providing and implementing a Storm Water</u> <u>Pollution Prevention Plan, prepared by and sealed by a registered professional engineer,</u> <u>for this project.</u>
- C. Contractor shall review implementation of the Storm Water Pollution Prevention Plan (SWPPP) in a meeting with the Owner and Engineer prior to start of construction.

1.02 LUMP SUM PRICE

A. Payment for this item shall be made on a lump sum basis and shall cover all costs associated with the preparation and submittal of the Storm Water Pollution Prevention Plan, prepared by a professional engineer registered in Texas, and submittal of all required forms including Notice of Intent to TCEQ, and any forms required by other governmental entities, payment of permit fees (if any), cost of implementation and maintenance of the storm water control measures as required throughout the project.

1.03 REFERENCES

- A. Part II.E.2. of TCEQ General Permit Number TXR150000.
- B. Part II.F.3 of TCEQ General Permit Number TXR150000 (notification of MS4 operator)
- PART 2 PRODUCTS As required by Storm Water Pollution Prevention Plan.
- PART 3 EXECUTION
- 3.01 SMALL CONSTRUCTION SITE NOTICE

A. The Contractor shall complete and sign the attached Small Construction Site Notice, and copies of the signed notice shall be submitted to TCEQ, the Owner, Engineer, City of Brownsville and shall be posted at the construction site, as specified.

3.02 STORM WATER POLLUTION PREVENTION PLAN

A. Contractor shall be responsible for implementation, maintenance, and inspection of storm water pollution prevention control measures including, but not limited to, erosion and sediment controls, storm water management plans, waste collection and disposal, off-site vehicle tracking, and other practices shown on the Storm Water Pollution Prevention Plan, or as specified by TCEQ or elsewhere in this or other Specifications.

3.03 RETENTION OF RECORDS

- A. The Contractor shall keep a copy of the Storm Water Pollution Prevention Plan at the construction site or at the Contractor's field office from the date that it became effective to the date of project completion.
- B. At project closeout, the Contractor shall submit to Owner all TPDES forms and certifications, as well as a copy of the SWPPP. Storm water pollution prevention records and data will be retained by Owner for a period of 3 years from the date of project completion.

3.04 REQUIRED NOTICES

- A. The following notices shall be posted from the date that this SWPPP goes into effect until the date of final site stabilization:
 - 1. Copies of the Small Construction Site Notice completed, signed and submitted by Contractor shall be posted at the construction site or at Contractor's office in a prominent place for public viewing.
 - 2. Notice to drivers of equipment and vehicles, instructing them to stop, check, and clean tires of debris and mud before driving onto traffic lanes. Post such notices at every stabilized construction exit area.
 - 3. In an easily visible location on site, post a notice of waste disposal procedures.
 - 4. If applicable, notice of hazardous material handling and emergency procedures shall be posted on site. Keep copies of Material Safety Data Sheets at a location on site that is known to all personnel.
 - 5. Keep a copy of each signed certification at the construction site or at Contractor's office.

END OF SECTION

SECTION 02 41 00

DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removing concrete paving, asphaltic concrete pavement, and base courses.
- B. Removing concrete curbs, concrete curbs and gutters, sidewalks and driveways.
- C. Removing pipe culverts and sewers.
- D. Removing existing inlets and manholes.
- E. Removing miscellaneous structures of concrete or masonry.
- 1.02 MEASUREMENT AND PAYMENT
 - A. Payment are based on a lump sum basis
- 1.03 REGULATORY REQUIREMENTS
 - A. Conform to applicable codes for disposal of debris.
 - B. Coordinate removal work with utility companies.
- PART 2 PRODUCTS Not Used
- PART 3 EXECUTION

3.01 PREPARATION

- A. Obtain advance approval from Public Works Director for dimensions and limits of removal work.
- B. Identify known utilities below grade. Stake and flag locations.

3.02 PROTECTION

- A. Protect the following from damage or displacement:
 - 1. Adjacent public and private property.
 - 2. Trees, plants, and other landscape features designated to remain.

Demolition

- 3. Utilities designated to remain.
- 4. Pavement and utility structures designated to remain.
- 5. Bench marks, monuments, and existing structures designated to remain.

3.03 REMOVALS

- A. Remove pavements and structures by methods that will not damage underground utilities. Do not use a drop hammer near existing underground utilities.
- B. Minimize amount of earth loaded during removal operations.
- C. Where existing pavement is to remain, make straight saw cuts in existing pavement to provide clean breaks prior to removal. Do not break concrete pavement or base with drop hammer unless concrete or base has been saw cut to a minimum depth of 2 inches.
- D. Where street and driveway saw cut locations coincide or fall within 3 feet of existing construction or expansion joints, break out to existing joint.
- E. Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint.
- F. Where existing end of pipe culvert or end of sewer is to remain, install an 8-inch-thick masonry plug in pipe end prior to backfill.

3.04 BACKFILL

A. Backfill of removal areas shall be in accordance with requirements of Section 31 23 16.16 - Excavation and Backfill for Structures.

3.05 DISPOSAL

- A. Inlet frames, grates and plates; and manhole frames and covers, may remain owner's property. Disposal shall be in accordance with local and state laws and the responsibility of the Contractor.
- B. Remove from the site debris resulting from work under this section in accordance with local and state laws and the responsibility of the Contractor.

END OF SECTION

Section 03 30 00

CAST-IN-PLACE CONCRETE CONCRETE FOR UTILITY CONSTRUCTION

PART 1 GENERAL

- 1.01 SECTION INCLUDES
 - A. Cast-in-place concrete work for utility construction or rehabilitation, such as slabs on grade, small vaults, site-cast bases for precast units, and in-place liners for manhole rehabilitation.
- 1.02 MEASUREMENT AND PAYMENT
 - A. Unit Prices.
 - 1. No payment will be made for concrete for utility construction under this Section. Include cost in applicable utility structure.

1.03 REFERENCES

- A. ACI 117 Standard Tolerances for Concrete Construction and Materials.
- B. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
- C. ACI 302.1R Guide for Concrete Floor and Slab Construction.
- D. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- E. ACI 308 Standard Practice for Curing Concrete.
- F. ACI 309R Guide for Consolidation of Concrete.
- G. ACI 311 Batch Plant Inspection and Field Testing of Ready Mixed Concrete.
- H. ACI 315 Manual of Standard Practice for Detailing Reinforced Concrete Structures.
- I. ACI 318 Building Code Requirements for Reinforced Concrete.
- J. ACI 544 Guide for Specifying, Mixing, Placing, and Finishing Steel Fiber Reinforced Concrete.
- K. ASTM A 82 Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

- L. ASTM A 185 Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
- M. ASTM A 615 Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- N. ASTM A 767 Standard Specifications for Zinc-coated (Galvanized) Bars for Concrete Reinforcement.
- O. ASTM A 775 Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- P. ASTM A 820 Steel Fibers for Fiber Reinforced Concrete.
- Q. ASTM A 884 Specification for Epoxy-coated Steel Wire and Welded Wire Fabric for Reinforcement.
- R. ASTM C 31 Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- S. ASTM C 33 Standard Specification for Concrete Aggregates.
- T. ASTM C 39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- U. ASTM C 42 Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- V. ASTM C 94 Standard Specification for Ready-Mixed Concrete.
- W. ASTM C 138 Standard Test Method for Unit Weight Yield and Air Content (Gravimetric) of Concrete.
- X. ASTM C 143 Standard Test Method for Slump of Hydraulic Cement Concrete.
- Y. ASTM C 150 Standard Specification for Portland Cement.
- Z. ASTM C 172 Standard Practice for Sampling Freshly Mixed Concrete.
- AA. ASTM C 173 Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.
- AB. ASTM C 231 Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- AC. ASTM C 260 Standard Specification for Air-Entraining Admixtures for Concrete.

- AD. ASTM C 309 Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.
- AE. ASTM C 494 Standard Specification for Chemical Admixtures for Concrete.
- AF. ASTM C 595 Standard Specification for Blended Hydraulic Cements.
- AG. ASTM C 685 Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
- AH. ASTM C 1017 Chemical Admixtures for Use in Producing Flowing Concrete.
- AI. ASTM C 1064 Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.
- AJ. ASTM C 1077 Standard Practice for Laboratory Testing of Concrete and Concrete Aggregate for Use in Construction and Criteria for Laboratory Evaluation.
- AK. ASTM D 638 Test Method for Tensile Properties of Plastics.
- AL. ASTM D 746 Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
- AM. ASTM D 747 Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.
- AN. CRSI MSP-1 Manual of Standard Practice.
- AO. CRSI Placing Reinforcing Bars.
- AP. Federal Specification SS-S-210A Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints
- AQ. NRMCA Concrete Plant Standards.
- 1.04 SUBMITTALS
 - A. Conform to Section 01 33 00 Submittal Procedures.
 - B. Submit proposed mix design and test data for each type and strength of concrete in the Work.
 - C. Submit laboratory reports prepared by an independent testing laboratory stating that materials used comply with requirements of this Section.
 - D. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for testing when required by the Engineer.

Cast-In-Place Concrete – Concrete for Utility Construction

- E. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Specification.
- F. When required on Drawings, submit shop drawings showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details, and other pertinent information.
- G. For waterstops, submit product information sufficient to indicate compliance with this Section, including manufacturer's descriptive literature and specifications.
- 1.06 HANDLING AND STORAGE
 - A. Cement: Store cement off of the ground in a well-ventilated, weatherproof building.
 - B. Aggregate: Prevent mixture of foreign materials with aggregate and preserve gradation of aggregate.
 - C. Reinforcing Steel: Store reinforcing steel to protect it from mechanical injury and formation of rust. Protect epoxy-coated steel from damage to the coating.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

- A. Cementitious Material:
 - 1. Portland Cement: ASTM C 150, Type II, unless the use of Type III is authorized by the Engineer; or ASTM C 595, Type IP. For concrete in contact with sewage use Type II cement.
 - 2. When aggregates are potentially reactive with alkalis in cement, use cement not exceeding 0.6 percent alkali content in the form of $Na_2O + 0.658K_2O$.
- B. Water: Clean, free from harmful amounts of oils, acids, alkalis, or other deleterious substances, and meeting requirements of ASTM C 94.
- C. Aggregate:
 - Coarse Aggregate: ASTM C 33. Unless otherwise indicated, use the following ASTM standard sizes: No. 357 or No. 467; No. 57 or No. 67, No. 7. Maximum size: Not larger than 1/5 of the narrowest dimension between sides of forms, nor larger than 3/4 of minimum clear spacing between reinforcing bars.
 - 2. Fine Aggregate: ASTM C 33.

Cast-In-Place Concrete – Concrete for Utility Construction

- 3. Determine the potential reactivity of fine and coarse aggregate in accordance with the Appendix to ASTM C 33.
- D. Air Entraining Admixtures: ASTM C 260.
- E. Chemical Admixtures:
 - 1. Water Reducers: ASTM C 494, Type A.
 - 2. Water Reducing Retarders: ASTM 494, Type D.
 - 3. High Range Water Reducers (Superplasticizers): ASTM C 494, Types F and G.
- F. Prohibited Admixtures: Admixtures containing calcium chloride, thiocyanate, or materials that contribute free chloride ions in excess of 0.1 percent by weight of cement.
- G. Reinforcing Steel:
 - 1. Use new billet steel bars conforming to ASTM A 615, ASTM A 767, or ASTM A 775, grade 40 or grade 60, as shown on Drawings. Use deformed bars except where smooth bars are specified. When placed in work, keep steel free of dirt, scale, loose or flaky rust, paint, oil or other harmful materials.
 - 2. Where shown, use welded wire fabric with wire conforming to ASTM A 185 or ASTM A 884. Supply the gauge and spacing shown, with longitudinal and transverse wires electrically welded together at points of intersection with welds strong enough not to be broken during handling or placing.
 - 3. Wire: ASTM A 82. Use 16-1/2 gauge minimum for tie wire, unless otherwise indicated.
- H. Fiber:
 - 1. Fibrillated Polypropylene Fiber:
 - a. Addition Rate: 1.5 pounds of fiber per cubic yard of concrete.
 - b. Physical Properties:
 - 1) Material: Polypropylene.
 - 2) Length: 1/2 inch or graded
 - 3) Specific Gravity: 0.9l.
 - c. Acceptable Manufacturer: W. R. Grace Company, Fibermesh, or approved equal.

- 2. Steel Fiber: Comply with applicable provisions of ACI 544 and ASTM A 820.
 - a. Ratio: 50 to 200 pounds of fiber per cubic yard of concrete.
 - b. Physical Properties
 - 1) Material: Steel.
 - 2) Aspect Ratio (for fiber lengths of 0.5 to 2.5 inch, length divided by diameter or equivalent diameter): 30:1 to 100:1.
 - 3) Specific Gravity: 7.8.
 - 4) Tensile Strength: 40-400 ksi.
 - 5) Young's Modulus: 29,000 ksi.
 - 6) Minimum Average Tensile Strength: 50,000 psi.
 - 7) Bending Requirements: Withstand bending around 0.125-inch diameter mandrel to an angle of 90 degrees, at temperatures not less than 60 degrees F, without breaking.
- I. Curing Compounds: Type 2 white-pigmented liquid membrane-forming compounds conforming to ASTM C 309.
- 2.02 FORMWORK MATERIALS
 - A. Lumber and Plywood: Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections which would affect strength or impair the finished surface of concrete. Use S4S lumber for facing or sheathing. Forms for bottoms of caps: At least 2-inch (nominal) lumber, or 3/4-inch form plywood backed adequately to prevent misalignment. For general use, provide lumber of 1-inch nominal thickness or form plywood of approved thickness.
 - B. Formwork for Exposed Concrete Indicated to Receive Rubbed Finish: Form or form-lining surfaces free of irregularities; plywood of 1/4-inch minimum thickness, preferably oiled at the mill.
 - C. Chamfer Strips and Similar Moldings: Redwood, cypress, or pine that will not split when nailed and which can be maintained to true line. Use mill-cut molding dressed on all faces.
 - D. Form Ties: Metal or fiberglass of approved type with tie holes not larger than 7/8 inch in diameter. Do not use wire ties or snap ties.
 - E. Metal Forms: Clean and in good condition, free from dents and rust, grease, or other foreign materials that tend to disfigure or discolor concrete in a gauge and condition capable of supporting concrete and construction loads without significant distortion. Countersink bolt and rivet heads on facing sides. Use only metal forms which present a smooth surface and which line up properly.

2.03 PRODUCTION METHODS

A. Use either ready-mixed concrete conforming to requirements of ASTM C 94, or concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685.

2.04 MEASUREMENT OF MATERIALS

- A. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C 685.
- B. Measure water and liquid admixtures by volume.

2.05 DESIGN MIX

- A. Use design mixes prepared by a certified testing laboratory in accordance with ASTM C 1077 and conforming to requirements of this section.
- B. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, Chapters 4 and 5, and this specification. Prepare mix design of Class A concrete so minimum cementitious content is 564 pounds per cubic yard. Submit concrete mix designs to the Engineer for review.
- C. Proportioning on the basis of field experience or trial mixtures in accordance with requirements at Section 5.3 of ACI 318 may be used, if approved by the Engineer.

Class	Түре	MINIMUM Compressive Strength (lbs/sq. in.)		Maximum W/C Ratio	AIR CONTENT (PERCENT)	CONSISTENCY RANGE IN SLUMP
		7-day	28-day			(INCHES)
А	Structural	3200	4000	0.45	4 <u>+</u> 1	2 to 4*
В	Pipe Block Fill, Thrust Block	2400	3000		4 <u>+</u> 1	5 to 7
*When ASTM C 494. Type F or Type G admixture is used to increase workability, this range may be 6 to 9.						

D. Classification:

- E. Add steel or polypropylene fibers only when called for on the Drawings or in another section of these Specifications.
- F. Determine air content in accordance with ASTM C 138, ASTM C 173 or ASTM C 231.
- G. Use of Concrete Classes: Use classes of concrete as indicated on the Drawings and other Specifications. Use Class B for non-reinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, and concrete fill unless indicated otherwise. Use Class A for all other applications.

2.06 PVC WATERSTOPS

- A. Extrude from virgin polyvinyl chloride elastomer. Use no reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that the material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.
- B. Flat Strip and Center-Bulb Waterstops:
 - 1. Thickness: not less than 3/8 inch
 - 2. Acceptable Manufacturers:
 - a. Kirkhill Rubber Co., Brea, California
 - b. Water Seals, Inc., Chicago, Illinois
 - c. Progress Unlimited, Inc., New York, New York
 - d. Greenstreak Plastic Products Co., St. Louis, Missouri
 - e. Approved equal.

2.07 RESILIENT WATERSTOP

- A. Resilient Waterstop: Where shown on the Drawings; either a bentonite- or adhesive-type material.
- B. Bentonite Waterstop:
 - 1. Material: 75 percent bentonite, mixed with butyl rubber-hydrocarbon containing less than 1.0 percent volatile matter, and free of asbestos fibers or asphaltics.
 - 2. Manufacturer's rated temperature ranges: For application, 5 to 125 degrees F; in service, -40 to 212 degrees F.
 - 3. Cross-sectional dimensions, unexpanded waterstop: 1 inch by 3/4 inch.
 - 4. Provide with adhesive backing capable of producing excellent adhesion to concrete surfaces.
- C. Adhesive Waterstop:
 - 1. Preformed plastic adhesive waterstop at least 2 inches in diameter.
 - 2. Meets or exceeds requirements of Federal Specification SS-S-210A.
 - 3. Supplied wrapped completely by a 2-part protective paper.

- 4. Submit independent laboratory tests verifying that the material seals joints in concrete against leakage when subjected to a minimum of 30 psi water pressure for at least 72 hours.
- 5. Provide primer, to be used on hardened concrete surfaces, from the same manufacturer who supplies the waterstop material.
- 6. Acceptable Manufacturer: Synko-Flex Preformed Plastic Adhesive Waterstop, Synko-Flex Products, Inc.; or approved equal.

PART 3 E X E C U T I O N

3.01 FORMS AND SHORING

- A. Provide mortar-tight forms sufficient in strength to prevent bulging between supports. Set and maintain forms to lines designated such that finished dimensions of structures are within the tolerances specified in ACI 117. Construct forms to permit removal without damage to concrete. Forms may be given slight draft to permit ease of removal. Provide adequate cleanout openings. Before placing concrete, remove extraneous matter from within forms.
- B. Install rigid shoring having no excessive settlement or deformation. Use sound timber in shoring centering. Shim to adjust and tighten shoring with hardwood timber wedges.
- C. Design Loads for Horizontal Surfaces of Forms and Shoring: Minimum fluid pressure, 175 pounds per cubic foot; live load, 50 pounds per square foot. Maximum unit stresses: 125 percent of allowable stresses used for form materials and for design of support structures.
- D. Back formwork with a sufficient number of studs and wales to prevent deflection.
- E. Re-oil or lacquer the liner on the job before using. Facing may be constructed of 3/4-inch plywood made with waterproof adhesive backed by adequate studs and wales. In such cases, form lining will not be required.
- F. Unless otherwise indicated, form outside corners and edges with triangular 3/4-inch chamfer strips (measured on sides).
- G. Remove metal form ties to depth of at least 3/4 inch from surface of concrete. Do not burn off ties. Do not use pipe spreaders. Remove spreaders which are separate from forms as concrete is being placed.
- H. Treat facing of forms with approved form coating before concrete is placed. When directed by Engineer, treat both sides of face forms with coating. Apply coating before reinforcement is placed. Immediately before the concrete is placed, wet surface of forms which will come in contact with concrete.

3.02 PLACING REINFORCEMENT

- A. Place reinforcing steel accurately in accordance with approved Drawings. Secure steel adequately in position in forms to prevent misalignment. Maintain reinforcing steel in place using approved concrete and hot-dip galvanized metal chairs and spacers. Place reinforcing steel in accordance with CRSI Publication "Placing Reinforcing Bars." Request inspection of reinforcing steel by the inspector and obtain acceptance before concrete is placed.
- B. Minimum spacing center-to-center of parallel bars: 2-1/2 times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar unless shown otherwise on the Drawings: 3 inches for surfaces cast against soil or subgrade, 2 inches for other surfaces.
- C. Detail bars in accordance with ACI 315. Fabricate reinforcing steel in accordance with CRSI Publication MSP-1, "Manual of Standard Practice." Bend reinforcing steel to required shape while steel is cold. Excessive irregularities in bending will be cause for rejection.
- D. Do not splice bars without written approval of the Engineer. Approved bar bending schedules or placing drawings constitute written approval. Splice and development length of bars shall conform to ACI 318, Chapters 7 and 12, and as shown on Drawings. Stagger splices or locate at points of low tensile stress.

3.03 EMBEDDED ITEMS

- A. Install conduit and piping as shown on Drawings. Accurately locate and securely fasten conduit, piping, and other embedded items in forms.
- B. Install waterstops as specified in other sections and according to manufacturer's instructions. Securely position waterstops at joints as indicated on Drawings. Protect waterstops from damage or displacement during concrete placing operations.

3.04 BATCHING, MIXING AND DELIVERY OF CONCRETE

- A. Measure, batch, mix, and deliver ready-mixed concrete in accordance with ASTM C 94, Sections 8 through 11. Produce ready-mixed concrete using an automatic batching system as described in NRMCA Concrete Plant Standards, Part 2 - Plant Control Systems.
- B. Measure, mix and deliver concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685, Sections 6 though 8.
- C. Maintain concrete workability without segregation of material and excessive bleeding. Obtain approval of the Engineer before adjustment and change of mix proportions.
- D. Ready-mixed concrete delivered to the site shall be accompanied by batch tickets providing the information required by ASTM C 94, Section 16. Concrete produced by continuous

mixing shall be accompanied by batch tickets providing the information required by ASTM C 685, Section 14.

- E. When adverse weather conditions affect quality of concrete, postpone concrete placement. Do not mix concrete when air temperature is at or below 40 degrees F and falling. Concrete may be mixed when temperature is 35 degrees F and rising. Take temperature readings in the shade, away from artificial heat. Protect concrete from temperatures below 32 degrees F until the concrete has cured for a minimum of 3 days at 70 degrees F or 5 days at 50 degrees F.
- F. Clean, maintain and operate equipment so that it thoroughly mixes material as required.
- G. Hand-mix only when approved by the Engineer.

3.05 PLACING CONCRETE

- A. Give sufficient advance notice to the Engineer (at least 24 hours prior to commencement of operations) to permit inspection of forms, reinforcing steel, embedded items and other preparations for placing concrete. Place no concrete prior to the Engineer's approval.
- B. Schedule concrete placing to permit completion of finishing operations in daylight hours. However, if necessary to continue after daylight hours, light the site as required. If rainfall occurs after placing operations are started, provide covering to protect the work.
- C. Use troughs, pipes and chutes lined with approved metal or synthetic material in placing concrete so that concrete ingredients are not separated. Keep chutes, troughs and pipes clean and free from coatings of hardened concrete. Allow no aluminum material to be in contact with concrete.
- D. Limit free fall of concrete to 4 feet. Do not deposit large quantities of concrete at one location so that running or working concrete along forms is required. Do not jar forms after concrete has taken an initial set; do not place any strain on projecting reinforcement or anchor bolts.
- E. Use tremies for placing concrete in walls and similar narrow or restricted locations. Use tremies made in sections, or provide in several lengths, so that outlet may be adjusted to proper height during placing operations.
- F. Place concrete in continuous horizontal layers approximately 12 inches thick. Place each layer while layer below is still plastic.
- G. Compact each layer of concrete with concrete spading implements and mechanical vibrators of approved type and adequate number for the size of placement. When immersion vibrators cannot be used, use form vibrators. Apply vibrators to concrete immediately after depositing. Move the vibrator vertically through the layer of concrete just placed and several inches into plastic layer below. Do not penetrate or disturb layers previously placed which have partially set. Do not use vibrators to aid lateral flow concrete. Closely supervise consolidation to ensure uniform insertion and duration of immersion.

H. Handling and Placing Concrete: Conform to ACI 302.1R, ACI 304R and ACI 309R.

3.06 WATERSTOPS

- A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for the extent of the joint; make splices necessary to provide such continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.
- B. Install waterstops in concrete on one side of joints, leaving other side exposed until the next pour. When a waterstop will remain exposed for 2 days or more, shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.
- C. Splicing PVC Waterstops:
 - 1. Splice waterstops by heat-sealing adjacent waterstop sections in accordance with the manufacturer's printed instructions.
 - 2. Butt end-to-end joints of two identical waterstop sections may be made in the forms during placement of waterstop material.
 - 3. Prior to placement in formwork, prefabricate waterstop joints involving more than two ends to be joined together, an angle cut, an alignment change, or the joining of two dissimilar waterstop sections, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon inspection and approval by the Engineer, install prefabricated waterstop joint assemblies in formwork, and butt-weld ends of the 24inch strips to the straight-run portions of waterstop in the forms.
- D. Setting PVC Waterstops:
 - 1. Correctly position waterstops during installation. Support and anchor waterstops during progress of the work to ensure proper embedment in concrete and to prevent folding over of the waterstop by concrete placement. Locate symmetrical halves of waterstops equally between concrete pours at joints, with center axis coincident with joint openings. Thoroughly work concrete in joint vicinity for maximum density and imperviousness.
 - 2. Where a waterstop in a vertical wall joint does not connect with any other waterstop, and is not intended to be connected to a waterstop in a future concrete placement, terminate the waterstop 6 inches below the top of the wall.
- E. Replacement of Defective Field Joints: Replace waterstop field joints showing evidence of misalignment, offset, porosity, cracks, bubbles, inadequate bond or other defects with products and joints complying to the Specifications.

F. Resilient Waterstop:

- 1. Install resilient waterstop in accordance with manufacturer's instructions and recommendations.
- 2. When requested by the Engineer, provide technical assistance by manufacturer's representative in the field at no additional cost to the Owner.
- 3. Use resilient waterstop only where complete confinement by concrete is provided; do not use in expansion or contraction joints.
- 4. Where resilient waterstop is used in combination with PVC waterstop, lap resilient waterstop over PVC waterstop a minimum of 6 inches and place in contact with the PVC waterstop. Where crossing PVC at right angles, melt PVC ribs to form a smooth joining surface.
- 5. At the free top of walls without connecting slabs, stop the resilient waterstop and grooves (where used) 6 inches from the top in vertical wall joints.
- 6. Bentonite Waterstop:
 - a. Locate bentonite waterstop as near as possible to the center of the joint and extend continuous around the entire joint. Minimum distance from edge of waterstop to face of member: 5 inches.
 - b. Where thickness of concrete member to be placed on bentonite waterstop is less than 12 inches, place waterstop in grooves at least 3/4 inch deep and 1-1/4 inches wide formed or ground into concrete. Minimum distance from edge of waterstop placed in groove to face of member: 2.5 inches.
 - c. Do not place bentonite waterstop when waterstop material temperature is below 40 degrees F. Waterstop material may be warmed so that it remains above 40 degrees F during placement but means used to warm it shall in no way harm the material or its properties. Do not install waterstop where air temperature falls outside manufacturer's recommended range.
 - d. Place bentonite waterstop only on smooth and uniform surfaces; grind concrete smooth if necessary to produce satisfactory substrate, or bond waterstop to irregular surfaces using an epoxy grout which completely fills voids and irregularities beneath the waterstop material. Prior to installation, wire brush the concrete surface to remove laitance and other substances that may interfere with bonding of epoxy.

- e. In addition to the adhesive backing provided with the waterstop, secure bentonite waterstop in place with concrete nails and washers at 12-inch maximum spacing.
- 7. Adhesive Waterstop:
 - a. With a wire brush thoroughly clean the concrete surface on which the waterstop is to be placed and then coat with primer.
 - b. If the surface is too rough to allow the waterstop to form a complete contact, grind to form an adequately smooth surface.
 - c. Install the waterstop with the top protective paper left in place. Overlap joints between strips a minimum of 1 inch and cover back over with protective paper.
 - d. Do not remove protective paper until just before final formwork completion. Concrete shall be placed immediately. The time that the waterstop material is uncovered prior to concrete placement shall be minimized and shall not exceed 24 hours.

3.07 CONSTRUCTION JOINTS

- A. Definitions:
 - 1. Construction joint: Contact surface between plastic (fresh) concrete and concrete that has attained initial set.
 - 2. Monolithic: Manner of concrete placement to reduce or eliminate construction joints; joints other than those indicated on Drawings will not be permitted without written approval of Engineer. Where so approved, make additional construction joints with details equivalent to those indicated for joints in similar locations.
 - 3. Preparation for Construction Joints: Roughen surface of concrete previously placed, leaving some aggregate particles exposed. Remove laitance and loose materials by sandblasting or high-pressure water blasting. Keep surface wet for several hours prior to placing of plastic concrete.

3.08 CURING

A. Comply with ACI 308. Cure by preventing loss of moisture, rapid temperature change and mechanical injury for a period of 7 curing days when Type II or IP cement has been used and for 3 curing days when Type III cement has been used. Start curing as soon as free water has disappeared from the concrete surface after placing and finishing. A curing day is any calendar day in which the temperature is above 50 degrees F for at least 19 hours. Colder days may be counted if air temperature adjacent to concrete is maintained above 50 degrees F. In continued cold weather, when artificial heat is not provided, removal of forms and shoring

may be permitted at the end of calendar days equal to twice the required number of curing days. However, leave soffit forms and shores in place until concrete has reached the specified 28-day strength, unless directed otherwise by the Engineer.

- B. Cure formed surfaces not requiring rubbed-finished surface by leaving forms in place for the full curing period. Keep wood forms wet during the curing period. Add water as needed for other types of forms. Or, at Contractor's option, forms may be removed after 2 days and curing compound applied.
- C. Rubbed Finish:
 - 1. At formed surfaces requiring rubbed finish, remove forms as soon as practicable without damaging the surface.
 - 2. After rubbed-finish operations are complete, continue curing formed surfaces by using either approved curing/sealing compounds or moist cotton mats until normal curing period is complete.
- D. Unformed Surfaces: Cure by membrane curing compound method.
 - 1. After concrete has received a final finish and surplus water sheen has disappeared, immediately seal surface with a uniform coating of approved curing compound, applied at the rate of coverage recommended by manufacturer or as directed by the Engineer. Do not apply less than 1 gallon per 180 square feet of area. Provide satisfactory means to properly control and check rate of application of the compound.
 - 2. Thoroughly agitate the compound during use and apply by means of approved mechanical power pressure sprayers equipped with atomizing nozzles. For application on small miscellaneous items, hand-powered spray equipment may be used. Prevent loss of compound between nozzle and concrete surface during spraying operations.
 - 3. Do not apply compound to a dry surface. If concrete surface has become dry, thoroughly moisten surface immediately prior to application. At locations where coating shows discontinuities, pinholes or other defects, or if rain falls on a newly coated surface before film has dried sufficiently to resist damage, apply an additional coat of compound at the specified rate of coverage.

3.09 REMOVAL OF FORMS AND SHORING

- A. Remove forms from surfaces requiring rubbing only as rapidly as rubbing operation progresses. Remove forms from vertical surfaces not requiring rubbed-finish when concrete has aged for the required number of curing days. When curing compound is used, do not remove forms before 2 days after concrete placement.
- B. Leave soffit forms and shores in place until concrete has reached the specified 28-day strength, unless directed otherwise by the Engineer.

3.10 DEFECTIVE WORK

A. Immediately repair any defective work discovered after forms have been removed. If concrete surface is bulged, uneven, or shows excess honeycombing or form marks which cannot be repaired satisfactorily through patching, remove and replace the entire section.

3.11 FINISHING

- A. Patch honeycomb, minor defects and form tie holes in concrete surfaces with cement mortar mixed one part cement to two parts fine aggregate. Repair defects by cutting out unsatisfactory material and replacing with new concrete, securely keyed and bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. Use a stiff mixture and thoroughly tamp into place. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off mortar flush with the surface.
- B. Apply a rubbed finish to exposed surfaces of formed concrete structures as noted on Drawings. After pointing has set sufficiently, wet the surface with a brush and perform first surface rubbing with No. 16 carborundum stone, or approved equal. Rub sufficiently to bring surface to paste, to remove form marks and projections, and to produce a smooth, dense surface. Add cement to form surface paste as necessary. Spread or brush material, which has been ground to paste, uniformly over surface and allow to reset. In preparation for final acceptance, clean surfaces and perform final finish rubbing with No. 30 carborundum stone or approved equal. After rubbing, allow paste on the surface to reset; then wash surface with clean water. Leave structure with a clean, neat and uniform-appearing finish.
- C. Apply a wood float finish to concrete slabs.

3.12 FIELD QUALITY CONTROL

- A. Testing shall be performed under provisions of Section 01 45 29 Testing Laboratory Services.
- B. Unless otherwise directed by Engineer, the following minimum testing of concrete is required. Testing shall be performed by qualified individuals employed by an approved independent testing agency, and conform to the requirements of ASTM C 1077.
 - 1. Take concrete samples in accordance with ASTM C 172.
 - 2. Make one set of four compression test specimens for each mix design at least once per day and for each 150 cubic yards or fraction thereof. Make, cure and test the specimens in accordance with ASTM C 31 and ASTM C 39.

- 3. When taking compression test specimens, test each sample for slump according to ASTM C 143, for temperature according to ASTM C 1064, for air content according to ASTM C 231, and for unit weight according to ASTM C 138.
- 4. Inspect, sample and test concrete in accordance with ASTM C 94, Section 13, 14, and 15, and ACI 311-5R.
- C. Test Cores: Conform to ASTM C 42.
- D. Testing High Early Strength Concrete: When Type III cement is used in concrete, the specified 7-day and 28-day compressive strengths shall be applicable at 3 and 7 days, respectively.
- E. If 7-day or 3-day test strengths (as applicable for type of cement being used) fail to meet established strength requirements, extended curing or resumed curing on those portions of structure represented by test specimens may be required. If additional curing fails to produce the required strength, strengthening or replacement of portions of structure which fail to develop required strength may be required by the Engineer, at no additional cost to the Owner.

3.13 **PROTECTION**

- A. Protect concrete against damage until final acceptance by the Owner.
- B. Protect fresh concrete from damage due to rain, hail, sleet, or snow. Provide such protection while the concrete is still plastic, and whenever such precipitation is imminent or occurring.
- C. Do not backfill around concrete structures or subject them to design loadings until components of the structure needed to resist the loading are complete and have reached the specified 28-day compressive strength, except as authorized otherwise by the Engineer.

END OF SECTION

Section 31 06 20.16

BACKFILL MATERIAL SCHEDULE UTILITY BACKFILL MATERIALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Material Classifications.
- B. Utility Backfill Materials: Concrete sand Gem sand Pea gravel Crushed stone Crushed concrete Bank run sand Select backfill Random backfill
- C. Material Handling and Quality Control Requirements.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. No payment will be made for backfill material under this Section. Include payment in unit price for applicable utility installation.
 - 2. Payment for backfill material, when included as a separate pay item, is on a cubic yard basis for material placed and compacted within theoretical trench width limits and thickness of material according to Drawings.
- B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.
- 1.03 DEFINITIONS
 - A. Unsuitable Material: Unsuitable soil materials are the following:
 - 1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

- 2. Materials that cannot be compacted to the required density because of either gradation, plasticity, or moisture content.
- 3. Materials that contain large clods, aggregate, and stones greater than 4 inches in any dimension; debris, vegetation, and waste; or any other deleterious materials.
- 4. Materials that are contaminated with hydrocarbons or other chemical contaminants.
- B. Suitable Material: Suitable soil materials are the following:
 - 1. Those meeting specification requirements.
 - 2. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement.
- C. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for the structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.
- D. Foundation Base: Crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. The foundation base provides a smooth, level working surface for the construction of the concrete foundation.
- E. Backfill Material: Classified soil material meeting specified quality requirements for the designated application as embedment or trench zone backfill.
- F. Embedment Material: Soil material placed under controlled conditions within the embedment zone extending vertically upward from top of foundation to an elevation 12 inches above top of pipe, and including pipe bedding, haunching, and initial backfill.
- G. Trench Zone Backfill: Classified soil material meeting specified quality requirements and placed under controlled conditions in the trench zone from top of embedment zone to base course in paved areas or to the surface grading material in unpaved areas.
- H. Foundation: Either suitable soil of the trench bottom, or material placed as backfill of overexcavation for removal and replacement of unsuitable or otherwise unstable soils.
- I. Source: A source selected by the Contractor for supply of embedment or trench zone backfill material. A selected source may be the project excavation, off-site borrow pits, commercial borrow pits, or sand and aggregate production or manufacturing plants.
- J. Refer to Section 31 23 33 Excavation and Backfill for Utilities for other definitions regarding utility installation by trench construction.

1.04	REFERENCES
A.	ASTM C 33 - Specification for Concrete Aggregate.
B.	ASTM C 40 - Test Method for Organic Impurities in Fine Aggregates for Concrete.
C.	ASTM C 123 - Test Method for Lightweight Pieces in Aggregate.
D.	ASTM C 131 - Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
E.	ASTM C 136 - Test Method for Sieve Analysis of Fine and Coarse Aggregates.
F.	ASTM C 142 - Test Method for Clay Lumps and Friable Particles in Aggregates.
G.	ASTM D 1140 - Test Method for Amount of Materials in Soils Finer Than No. 200 Sieve.
H.	ASTM D 2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).
I.	ASTM D 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
J.	ASTM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
K.	ASTM D 4643 - Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.
L.	TxDOT Tex-101-E - Preparation of Soil and Flexible Base Materials for Testing.
M.	TxDOT Tex-104-E - Test Method for Determination of Liquid Limit of Soils (Part 1)
N.	TxDOT Tex-106-E - Test Method - Methods of Calculating Plasticity Index of Soils.
О.	TxDOT Tex-110-E - Determination of Particle Size Analysis of Soils.
1.05	SUBMITTALS
A.	Conform to requirements of Section 01 33 00 - Submittal Procedures.

- B. Submit a description of source, material classification and product description, production method, and application of backfill materials.
- C. Submit test results for samples of off-site backfill materials to comply with Materials Testing.

- D. Before stockpiling materials, submit a copy of temporary easement or approval from landowner for stockpiling backfill material on private property.
- E. For each delivery of material, provide a delivery ticket which includes source location.

1.06 TESTS

- A. Perform tests of sources for backfill material in accordance with Paragraph 2.03B.
- B. Verification tests of backfill materials may be performed by the Owner in accordance with Section 01 45 29 Testing Laboratory Services.
- C. Random fill obtained from the project excavation as source is exempt from pre-qualification requirements by Contractor but must be inspected by the testing lab for unacceptable materials based on ASTM D 2488.

PART 2 P R O D U C T S

2.01 MATERIAL CLASSIFICATIONS

- A. Materials for backfill shall be classified for the purpose of quality control in accordance with the Unified Soil Classification Symbols as defined in ASTM D 2487. Material use and application is defined in utility installation specifications and Drawings either by class, as described in Paragraph 2.01B, or by product descriptions, as given in Paragraph 2.02.
- B. Class Designations Based on Laboratory Testing:
 - 1. Class I: Well-graded gravels and sands, gravel-sand mixtures, crushed well-graded rock, little or no fines (GW, SW):
 - a. Plasticity index: nonplastic.
 - b. Gradation: D_{60}/D_{10} greater than 4 percent; amount passing No. 200 sieve less than or equal to 5 percent.
 - 2. Class II: Poorly graded gravels and sands, silty gravels and sands, little to moderate fines:
 - a. Plasticity index: nonplastic to 4.
 - b. Gradations:
 - 1) Gradation (GP, SP): amount passing No. 200 sieve less than 5 percent.
 - 2) Gradation (GM, SM): amount passing No. 200 sieve between 12 percent and 50 percent.
 - 3) Borderline gradations with dual classifications (e.g., SP-SM): amount passing No. 200 sieve between 5 percent and 12 percent.

- 3. Class III: Clayey gravels and sands, poorly graded mixtures of gravel, sand, silt, and clay (GC, SC, and dual classifications, e.g., SP-SC):
 - a. Plasticity index: greater than 7.
 - b. Gradation: amount passing No. 200 sieve between 12 percent and 50 percent.
- 4. Class IVA: Lean clays (CL).
 - a. Plasticity Indexes:
 - 1) Plasticity index: greater than 7, and above A line.
 - 2) Borderline plasticity with dual classifications (CL-ML): PI between 4 and 7.
 - b. Liquid limit: less than 50.
 - c. Gradation: amount passing No. 200 sieve greater than 50 percent.
 - d. Inorganic.
- 5. Class IVB: Fat clays (CH)
 - a. Plasticity index: above A line.
 - b. Liquid limit: 50 or greater.
 - c. Gradation: amount passing No. 200 sieve greater than 50 percent.
 - d. Inorganic.
- 6. Use soils with dual class designation according to ASTM D 2487, and which are not defined above, according to the more restrictive class.

2.02 PRODUCT DESCRIPTIONS

- A. Soils classified as silt (ML), elastic silt (MH), organic clay and organic silt (OL, OH), and organic matter (PT) are not acceptable as backfill materials. These soils may be used for site grading and restoration in unimproved areas as approved by the Owner. Soils in Class IVB, fat clay (CH) may be used as backfill materials where allowed by the applicable backfill installation specification. Refer to Section 02317 Excavation and Backfill for Utilities.
- B. Provide backfill material that is free of stones greater than 6 inches, free of roots, waste, debris, trash, organic material, unstable material, non-soil matter, hydrocarbon or other contamination, conforming to the following limits for deleterious materials:
 - 1. Clay lumps: Less than 0.5 percent for Class I, and less than 2.0 percent for Class II, when tested in accordance with ASTM C 142.
 - 2. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C 123.
- 3. Organic impurities: No color darker than standard color when tested in accordance with ASTM C 40.
- C. Manufactured materials, such as crushed concrete, may be substituted for natural soil or rock products where indicated in the product specification, and approved by the Engineer, provided that the physical property criteria are determined to be satisfactory by testing.
- D. Bank Run Sand: Durable bank run sand classified as SP, SW, or SM by the Unified Soil Classification System (ASTM D 2487) meeting the following requirements:
 - 1. Less than 15 percent passing the number 200 sieve when tested in accordance with ASTM D 1140. The amount of clay lumps or balls not exceeding 2 percent.
 - 2. Material passing the number 40 sieve shall meet the following requirements when tested in accordance with ASTM D 4318:
 - a. Liquid limit: not exceeding 25 percent.
 - b. Plasticity index: not exceeding 7.
- E. Concrete Sand: Natural sand, manufactured sand, or a combination of natural and manufactured sand conforming to the requirements of ASTM C 33 and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing	
3/8"	100	
No. 4	95 to 100	
No. 8	80 to 100	
No. 16	50 to 85	
No. 30	25 to 60	
No. 50	10 to 30	
No. 100	2 to 10	

F. Gem Sand: Sand conforming to the requirements of ASTM C 33 for course aggregates specified for number 8 size and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing	
3/8"	95 to 100	
No. 4	60 to 80	
No. 8	15 to 40	

G. Pea Gravel: Durable particles composed of small, smooth, rounded stones or pebbles and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing	
1/2"	100	
3/8"	85 to 100	
No. 4	10 to 30	
No. 8	0 to10	
No. 16	0 to 5	

- H. Crushed Aggregates: Crushed aggregates consist of durable particles obtained from an approved source and meeting the following requirements:
 - 1. Materials of one product delivered for the same construction activity from a single source.
 - 2. Non-plastic fines.
 - 3. Los Angeles abrasion test not exceeding 45 percent when tested in accordance with ASTM C 131.
 - 4. Crushed aggregate shall have a minimum of 90 percent of the particles retained on the No. 4 sieve with 2 or more crushed faces as determined by Test Method Tex-460-A, Part I.
 - 5. Crushed stone: Produced from oversize plant processed stone or gravel, sized by crushing to predominantly angular particles from a naturally occurring single source. Uncrushed gravel is not acceptable material for embedment where crushed stone is shown on the applicable utility embedment drawing details.
 - 6. Crushed Concrete: Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Gradation and quality control test requirements are the same as crushed stone. Provide crushed concrete produced from normal weight concrete of uniform quality; containing particles of aggregate and cement material, free from other substances such as asphalt, reinforcing steel fragments, soil, waste gypsum (calcium sulfate), or debris.

Sieve	Percent Passing by Weight for Pipe Embedment by Ranges of Nominal Pipes Sizes		
	>15"	15" - 8"	<8"
1"	95 - 100	100	-
3/4"	60 - 90	90 - 100	100
1/2"	25 - 60	-	90 - 100
3/8"	-	20 - 55	40 - 70
No. 4	0 - 5	0 - 10	0 - 15
No. 8	-	0 - 5	0 - 5

7. Gradations, as determined in accordance with Tex-110-E.

- I. Select Backfill: Class III clayey gravel or sand or Class IV lean clay with a plasticity index between 7 and 20 or clayey soils treated with lime in accordance with Section 31 32 13.19 Lime Treatment for Subgrade, to meet plasticity criteria.
- J. Random Backfill: Any suitable soil or mixture of soils within Classes I, II, III and IV; or fat clay (CH) where allowed by the applicable backfill installation specification. Refer to Section 31 23 16.16 - Excavation and Backfill for Structures and Section 31 23 33 - Excavation and Backfill for Utilities.
- K. Cement Stabilized Sand: Conform to requirements of Section 31 32 13.16 Cement Stabilized Sand.
- L. Concrete Backfill: Conform to Class B concrete as specified in Section 33 05 16 Concrete for Utility Construction.
- 2.03 MATERIAL TESTING
 - A. Ensure that material selected, produced and delivered to the project meets applicable specifications and is of sufficient uniform properties to allow practical construction and quality control.
 - B. Source or Supplier Qualification. Perform testing, or obtain representative tests by suppliers, for selection of material sources and products. Provide test results for a minimum of three samples for each source and material type. Test samples of processed materials from current production representing material to be delivered. Tests shall verify that the materials meet specification requirements. Repeat qualification test procedures each time the source characteristic changes or there is a planned change in source location or supplier. Qualification tests shall include, as applicable:

- 1. Gradation. Complete sieve analyses shall be reported regardless of the specified control sieves. The range of sieves shall be from the largest particle through the No. 200 sieve.
- 2. Plasticity of material passing the No. 40 sieve.
- 3. Los Angeles abrasion test of material retained on the No. 4 sieve.
- 4. Clay lumps.
- 5. Lightweight pieces
- 6. Organic impurities
- C. Production Testing. Provide reports to the Owner and the Engineer from an independent testing laboratory that backfill materials to be placed in the Work meet applicable specification requirements.
- D. Assist the Owner and Testing Lab in obtaining material samples for verification testing at the source or at the production plant.

PART 3 E X E C U T I O N

3.01 SOURCES

- A. Use of material encountered in the trench excavations is acceptable, provided applicable specification requirements are satisfied. If excavation material is not acceptable, provide from other approved source.
- B. Identify off-site sources for backfill materials at least 14 days ahead of intended use so that the Owner or Lab may obtain samples for verification testing.
- C. Obtain approval for each material source by the Engineer before delivery is started. If sources previously approved do not produce uniform and satisfactory products, furnish materials from other approved sources. Materials may be subjected to inspection or additional verification testing after delivery. Materials which do not meet the specifications will be rejected. Do not use material which, after approval, has become unsuitable for use due to segregation, mixing with other materials, or by contamination. Once a material is approved by the Owner, expense for sampling and testing required to change to a different material will be credited to the Owner through a change order.
- D. Bank run sand, select backfill, and random backfill, if available in the project excavation, may be obtained by selective excavation and acceptance testing. Obtain additional quantities of these materials and other materials required to complete the work from off-site sources.

E. The Owner does not represent or guarantee that any soil found in the excavation work will be suitable and acceptable as backfill material.

3.02 MATERIAL HANDLING

- A. When backfill material is obtained from either a commercial or non-commercial borrow pit, open the pit to expose the vertical faces of the various strata for identification and selection of approved material to be used. Excavate the selected material by vertical cuts extending through the exposed strata to achieve uniformity in the product.
- B. Establish temporary stockpile locations for practical material handling and control, and verification testing by the Owner in advance of final placement. Obtain approval from landowner for storage of backfill material on adjacent private property.
- C. When stockpiling backfill material near the project site, use appropriate covers to eliminate blowing of materials into adjacent areas and prevent runoff containing sediments from entering the drainage system.
- D. Place stockpiles in layers to avoid segregation of processed materials. Load material by making successive vertical cuts through entire depth of stockpile.

3.03 FIELD QUALITY CONTROL

- A. Quality Control
 - 1. The Owner or Engineer may sample and test backfill at:
 - a. Sources including borrow pits, production plants and Contractor's designated off-site stockpiles.
 - b. On-site stockpiles.
 - c. Materials placed in the Work.
 - 2. The Owner or Engineer may resample material at any stage of work or location if changes in characteristics are apparent.
- B. Production Verification Testing: The Owner's testing laboratory will provide verification testing on backfill materials, as directed by the Engineer. Samples may be taken at the source or at the production plant, as applicable.

Section 31 10 00

SITE CLEARING - PREPARATION OF SITE

PART 1 GENERAL

1.01 SECTION INCLUDES

This Item shall govern for the preparation of the site for construction operations by the removal and disposal of all obstructions, including obstructions not otherwise shown on the plans and specifications.

Such obstructions shall be considered to include remains of houses, foundations, floor slabs, concrete, brick, lumber, plaster, septic tank drain fields, basements, abandoned utility pipes or conduits, equipment, fences, retaining walls, outhouses and shacks.

This Item shall also include the removal of trees and shrubs and other landscape features not designated for preservation, stumps, brush, roots, vegetation, logs, curb and gutter, driveways, paved parking areas, miscellaneous stone, sidewalks, drainage structures, manholes, inlets, abandoned railroad tracks, scrap iron and debris, whether above or below ground except live utility facilities.

1.02 MEASUREMENT AND PAYMENT

A. As prescribed elsewhere in the Contract Documents.

PART 2 E X E C U T I O N

2.01 PREPARATION

- A. All areas, as shown on the plans, shall be cleared of all structures and obstructions as defined above. Those trees, shrubs and other landscape features specifically designated by the Engineer for preservation shall be carefully protected from abuse, marring, or damage during construction operations. Continual parking and/or servicing of equipment under the branches of trees marked for preservation will not be permitted. When trees and shrubs are designated for preservation and require pruning, they shall be trimmed as directed by the Engineer and all exposed cuts over 2 inches in diameter shall be treated with a material approved by the Engineer.
- B. Culverts, storm sewers, manholes and inlets shall be removed in proper sequence for maintenance of traffic and drainage.

- C. Underground obstructions, except those items designated for preservation, shall be removed to the following depths:
 - (a) In areas to receive embankment: 2 feet below natural ground, except when permitted by the plans, trees and stumps may be cut off as close to natural ground as practicable on areas which are to be covered by at least three feet of embankment.
 - (b) In areas to be excavated: 2 feet below the lower elevation of the excavation.
 - (c) All other areas: 1 foot below natural ground.

2.02 DISPOSAL

- A Unless otherwise instructed by Owner or Engineer, all brush from existing trees and vegetation cleared on project site shall be collected and neatly stored on-site, in an area designated by Owner (for mulching and reuse).
- B. Contractor shall remove all debris, rock, trash and other material deemed objectionable by Owner or Engineer. Disposal shall be off-site shall be at contractor's sole expanse.
- C. Unless otherwise shown herein, all materials and debris removed shall become the property of the Contractor and shall be removed from the project site in a manner satisfactory to Owner and Engineer.
- D. No timber shall be cut or defaced outside of the areas identified for clearing and demolition.

2.03 BACKFILL

- A. Holes remaining after removal of all obstructions, objectionable material, trees, stumps, etc., shall be backfilled with approved material, compacted and restored to approximately its original contours by blading, bulldozing, or by other methods, as approved by the Engineer. In areas to be immediately excavated, the backfilling of holes may not be required when approved by the Engineer.
- B. Before backfilling, the remaining ends of all abandoned storm sewers, culverts, sanitary sewers, conduits, and water or gas pipes over 3 inches in diameter, shall be plugged with an adequate quantity of concrete to form a tight closure.

Section 31 23 00

EARTHWORK, EXCAVATION, FILL AND GRADING

PART 1 GENERAL

- 1.01 This section shall cover earthwork, including general clearing, removal, disposal or reutilization of all excavated earthen materials necessary and placement of imported fill material for performing the Work as shown on the drawings, including sheeting and bracing, drainage, and other Work incidental to the preparation of the site for subsequent construction Work.
- 1.02 Prior to commencing construction operations, the contractor shall make all the provisions necessary to assure the protection of all existing improvements, both public and private. Where identified, he shall protect trees, shrubs, planting and grass areas and shall make provisions for maintaining public travel in an acceptable manner.
- 1.03 PROTECTION OF EXISTING IMPROVEMENTS. Before any excavation is started, adequate protection shall be provided for all lawns, trees, shrubs, landscape work, fences, sidewalks, hydrants, utility poles, street, alley and driveway paving, curbs, storm sewers, ditches, headwalls, catch basins, surface inlets and all other improvements that are to remain in place. Such protection shall be provided as long as necessary to prevent damage from the CONTRACTOR's operations. Shrubs, bushes, small trees and flowers, which have to be removed to permit excavation for the waterline, shall be protected and replanted or replaced when the backfill is completed. The CONTRACTOR shall exercise every precaution to prevent damage to property within and outside easements.
- 1.04 Any damage to driveways, buildings, fences, retaining walls, culverts, drains, pavings, sidewalks, etc. which are removed or damaged during construction shall be repaired by contractor. Repair, restoration or replacements of any improvements damaged or removed shall be the obligation of the contractor at no additional cost to Owner.
- 1.05 Contractor will obtain all necessary permits in public and private rights-of-way from the City of Brownsville, or any other local regulatory authority, as required
- 1.06 Drainage: Contractor shall make provisions for temporarily handling runoff on site, flows in existing creeks, ditches, sewers, and trenches by employing pipes, flumes, or other approved methods at all times when his operations would, in any way, interfere with the natural functioning of said creeks, ditches, sewers and drains. The contractor shall at all times during construction provide and maintain sufficient equipment for the lawful disposal of all ponding water, or water which enters excavations, to render such area firm and dry through the construction phase.
- 1.07 It shall be the responsibility of the Bidder and/or Contractor to determine by a careful study of the plans and field conditions the quantities of excavation and imported fill required to bring the ground to the correct elevation.

PART 2 PRODUCTS

- 2.01 Excavated Material: Contractor will utilize all of the excess excavated soil material that is not deemed objectionable unless otherwise instructed. All material will be placed, spread, compacted to lines and grades shown on plans or as directed by Engineer
- 2.02 Imported Fill: <u>Select Backfill</u> is acceptable as follows Class III clayey gravel or sand or Class IV lean clay with a plasticity index between 7 and 20. For pavement subgrade, select fill will serve as an equal to soil treated with lime in accordance with Section 31 32 13.19 Lime Treatment for Subgrade, to meet plasticity criteria.
- 2.03 Imported Fill: <u>Random Backfill</u> is acceptable as follows Any suitable soil or mixture of soils within Classes I, II, III and IV; or fat clay (CH) where allowed by the applicable fill or backfill installation specification. Refer to Section 31 23 16.16 Excavation and Backfill for Structures and Section 31 23 33 Excavation and Backfill for Utilities. If Random backfill is to be used for pavement subgrade, it shall be treated with lime in accordance with Section 31 32 13.19 Lime Treatment for Subgrade, to meet plasticity criteria.

PART 3 E X E C U T I O N

2.01 DISPOSAL OF EXCAVATED MATERIAL

A. Contractor will utilize all of the excess excavated material, unless otherwise instructed. In such event, Contractor shall dispose of material off site at no cost to Owner. All material will be graded and compacted as shown on plans or as directed by Engineer.

2.02 DESCRIPTION

A. Work shall consist of the required excavation and placement of excavated materials, and the placement and compaction of imported fill material, within the limits of the site as shown on the plans. The proper utilization of all excavated and imported fill material and the construction shaping and finishing of all earth work on the entire length of pavement, and all other areas within the site will be done in conformity with the required lines, grades, and typical cross sections in accordance with specification requirements herein outlined.

2.03 CONSTRUCTION METHODS

- A. All excavation and corresponding embankment construction shall be performed as specified herein and in the design plans, and the completed site shall conform to the established alignment, grades and cross sections.
- B. When using either excavated material or imported soil material to perform fill or grading operations, each lift shall be mechanically compacted in 6" (six inch) layers to a minimum density of 90% Standard Proctor, for general areas. Engineer may select random areas for density testing to confirm minimum compaction. In areas of street construction (subgrade) minimum density shall be 95%. For backfill of utilities (trenches) or structures, minimum density shall be as prescribed in the applicable specifications, or on the plans.

SECTION 31 23 16.13

TRENCH SAFETY SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

- 1. Trench safety system for the construction of trench excavations.
- 2. Trench safety system for structural excavations which fall under provisions of State and Federal trench safety laws.
- 1.2 DELETED

1.3 DEFINITIONS

- 1. A trench shall be defined as a narrow excavation (in relation to its depth) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet.
- 2. The trench safety system requirements will apply to larger open excavations if the erection of structures or other installations limits the space between the excavation slope and these installation to dimensions equivalent of a trench as defined.
- 3. Trench Safety Systems include but are not limited to sloping, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering or diversion of water to provide adequate drainage.

1.04 SUBMITTALS

- A. Submittals shall conform to requirements of Section 01 33 00 Submittal Procedures.
- B. Submit a safety program specifically for the construction of trench excavation. Design the trench safety program to be in accordance with OSHA 29CFR standards governing the presence and activities of individuals working in and around trench excavations.

- C. Construction and shop drawings containing deviations from OSHA standards or special designs shall be sealed by a licensed Engineer retained and paid by the Contractor.
- D. Review of the safety program by the City or Engineer will only be in regard to compliance with this specification and will not constitute approval by the City Engineer nor relieve Contractor of obligations under State and Federal trench safety laws.

1.05 REGULATORY REQUIREMENTS

- A. Install and maintain trench safety systems in accordance with the detail specifications set out in the provision of Excavations, Trenching, and Shoring, Federal Occupation Safety and Health Administration (OSHA) Standards, 29CFR, Part 1926, Subpart P, as amended, including Final Rule, published in the Federal Register Vol. 54, No. 209 on Tuesday, October 31, 1989. The sections that are incorporated into these specifications by reference include Sections 1926-650 through 1926-652.
- B. A reproduction of the OSHA standards included in "Subpart P Excavations" from the Federal Register Vol. 54, No. 209 is available upon request to Contractors bidding on City projects. The City assumes no responsibility for the accuracy of the reproduction. The Contractor is responsible for obtaining a copy of this section of the Federal Register.
- C. Legislation that has been enacted by the Texas Legislature with regard to Trench Safety Systems, is hereby incorporated, by reference, into these specifications. Refer to Texas Health and Safety Code Ann., §756.021 (Vernon 1991).

1.06 INDEMNIFICATION

- A. Contractor shall indemnify and hold harmless the City, its employees and agents, from any and all damages, costs (including, without limitation, legal fees, court costs, and the cost of investigation), judgements or claims by anyone for injury or death of persons resulting from the collapse or failure of trenches constructed under this Contract.
- B. Contractor acknowledges and agrees that this indemnity provision provides indemnity for the City in case the City is negligent either by act or omission in providing for trench safety, including, but not limited to safety program and design reviews, inspections, failures to issue stop work orders, and the hiring of the Contractor.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

1.4 INSTALLATION

- 1. Install and maintain trench safety systems in accordance with provisions of OSHA 29CFR.
- 2. Install specially designed trench safety systems in accordance with the Contractor's trench excavation safety program for the locations and conditions identified in the program.
- 3. A competent person, as identified in the Contractor's Trench Safety Program, shall verify that trench boxes and other pre-manufactured systems are certified for the actual installation conditions.

1.5 INSPECTION

- 1. Contractor, or Contractor's independently retained consultant, shall make daily inspections of the trench safety systems to ensure that the installed systems and operations meet OSHA 29CFR and other personnel protection regulations requirements.
- 2. If evidence of possible cave-ins or slides is apparent, Contractor shall immediately stop work in the trench and move personnel to safe locations until the necessary precautions have been taken by Contractor to safeguard personnel entering the trench.
- 3. Maintain a permanent record of daily inspections.

1.6 FIELD QUALITY CONTROL

1. Contractor shall verify specific applicability of the selected or specially designed trench safety systems to each field condition encountered on the project.

SECTION 31 23 16.16

EXCAVATION AND BACKFILL FOR MINOR STRUCTURES

PART 1 GENERAL

- 1.01 SECTION INCLUDES
 - A. Excavation, backfilling, and compaction of backfill for structures.
- 1.02 MEASUREMENT AND PAYMENT
 - A. Unit Prices.
 - 1. No payment will be made for structural excavation and backfill under this Section. Include payment in unit price or lump sum for construction of structures.
- 1.03 DEFINITIONS
 - A. Unsuitable Material: Unsuitable soil materials are the following:
 - 1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
 - 2. Materials that cannot be compacted to the required density due to either gradation, plasticity, or moisture content.
 - 3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.
 - 4. Materials that are contaminated with hydrocarbons or other chemical contaminants.
 - B. Suitable Material: Suitable soil materials are those meeting specification requirements. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement shall be considered suitable, unless otherwise indicated.
 - C. Select Material: Material as defined in Section 31 06 20.16 Utility Backfill Materials.
 - D. Backfill: Select material meeting specified quality requirements, placed and compacted under controlled conditions around structures.
 - E. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for the structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.

- F. Foundation Base: For foundation base material, use crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. The foundation base provides a smooth, level working surface for the construction of the concrete foundation.
- G. Foundation Subgrade: Foundation subgrade is the surface of the natural soil which has been excavated and prepared to support the foundation base or foundation backfill, where needed.
- H. Ground Water Control Systems: Installations external to the excavation such as well points, eductors, or deep wells. Ground water control includes dewatering to lower the ground water, intercepting seepage which would otherwise emerge from the side or bottom of the excavation, and depressurization to prevent failure or heaving of the excavation bottom. Refer to Section 31 23 19 Control of Ground Water and Surface Water.
- I. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from the excavation. Remove rain water and surface water which accidentally enters the excavation as a part of excavation drainage.
- J. Excavation Drainage: Removal of surface and seepage water in the excavation by sump pumping and using French drains surrounding the foundation to intercept the water.
- K. Over-Excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below the foundation as shown on Drawings, and backfilled with foundation backfill material.
- L. Shoring System: A structure that supports the sides of an excavation to maintain stable soil conditions and prevent cave-ins.
- 1.04 REFERENCES
 - A. ASTM D 558 Test Methods for Moisture-Density Relations of Soil Cement Mixtures.
 - B. ASTM D 698 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49-kg) Rammer and 12-in. (304.88-mm) Drop.
 - C. ASTM D 1556 Density of Soil in Place by the Sand-Cone Method.
 - D. ASTM D 2487 Classification of Soils for Engineering Purposes.
 - E. ASTM D 2922 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - F. ASTM D 3017 Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depths).
 - G. ASTM D 4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - H. TxDOT Tex-101-E Preparation of Soil and Flexible Base Materials for Testing.

- I. TxDOT Tex-110-E Determination of Particle Size Analysis of Soils.
- J. Federal Regulations, 29 CFR, Part 1926, Standards Excavation, Occupational Safety and Health Administration (OSHA).
- 1.05 SUBMITTALS
 - A. Conform to requirements of Section 01 33 00 Submittal Procedures.
 - B. Submit a work plan for excavation and backfill for each structure with complete written description which identifies details of the proposed method of construction and the sequence of operations for construction relative to excavation and backfill activities. The descriptions, with supporting illustrations, shall be sufficiently detailed to demonstrate to the Entity that the procedures meet the requirements of the Specifications and Drawings.
 - C. Submit excavation safety system plan.
 - 1. The excavation safety system plan shall be in accordance with applicable OSHA requirements for all excavations.
 - 2. The excavation safety system plan shall be in accordance with the requirements of Section 31 23 16.13 Trench Safety System, for all excavations that fall under State and Federal trench safety laws.
 - D. Submit a ground and surface water control plan in accordance with requirements in this Section and Section 31 23 19 Control of Ground Water and Surface Water.
 - E. Submit backfill material sources and product quality information in accordance with requirements of Section 31 06 20.16 Utility Backfill Materials.
- 1.06 TESTS
 - A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by the Owner in accordance with requirements of Section 01 45 29 Testing Laboratory Services and as specified in this Section.
 - B. Contractor shall perform embedment and backfill material source qualification testing in accordance with requirements of Section 31 06 20.16 Utility Backfill Materials.

PART 2 PRODUCTS

2.01 EQUIPMENT

- A. Perform excavation with equipment suitable for achieving the requirements of this Specification.
- B. Use equipment which will produce the degree of compaction specified. Backfill within 3 feet of walls shall be compacted with hand operated equipment. Do not use equipment weighing more than 10,000 pounds closer to walls than a horizontal distance equal to the depth of the fill at that time. Use hand operated power compaction equipment where use of heavier equipment is impractical or restricted due to weight limitations.

2.02 MATERIAL CLASSIFICATIONS

A. Backfill materials shall conform to the classifications and product descriptions of Section 31 06 20.16 - Utility Backfill Materials. The classification or product description for backfill applications shall be as shown on the Drawings and as specified.

PART 3 E X E C U T I O N

3.01 PREPARATION

- A. Conduct an inspection to determine condition of existing structures and other permanent installations.
- B. Set up necessary street detours and barricades in preparation for excavation if construction will affect traffic. Conform to State and local government requirements. Maintain barricades and warning devices at all times for streets and intersections where work is in progress, or where affected by the Work, and is considered hazardous to traffic movements.
- C. Perform work in accordance with OSHA standards. Employ an excavation safety system as specified in Section 31 23 16.13 Trench Safety Systems.
- D. Remove existing pavements and structures, including sidewalks and driveways, in accordance with requirements of Section 02200 Removing Existing Pavements and Structures.
- E. Install and operate necessary dewatering and surface water control measures in accordance with requirements of Section 31 23 19 Control of Ground Water and Surface Water.

3.02 PROTECTION

- A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within the grading limits as designated on the Drawings.
- B. Protect and support above-grade and below-grade utilities which are to remain.

- C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities are indicated on the Drawings.
- D. Prevent erosion of excavations and backfill. Do not allow water to pond in excavations.
- E. Maintain excavation and backfill areas until start of subsequent work. Repair and recompact slides, washouts, settlements, or areas with loss of density at no additional cost to the Owner.

3.03 EXCAVATION

- A. Perform excavation work so that the underground structure can be installed to depths and alignments shown on Drawings. Use caution during excavation work to avoid disturbing surrounding ground and existing facilities and improvements. Keep excavation to the absolute minimum necessary. No additional payment will be made for excess excavation not authorized by Entity.
- B. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Entity and obtain instructions before proceeding in such areas.
- C. Immediately notify the agency or company owning any line which is damaged, broken or disturbed. Obtain approval from Entity and agency for any repairs or relocations, either temporary or permanent.
- D. Avoid settlement of surrounding soil due to equipment operations, excavation procedures, vibration, dewatering, or other construction methods.
- E. Provide surface drainage during construction to protect work and to avoid nuisance to adjoining property. Where required, provide proper dewatering and piezometric pressure control during construction.
- F. Conduct hauling operations so that trucks and other vehicles do not create a dirt nuisance in streets. Verify that truck beds are sufficiently tight and loaded in such a manner that objectionable materials will not spill onto streets. Promptly clear away any dirt, mud, or other materials that spill onto streets or are deposited onto streets by vehicle tires.
- G. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed, replace those which are damaged or destroyed by the Work.
- H. Provide sheeting, shoring, and bracing where required to safely complete the Work, to prevent excavation from extending beyond limits indicated on Drawings, and to protect the Work and adjacent structures or improvements. Sheeting, shoring, and bracing used to protect workmen and the public shall conform to requirements of Section 31 23 16.13 Trench Safety Systems.
- I. Prevent voids from forming outside of sheeting. Immediately fill voids with grout, concrete fill, cement stabilized sand, or other material approved by Entity.

- J. After completion of the structure, remove sheeting, shoring, and bracing unless shown on Drawings to remain in place or directed by Entity in writing that such temporary structures may remain. Remove sheeting, shoring and bracing in such a manner as to maintain safety during backfilling operations and to prevent damage to the Work and adjacent structures or improvements.
- K. Immediately fill and compact voids left or caused by removal of sheeting with cement stabilized sand or material approved by Entity.
- 3.04 HANDLING EXCAVATED MATERIALS
 - A. Classify excavated materials. Place material which is suitable for use as backfill in orderly piles at a sufficient distance from excavation to prevent slides or cave-ins.
 - B. Provide additional backfill material if adequate quantities of suitable material are not available from excavation and trenching operations at the site.
- 3.05 DEWATERING
 - A. Provide ground water control per Section 31 23 19 Control of Ground Water and Surface Water.
 - B. Keep ground water surface elevation a minimum of 2 feet below the bottom of the foundation base.
 - C. Maintain ground water control as directed by Section 31 23 19 Control of Ground Water and Surface Water and until the structure is sufficiently complete to provide the required weight to resist hydrostatic uplift with a minimum safety factor of 1.2.
- 3.06 FOUNDATION EXCAVATION
 - A. Notify Entity at least 48 hours prior to planned completion of foundation excavations. Do not place the foundation base until the excavation is accepted by the Entity.
 - B. Excavate to elevations shown on Drawings, as needed to provide space for the foundation base, forming a level undisturbed surface, free of mud or soft material. Remove pockets of soft or otherwise unstable soils and replace with foundation backfill material or a material as directed by the Entity. Prior to placing material over it, recompact the subgrade where indicated on the Drawings, scarifying as needed, to 95 percent of the maximum Standard Dry Density according to ASTM D 698. If the specified level of compaction cannot be achieved, moisture condition the subgrade and recompact until 95 percent is achieved, over-excavate to provide a minimum layer of 24 inches of foundation backfill material, or other means acceptable to the Entity.
 - C. Fill unauthorized excessive excavation with foundation backfill material or other material as directed by the Entity.

- D. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in a satisfactory, undisturbed condition. Keep excavations free of standing water and completely free of water during concrete placement.
- E. Soils which become unsuitable due to inadequate dewatering or other causes, after initial excavation to the required subgrade, shall be removed and replaced with foundation backfill material, as directed by Engineer, at no additional cost to the Owner.
- F. Place foundation base, or foundation backfill material where needed, over the subgrade on same day that excavation is completed to final grade. Where base of excavations are left open for longer periods, protect them with a seal slab or cement-stabilized sand.
- G. Crushed aggregate, and other free draining Class I materials, shall have a filter fabric separating it from native soils or select material backfill. The fabric shall overlap a minimum of 12 inches beyond where another material stops contact with the soil.
- H. Crushed aggregate, and other Class I materials, shall be placed in uniform layers of 8-inch maximum thickness. Compaction shall be by means of at least two passes of a vibratory compactor.

3.07 FOUNDATION BASE

- A. After the subgrade is properly prepared, including the placement of foundation backfill where needed, the foundation base shall be placed. The foundation base shall consist of a 12-inch layer of crushed stone aggregate or cement stabilized sand. Alternately, a seal slab with a minimum thickness of 4 inches may be placed. The foundation base shall extend a minimum of 12 inches beyond the edge of the structure foundation, unless shown otherwise on the Drawings.
- B. Where the foundation base and foundation backfill are of the same material, both can be placed in one operation.

3.08 BACKFILL

- A. Complete backfill to surface of natural ground or to lines and grades shown on Drawings. Use existing material that qualifies as select material, unless indicated otherwise. Deposit backfill in uniform layers and compact each layer as specified.
- B. Do not place backfill against concrete walls or similar structures until laboratory test breaks indicate that the concrete has reached a minimum of 85 percent of the specified compressive strength. Where walls are supported by slabs or intermediate walls, do not begin backfill operations until the slab or intermediate walls have been placed and concrete has attained sufficient strength.
- C. Remove concrete forms before starting backfill and remove shoring and bracing as work progresses.

- D. Maintain fill material at no less than 2 percent below nor more than 2 percent above optimum moisture content. Place fill material in uniform 8-inch maximum loose layers. Compaction of fill shall be to at least 95 percent of the maximum Standard Dry Density according to ASTM D 698 under paved areas. Compact to at least 90 percent around structures below unpaved areas.
- E. Where backfill is placed against a sloped excavation surface, run compaction equipment across the boundary of the cut slope and backfill to form a compacted slope surface for placement of the next layer of backfill.
- F. Place backfill using cement stabilized sand in accordance with Section 31 32 13.16 Cement Stabilized Sand.
- 3.09 FIELD QUALITY CONTROL
 - A. Testing will be performed under provisions of Section 01 45 29 Testing Laboratory Services.
 - B. Tests will be performed initially on minimum of one different sample of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is a noticeable change in material gradation or plasticity.
 - C. In-place density tests of compacted subgrade and backfill will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at the following frequencies and conditions:
 - 1. A minimum of one test for every 100 cubic yards of compacted backfill material.
 - 2. A minimum of three density tests for each full work shift.
 - 3. Density tests will be performed in all placement areas.
 - 4. The number of tests will be increased if inspection determines that soil types or moisture contents are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density.
 - D. At least one test for moisture-density relationships will be initially performed for each type of backfill material in accordance with ASTM D 698. Additional moisture-density relationship tests will be performed whenever there is a noticeable change in material gradation or plasticity.
 - E. If tests indicate work does not meet specified compaction requirements, recondition, recompact, and retest at Contractor's expense.

3.10 DISPOSAL OF EXCESS MATERIAL

Remove from the site debris resulting from work under this section in accordance with local and state laws and the responsibility of the Contractor.

Section 31 23 19

DEWATERING CONTROL OF GROUND WATER AND SURFACE WATER

PART 1 GENERAL

1.1 SECTION INCLUDES

- 1. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations, and foundation beds in a stable condition, and controlling ground water conditions for trench and tunnel excavations.
- 2. Protecting work against surface runoff and rising flood waters.
- 3. Disposing of removed water.

1.2 METHOD OF PAYMENT

A. Unless prescribed elsewhere in the Contract Documents, no separate payment will be made for control of ground water and surface water. Include the cost to control ground water and surface water in unit price for work requiring such controls.

1.3 REFERENCES

- 1. ASTM D 698 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49 kg) Rammer and 12-inch (304.8 mm) Drop.
- 2. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).
- 3. Federal Register 40 CFR (Vol. 55, No. 222) Part 122, EPA Administered Permit Programs (NPDES), Para.122.26(b)(14) Storm Water Discharge.

1.4 DEFINITIONS

- 1. Ground water control includes both dewatering and depressurization of water-bearing soil layers.
 - 1. Dewatering includes lowering the water table and intercepting seepage which would otherwise emerge from slopes or bottoms of excavations, or into tunnels and shafts, and disposing of removed water. The intent of dewatering is to increase stability of tunnel excavations and excavated slopes; prevent dislocation of material from slopes or bottoms of excavations; reduce lateral loads on sheeting and bracing; improve excavating and hauling characteristics of excavated material; prevent failure or heaving of the bottom of excavations; and to provide suitable conditions for placement of backfill materials and construction of structures and other installations.

- 2. Depressurization includes reduction in piezometric pressure within strata not controlled by dewatering alone, as required to prevent failure or heaving of excavation bottom or instability of tunnel excavations.
- 2. Excavation drainage includes keeping excavations free of surface and seepage water.
- 3. Surface drainage includes use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines as required to protect the Work from any source of surface water.
- 4. Equipment and instrumentation for monitoring and control of the ground water control system includes piezometers and monitoring wells, and devices, such as flow meters, for observing and recording flow rates.

1.5 PERFORMANCE REQUIREMENTS

- 1. Conduct subsurface investigations to identify groundwater conditions and to provide parameters for design, installation, and operation of groundwater control systems.
- Design a ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926 and Section 31 23 16.13 - Trench Safety Systems, to produce the following results:
 - 1. Effectively reduce the hydrostatic pressure affecting:
 - 1. Excavations.
 - 2. Tunnel excavation, face stability or seepage into tunnels.
 - 2. Develop a substantially dry and stable subgrade for subsequent construction operations.
 - 3. Preclude damage to adjacent properties, buildings, structures, utilities, installed facilities, and other work.
 - 4. Prevent the loss of fines, seepage, boils, quick condition, or softening of the foundation strata.
 - 5. Maintain stability of sides and bottom of excavations.
- 3. Provide ground water control systems may include single-stage or multiple-stage well point systems, eductor and ejector-type systems, deep wells, or combinations of these equipment types.
- 4. Provide drainage of seepage water and surface water, as well as water from any other source entering the excavation. Excavation drainage may include placement of drainage materials, such as crushed stone and filter fabric, together with sump pumping.

- 5. Provide ditches, berms, pumps and other methods necessary to divert and drain surface water from excavation and other work areas.
- 6. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.
- 7. Assume sole responsibility for ground water control systems and for any loss or damage resulting from partial or complete failure of protective measures and any settlement or resultant damage caused by the ground water control operations. Modify ground water control systems or operations if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells, or affect potentially contaminated areas. Repair damage caused by ground water control systems or resulting from failure of the system to protect property as required.
- 8. Provide an adequate number of piezometers installed at the proper locations and depths as required to provide meaningful observations of the conditions affecting the excavation, adjacent structures, and water wells.
- 9. Provide environmental monitoring wells installed at the proper locations and depths as required to provide adequate observations of hydrostatic conditions and possible contaminant transport from contamination sources into the work area or into the ground water control system.
- 10. Decommission piezometers and monitoring wells installed during design phase studies and left for Contractors monitoring and use.
- 1.6 SUBMITTALS
 - 1. Submittals shall conform to requirements of Section 01 33 00 Submittals Procedures.
 - 2. Submit a Ground Water and Surface Water Control Plan for review by the Owner and Engineer prior to start of any field work. The Plan shall be signed by a Professional Engineer registered in the State of Texas. Submit a plan to include the following:
 - 1. Results of subsurface investigation and description of the extent and characteristics of water bearing layers subject to ground water control.
 - 2. Names of equipment suppliers and installation subcontractors.
 - 3. A description of proposed ground water control systems indicating arrangement, location, depth and capacities of system components, installation details and criteria, and operation and maintenance procedures.
 - 4. A description of proposed monitoring and control system indicating depths and locations of piezometers and monitoring wells, monitoring installation details and criteria, type of equipment and instrumentation with pertinent data and characteristics.

- 5. A description of proposed filters including types, sizes, capacities and manufacturer's application recommendations.
- 6. Design calculations demonstrating adequacy of proposed systems for intended applications. Define potential area of influence of ground water control operation near contaminated areas.
- 7. Operating requirements, including piezometric control elevations for dewatering and depressurization.
- 8. Excavation drainage methods including typical drainage layers, sump pump application and other necessary means.
- 9. Surface water control and drainage installations.
- 10. Proposed methods and locations for disposing of removed water.
- 3. Submit the following records upon completed initial installation:
 - 1. Installation and development reports for well points, eductors, and deep wells.
 - 2. Installation reports and baseline readings for piezometers and monitoring wells.
 - 3. Baseline analytical test data of water from monitoring wells.
 - 4. Initial flow rates.
- 4. Submit the following records on a weekly basis during operations:
 - 1. Records of flow rates and piezometric elevations obtained during monitoring of dewatering and depressurization. Refer to Paragraph 3.2, Requirements for Eductor, Well Points, or Deep Wells.
 - 2. Maintenance records for ground water control installations, piezometers, and monitoring wells.
- 5. Submit the following records at end of work. Decommissioning (abandonment) reports for monitoring wells and piezometers installed by other during the design phase and left for Contractor's monitoring and use.
- 1.7 ENVIRONMENTAL REQUIREMENTS
 - 1. Comply with requirements of agencies having jurisdiction.
 - 2. Comply with Texas Natural Resource Conservation Commission regulations and Texas Water Well Drillers Association for development, drilling, and abandonment of wells used in dewatering system.

- 3. Obtain permit from EPA under the National Pollutant Discharge Elimination System (NPDES), for storm water discharge from construction sites. Refer to Section 01571 NPDES Permit Requirements.
- 4. Obtain all necessary permits from agencies with control over the use of groundwater and matters affecting well installation, water discharge, and use of existing storm drains and natural water sources. Because the review and permitting process may be lengthy, take early action to pursue and submit for the required approvals.
- 5. Monitor ground water discharge for contamination while performing pumping in the vicinity of potentially contaminated sites.

PART 2 PRODUCTS

1.8 EQUIPMENT AND MATERIALS

- 1. Equipment and materials are at the option of Contractor as necessary to achieve desired results for dewatering. Selected equipment and materials are subject to review by the Owner and Engineer through submittals required in Paragraph 1.6, Submittals.
- 2. Eductors, well points, or deep wells, where used, must be furnished, installed and operated by an experienced contractor regularly engaged in ground water control system design, installation, and operation.
- 3. All equipment must be in good repair and operating order.
- 4. Sufficient standby equipment and materials shall be kept available to ensure continuous operation, where required.

PART 3 E X E C U T I O N

1.9 GROUND WATER CONTROL

- 1. Perform a subsurface investigation by borings as necessary to identify water bearing layers, piezometric pressures, and soil parameters for design and installation of ground water control systems. Perform pump tests, if necessary to determine the drawdown characteristics of the waterbearing layers. The results shall be presented in the Ground Water and Surface Water Control Plan (See Paragraph 1.06B.1).
- 2. Provide labor, material, equipment, techniques and methods to lower, control and handle ground water in a manner compatible with construction methods and site conditions. Monitor effectiveness of the installed system and its effect on adjacent property.

- 3. Install, operate, and maintain ground water control systems in accordance with the Ground Water and Surface Water Control Plan. Notify the Engineer in writing of any changes made to accommodate field conditions and changes to the Work. Provide revised drawings and calculations with such notification.
- 4. Provide for continuous system operation, including nights, weekends, and holidays. Arrange for appropriate backup if electrical power is primary energy source for dewatering system.
- 5. Monitor operations to verify that the system lowers ground water piezometric levels at a rate required to maintain a dry excavation resulting in a stable subgrade for prosecution of subsequent operations.
- 6. Where hydrostatic pressures in confined water bearing layers exist below excavation, depressurize those zones to eliminate risk of uplift or other instability of excavation or installed works. Allowable piezometric elevations shall be defined in the Ground Water and Surface Water Control Plan.
- 7. Remove ground water control installations.
 - 1. Remove pumping system components and piping when ground water control is no longer required.
 - 2. Remove piezometers, including piezometers installed during the design phase investigations and left for Contractor's use, upon completion of testing, in accordance with Section 02533 Acceptance Testing of Sanitary Sewers.
 - 3. Remove monitoring wells when directed by the Engineer.
 - 4. Grout abandoned well and piezometer holes. Fill piping that is not removed with cement-bentonite grout or cement-sand grout.
- 8. During backfilling, dewatering may be reduced to maintain water level a minimum of 5 feet below prevailing level of backfill. However, do not allow that water level to result in uplift pressures in excess of 80 percent of downward pressure produced by weight of structure or backfill in place. Do not allow water levels to rise into cement stabilized sand until at least 48 hour after placement.
- 9. Provide a uniform diameter for each pipe drain run constructed for dewatering. Remove pipe drain when it has served its purpose. If removal of pipe is impractical, provide grout connections at 50-foot intervals and fill pipe with cement-bentonite grout or cement-sand grout when pipe is removed from service.
- 10. Extent of construction ground water control for structures with a permanent perforated underground drainage system may be reduced, such as for units designed to withstand hydrostatic uplift pressure. Provide a means of draining the affected portion of underground system, including standby equipment. Maintain drainage system during operations and remove it when no longer required.

- 11. Remove system upon completion of construction or when dewatering and control of surface or ground water is no longer required.
- 12. Compact backfill to not less than 95 percent of the maximum dry density in accordance with ASTM D 698.
- 1.10 REQUIREMENTS FOR EDUCTOR, WELL POINTS, OR DEEP WELLS
 - 1. For aboveground piping in ground water control system, include a 12-inch minimum length of clear, transparent piping between every eductor well or well point and discharge header so that discharge from each installation can be visually monitored.
 - 2. Install sufficient piezometers or monitoring wells to show that all trench or shaft excavations in water bearing materials are predrained prior to excavation. Provide separate piezometers for monitoring of dewatering and for monitoring of depressurization. Install piezometers and monitoring wells for tunneling as appropriate for Contractor's selected method of work.
 - 3. Install piezometers or monitoring wells not less than one week in advance of beginning the associated excavation.
 - 4. Dewatering may be omitted for portions of underdrains or other excavations, but only where auger borings and piezometers or monitoring wells show that soil is predrained by an existing system such that the criteria of the ground water control plan are satisfied.
 - 5. Replace installations that produce noticeable amounts of sediments after development.
 - 6. Provide additional ground water control installations, or change the methods, in the event that the installations according to the ground water control plan does not provide satisfactory results based on the performance criteria defined by the plan and by the specification. Submit a revised plan according to Paragraph 1.06B.

1.11 EXCAVATION DRAINAGE

1. Contractor may use excavation drainage methods if necessary to achieve well-drained conditions. The excavation drainage may consist of a layer of crushed stone and filter fabric, and sump pumping in combination with sufficient wells for ground water control to maintain stable excavation and backfill conditions.

1.12 MAINTENANCE AND OBSERVATION

- 1. Conduct daily maintenance and observation of piezometers or monitoring wells while the ground water control installations or excavation drainage are operating in an area or seepage into tunnel is occurring. Keep system in good condition.
- 2. Replace damaged and destroyed piezometers or monitoring wells with new piezometers or wells as necessary to meet observation schedule.

- 3. Cut off piezometers or monitoring wells in excavation areas where piping is exposed, only as necessary to perform observation as excavation proceeds. Continue to maintain and make observations, as specified.
- 4. Remove and grout piezometers inside or outside the excavation area when ground water control operations are complete. Remove and grout monitoring wells when directed by the Engineer.

1.13 MONITORING AND RECORDING

- 1. Monitor and record average flow rate of operation for each deep well, or for each wellpoint or eductor header used in dewatering system. Also monitor and record water level and ground water recovery. These records shall be obtained daily until steady conditions are achieved, and twice weekly thereafter.
- 2. Observe and record elevation of water level daily as long as ground water control system is in operation, and weekly thereafter until the Work is completed or piezometers or wells are removed, except when Engineer determines that more frequent monitoring and recording are required. Comply with Engineer's direction for increased monitoring and recording and take measures as necessary to ensure effective dewatering for intended purpose.

1.14 SURFACE WATER CONTROL

- 1. Intercept surface water and divert it away from excavations through use of dikes, ditches, curb walls, pipes, sumps or other approved means. The requirement includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.
- 2. Divert surface water and seepage water into sumps and pump it into drainage channels or storm drains, when approved by agencies having jurisdiction. Provide settling basins when required by such agencies.

Section 31 23 33

TRENCHING & BACKFILLING EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 GENERAL

- 1.01 SECTION INCLUDES
 - A. Excavation, trenching, foundation, embedment, and backfill for installation of utilities, including manholes and other pipeline structures.
- 1.02 MEASUREMENT AND PAYMENT
 - A. Unit Prices.
 - 1. No additional payment will be made for trench excavation, embedment and backfill under this Section, including gravel bedding as required. Include cost in the unit price for installed underground piping, sewer, conduit, or duct work.
 - 2. No separate or additional payment will be made for surface water control, ground water control (well-points) or for excavation drainage. Include in the unit price for the installed piping, sewer, conduit, or duct work.
 - B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 DEFINITIONS

- A. Pipe Foundation: Suitable and stable native soils that are exposed at the trench subgrade after excavation to depth of bottom of the bedding as shown on the Drawings, or foundation backfill material placed and compacted in over-excavations.
- B. Pipe Bedding: The portion of trench backfill that extends vertically from top of foundation up to a level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.
- C. Haunching: The material placed on either side of pipe from top of bedding up to springline of pipe and horizontally from one trench sidewall to opposite sidewall.
- D. Initial Backfill: The portion of trench backfill that extends vertically from springline of pipe (top of haunching) up to a level line 12 inches above top of pipe, and horizontally from one trench sidewall to opposite sidewall.

- E. Pipe Embedment: The portion of trench backfill that consists of bedding, haunching and initial backfill.
- F. Trench Zone: The portion of trench backfill that extends vertically from top of pipe embedment up to pavement subgrade or up to final grade when not beneath pavement.
- G. Unsuitable Material: Unsuitable soil materials are the following:
 - 1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.
 - 2. Materials that cannot be compacted to required density due to either gradation, plasticity, or moisture content.
 - 3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.
 - 4. Materials that are contaminated with hydrocarbons or other chemical contaminants.
- H. Suitable Material: Suitable soil materials are those meeting specification requirements. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement are considered suitable, unless otherwise indicated.
- I. Backfill: Suitable material meeting specified quality requirements, placed and compacted under controlled conditions.
- J. Ground Water Control Systems: Installations external to trench, such as well points. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 31 23 19 Control of Ground Water and Surface Water.
- K. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as a part of excavation drainage.
- L. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using a drainage layer, as defined in ASTM D 2321, placed on the foundation beneath pipe bedding or thickened bedding layer of Class I material.
- M. Trench Conditions are defined with regard to the stability of trench bottom and trench walls of pipe embedment zone. Maintain trench conditions that provide for effective placement and compaction of embedment material directly on or against undisturbed soils or foundation backfill, except where structural trench support is necessary.

- 1. Dry Stable Trench: Stable and substantially dry trench conditions exist in pipe embedment zone as a result of typically dry soils or achieved by ground water control (dewatering or depressurization) for trenches extending below ground water level.
- 2. Stable Trench with Seepage: Stable trench in which ground water seepage is controlled by excavation drainage.
 - a. Stable Trench with Seepage in Clayey Soils: Excavation drainage is provided in lieu of or to supplement ground water control systems to control seepage and provide stable trench subgrade in predominately clayey soils prior to bedding placement.
 - b. Stable Wet Trench in Sandy Soils: Excavation drainage is provided in the embedment zone in combination with ground water control in predominately sandy or silty soils.
- 3. Unstable Trench: Unstable trench conditions exist in the pipe embedment zone if ground water inflow or high water content causes soil disturbances, such as sloughing, sliding, boiling, heaving or loss of density.
- N. Subtrench: Subtrench is a special case of benched excavation. Subtrench excavation below trench shields or shoring installations may be used to allow placement and compaction of foundation or embedment materials directly against undisturbed soils. Depth of a subtrench depends upon trench stability and safety as determined by the Contractor.
- O. Trench Dam: A placement of low permeability material in pipe embedment zone or foundation to prohibit ground water flow along the trench.
- P. Over-Excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below top of foundation as shown on Drawings, and backfilled with foundation backfill material.
- Q. Foundation Backfill Materials: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill to provide stable support for bedding. Foundation backfill materials may include concrete seal slabs.
- R. Trench Safety Systems include both protective systems and shoring systems as defined in Section 31 23 16.13 Trench Safety Systems.
- S. Trench Shield (Trench Box): A portable worker safety structure moved along the trench as work proceeds, used as a protective system and designed to withstand forces imposed on it by cave-in, thereby protecting persons within the trench. Trench shields may be stacked if so designed or placed in a series depending on depth and length of excavation to be protected.

- T. Shoring System: A structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins, or to prevent movement of the ground affecting adjacent installations or improvements.
- U. Special Shoring: A shoring system meeting special shoring as specified in Paragraph 1.08, Special Shoring Design Requirements, for locations identified on the Drawings.
- 1.04 REFERENCES
 - A. ASTM C 12 Standard Practice for Installing Vitrified Clay Pipe Lines.
 - B. ASTM D 558 Test Methods for Moisture-Density Relations of Soil Cement Mixtures.
 - C. ASTM D 698 Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (304.8-mm) Drop.
 - D. ASTM D 1556 Test Method for Density in Place by the Sand-Cone Method.
 - E. ASTM D 2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
 - F. ASTM D 2487 Classification of Soils for Engineering Purposes.
 - G. ASTM D 2922 Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - H. ASTM D 3017 Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
 - I. ASTM D 4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - J. TxDOT Tex-101-E Preparation of Soil and Flexible Base Materials for Testing.
 - K. TxDOT Tex-110-E Determination of Particle Size Analysis of Soils.
 - L. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).
- 1.05 SCHEDULING
 - A. Schedule work so that pipe embedment can be completed on the same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.
- 1.06 SUBMITTALS

- A. Conform to Section 01 33 00 Submittal Procedures.
- B. Submit a written description for information only of the planned typical method of excavation, backfill placement and compaction, including:
 - 1. Sequence of work and coordination of activities.
 - 2. Selected trench widths.
 - 3. Procedures for foundation and embedment placement, and compaction.
 - 4. Procedure for use of trench boxes and other pre-manufactured systems while assuring specified compaction against undisturbed soil.
 - 5. Procedure for installation of Special Shoring at locations identified on the Drawings.
- C. Submit a ground and surface water control plan in accordance with requirements in this Section and Section 31 23 19 Control of Ground Water and Surface Water.
- D. Submit backfill material sources and product quality information in accordance with requirements of Section 31 06 20.16 Utility Backfill Materials.
- E. Submit a trench excavation safety program in accordance with requirements of Section 31 23 16.13 - Trench Safety System. Include designs for special shoring meeting the requirements defined in Paragraph 1.08, Special Shoring Design Requirements.
- F. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.
- 1.07 TESTS
 - A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by the Owner in accordance with requirements of Section 01 45 29 Testing Laboratory Services and as specified in this Section.
 - B. Perform backfill material source qualification testing in accordance with requirements of Section 31 06 20.16 Utility Backfill Materials.

1.08 SPECIAL SHORING DESIGN REQUIREMENTS

A. Have special shoring designed or selected by the Contractor's Professional Engineer to provide support for the sides of the excavations, including soils and hydrostatic ground water pressures as applicable, and to prevent ground movements affecting adjacent installations or improvements such as structures, pavements and utilities. Special shoring may be a pre-

Trenching & Backfilling – Excavation & Backfill for Utilities

31 23 33 - 5

manufactured system selected by the Contractor's Professional Engineer to meet the project site requirements based on the manufacturer's standard design.

PART 2 P R O D U C T S

2.01 EQUIPMENT

- A. Perform excavation with hydraulic excavator or other equipment suitable for achieving the requirements of this Section.
- B. Use only hand-operated tamping equipment until a minimum cover of 12 inches is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.
- C. Use trench shields or other protective systems or shoring systems which are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.
- D. Use special shoring systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.09, Shoring Design Requirements.
- 2.02 MATERIAL CLASSIFICATIONS
 - A. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Section 31 06 20.16 Utility Backfill Materials.
 - B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Section 33 05 16 Concrete for Utility Construction.
 - C. Geotextile (Filter Fabric): Conform to requirements of Section 02621- Geotextile.
 - D. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.
 - E. Timber Shoring Left in Place: Untreated oak.

PART 3 E X E C U T I O N

3.01 STANDARD PRACTICE

A. Install flexible pipe, including "semi-rigid" pipe, to conform to standard practice described in ASTM D 2321, and as described in this Section. Where an apparent conflict occurs between the standard practice and the requirements of this Section, this Section governs.
B. Install rigid pipe to conform to standard practice described in ASTM C 12, and as described in this Section. Where an apparent conflict occurs between the standard practice and the requirements of this Section, this Section governs.

3.02 PREPARATION

- A. Establish traffic control to conform with requirements of Section 01 55 26 Traffic Control and Regulation. Maintain barricades and warning lights for streets and intersections affected by the Work, and is considered hazardous to traffic movements.
- B. Perform work to conform with applicable safety standards and regulations. Employ a trench safety system as specified in Section 31 23 16.13 Trench Safety Systems.
- C. Immediately notify the agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from the appropriate entity for any repairs or relocations, either temporary or permanent.
- D. Remove existing pavements and structures, including sidewalks and driveways, to conform with requirements of Section 02200 Removing Existing Pavements and Structures, as applicable.
- E. Install and operate necessary dewatering and surface water control measures to conform with Section 31 23 19 Control of Ground Water and Surface Water.
- F. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed in accordance with Section 01725 Field Surveying.

3.03 PROTECTION

- A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within the grading limits as designated on the Drawings, and in accordance with requirements of Section 01562 Tree and Plant Protection.
- B. Protect and support above-grade and below-grade utilities which are to remain.
- C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities are indicated on the Drawings.
- D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, re-compact, and pave those areas at no additional cost to Owner.

3.04 EXCAVATION

- A. Except as otherwise specified or shown on the Drawings, install underground utilities in open cut trenches with vertical sides.
- B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on the Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.
- C. Determine trench excavation widths using the following schedule as related to pipe outside diameter (O.D.). Maximum trench width shall be the minimum trench width plus 24 inches.

Nominal <u>Pipe Size, Inches</u>	Minimum Trench Width, Inches
Less than 18	O.D. + 18
18 to 30	O.D. + 24
Greater than 30	O.D. + 36

- D. Use sufficient trench width or benches above the embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from the surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment and backfill, and other materials.
- E. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify the appropriate entity and obtain instructions before proceeding.
- F. Shoring of Trench Walls.
 - 1. Install Special Shoring in advance of trench excavation or simultaneously with the trench excavation, so that the soils within the full height of the trench excavation walls will remain laterally supported at all times.
 - 2. For all types of shoring, support trench walls in the pipe embedment zone throughout the installation. Provide trench wall supports sufficiently tight to prevent washing the trench wall soil out from behind the trench wall support.
 - 3. Unless otherwise directed by the Enginer, leave sheeting driven into or below the pipe embedment zone in place to preclude loss of support of foundation and embedment materials. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and the trench wall in the vicinity of the pipe zone.
 - 4. Employ special methods for maintaining the integrity of embedment or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.

- 5. If sheeting or other shoring is used below top of the pipe embedment zone, do not disturb pipe foundation and embedment materials by subsequent removal. Maximum thickness of removable sheeting extending into the embedment zone shall be the equivalent of a 1-inch-thick steel plate. Fill voids left on removal of supports with compacted backfill material.
- G. Use of Trench Shields. When a trench shield (trench box) is used as a worker safety device, the following requirements apply:
 - 1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to the trench sidewalls.
 - 2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor the degree of compaction reduced.
 - 3. When required, place, spread, and compact pipe foundation and bedding materials beneath the shield. For backfill above bedding, lift the shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.
 - 4. Maintain trench shield in position to allow sampling and testing to be performed in a safe manner.

3.05 HANDLING EXCAVATED MATERIALS

- A. Use only excavated materials which are suitable as defined in this Section and conforming with Section 31 06 20.16 Utility Backfill Materials. Place material suitable for backfilling in stockpiles at a distance from the trench to prevent slides or cave-ins.
- B. When required, provide additional backfill material conforming with requirements of Section 31 06 20.16 Utility Backfill Materials.
- C. Do not place stockpiles of excess excavated materials on streets and adjacent properties.
 Protect excess stockpiles for use on site. Maintain site conditions in accordance with Section 01 50 00 Temporary Facilities and Controls.
- 3.06 GROUND WATER CONTROL
 - A. Implement ground water control according to Section 31 23 19 Control of Ground Water and Surface Water. Provide a stable trench to allow installation in accordance with the Specifications.
- 3.07 TRENCH FOUNDATION

- A. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials. Install gravel base on trench bottom as required by BPUB.
- B. Place trench dams in Class I foundations in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.08 PIPE EMBEDMENT, PLACEMENT, AND COMPACTION

- A. Immediately prior to placement of embedment materials, the bottoms and sidewalls of trenches shall be free of loose, sloughing, caving, or otherwise unsuitable soil.
- B. Place embedment including bedding, haunching, and initial backfill as shown on Drawings.
- C. For pipe installation, manually spread embedment materials around the pipe to provide uniform bearing and side support when compacted. Do not allow materials to free-fall from heights greater than 24 inches above top of pipe. Perform placement and compaction directly against the undisturbed soils in the trench sidewalls, or against sheeting which is to remain in place.
- D. Do not place trench shields or shoring within height of the embedment zone unless means to maintain the density of compacted embedment material are used. If moveable supports are used in embedment zone, lift the supports incrementally to allow placement and compaction of the material against undisturbed soil.
- E. Place geotextile to prevent particle migration from the in-situ soil into open-graded (Class I) embedment materials or drainage layers.
- F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations. When embedding coated or wrapped pipes, do not use crushed stone or other sharp, angular aggregates.
- G. Place haunching material manually around the pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside the pipe with sand bags or other suitable means.
- H. Place electrical conduit, if used, directly on foundation without bedding.
- I. Shovel in-place and compact embedment material using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted areas. Compact each lift before proceeding with placement of next lift. Water tamping is not allowed.

- J. For water lines construction embedment, use bank run sand, concrete sand, gem sand, pea gravel, or crushed limestone as specified in Section 31 06 20.16 Utility Backfill Material. For water lines adhere to the following subparagraph numbers 1 and 2; for utility installation other than water, adhere to numbers 3 and 4 below:
 - 1. Class I, II, and III Embedment Materials:
 - a. Maximum 6 inches compacted lift thickness.
 - b. Compact to achieve a minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
 - c. Moisture content to be within -3 percent to +3 percent of optimum as determined according to ASTM D 698, unless otherwise approved by Engineer.
 - 2. Cement Stabilized Sand:
 - a. Maximum 6 inches compacted thickness.
 - b. Compact to achieve a minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
 - c. Moisture content to be on dry side of optimum as determined according to ASTM D 698 but sufficient for effective hydration.
 - 3. Class I embedment materials.
 - a. Maximum 6-inches compacted lift thickness.
 - b. Systematic compaction by at least two passes of vibrating equipment. Increase compaction effort as necessary to effectively embed the pipe to meet the deflection test criteria.
 - c. Moisture content as determined by Contractor for effective compaction without softening the soil of trench bottom, foundation or trench walls.
 - 4. Class II embedment and cement stabilized sand.
 - a. Maximum 6-inches compacted thickness.
 - Compaction by methods determined by Contractor to achieve a minimum of 95 percent of the maximum dry density as determined according to ASTM D 698 for Class II materials and according to ASTM D 558 for cement stabilized materials.

- c. Moisture content of Class II materials within 3 percent of optimum as determined according to ASTM D 698. Moisture content of cement stabilized sands on the dry side of optimum as determined according to ASTM D 558 but sufficient for effective hydration.
- K. Place trench dams in Class I embedments in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.09 TRENCH ZONE BACKFILL PLACEMENT AND COMPACTION

- A. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only the minimum length of trench open as necessary for construction.
- B. Where damage to completed pipe installation work is likely to result from withdrawal of sheeting, leave the sheeting in place. Cut off sheeting 1.5 feet or more above the crown of the pipe. Remove trench supports within 5 feet from the ground surface.
- C. For sewer pipes, use backfill materials described here as determined by trench limits. As trench zone backfill in paved areas for streets and to one foot back of curbs and pavements, use cement stabilized sand for pipe of nominal sizes less than 36 inches. Uniformly backfill trenches partially within limits one foot from streets and curbs according to the paved area criteria. Use select backfill within one foot below pavement subgrade for rigid pavement. For asphalt concrete, use flexible base material within one foot below pavement subgrade.
- D. For water lines, backfill in trench zone, including auger pits, with bank run sand, select fill, or random backfill material as specified in Section 31 06 20.16 Utility Backfill materials.
- E. When shown on Drawings, a random backfill of suitable material may be used in trench zone for trench excavations outside pavements.
- F. Place trench zone backfill in lifts and compact by methods selected by the Contractor. Fully compact each lift before placement of the next lift.
 - 1. Bank run sand.
 - a. Maximum 9-inches compacted lift thickness.
 - b. Compaction by vibratory equipment to a minimum of 95 percent of the maximum dry density determined according to ASTM D 698.
 - c. Moisture content within 3 percent of optimum determined according to ASTM D 698
 - 2. Cement-stabilized sand.

- a. Maximum lift thickness determined by Contractor to achieve uniform placement and required compaction, but not exceeding 24 inches.
- b. Compaction by vibratory equipment to a minimum of 95 percent of the maximum dry density determined according to ASTM D 558.
- c. Moisture content on the dry side of optimum determined according to ASTM D 558 but sufficient for cement hydration.
- 3. Select fill.
 - a. Maximum 6-inches compacted thickness.
 - b. Compaction by equipment providing tamping or kneading impact to a minimum of 95 percent of the maximum dry density determined according to ASTM D 698.
 - c. Moisture content within 2 percent of optimum determined according to ASTM D 698.
- G. For trench excavations outside pavements, a random backfill of suitable material may be used in the trench zone.
 - 1. Fat clays (CH) may be used as trench zone backfill outside paved areas at the Contractor's option. If the required density is not achieved, the Contractor, at his option and at no additional cost to the Owner, may use lime stabilization to achieve compaction requirements or use a different suitable material.
 - 2. Maximum 9-inch compacted lift thickness for clayey soils and maximum 12-inch lift thickness for granular soils.
 - 3. Compact to a minimum of 90 percent of the maximum dry density determined according to ASTM D 698.
 - 4. Moisture content as necessary to achieve density.
- H. For electric conduits, remove formwork used for construction of conduits before placing trench zone backfill.
- 3.10 MANHOLES, JUNCTION BOXES, AND OTHER PIPELINE STRUCTURES
 - A. Meet the requirements of adjoining utility installations for backfill of pipeline structures, as shown on the Drawings.
- 3.11 FIELD QUALITY CONTROL

- A. Test for material source qualifications as defined in Section 31 06 20.16 Utility Backfill Materials.
- B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to Owner.
- C. Tests will be performed on a minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is a noticeable change in material gradation or plasticity.
- D. At least three tests for moisture-density relationships will be performed initially for backfill materials in accordance with ASTM D 698, and for cement- stabilized sand in accordance with ASTM D 558. Additional moisture-density relationship tests will be performed whenever there is a noticeable change in material gradation or plasticity.
- E. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at the following frequencies and conditions.
 - 1. A minimum of one test for every 20 cubic yards of compacted embedment and for every 50 cubic yards of compacted trench zone backfill material.
 - 2. A minimum of three density tests for each full shift of Work.
 - 3. Density tests will be distributed among the placement areas. Placement areas are: foundation, bedding, haunching, initial backfill and trench zone.
 - 4. The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.
 - 5. Density tests may be performed at various depths below the fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.
 - 6. Two verification tests will be performed adjacent to in-place tests showing density less than the acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.
 - 7. Recompacted placement will be retested at the same frequency as the first test series, including verification tests.
- F. Recondition, recompact, and retest at Contractor's expense if tests indicate Work does not meet specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at Contractor's expense.

Trenching & Backfilling – Excavation & Backfill for Utilities 31 23 33 - 14

- G. Acceptability of crushed rock compaction will be determined by inspection.
- 3.12 DISPOSAL OF EXCESS MATERIAL
 - A. Dispose of excess materials in accordance with requirements of Section 01576 Waste Material Disposal

END OF SECTION

SECTION 31 32 13.16

STABILIZED BACKFILL (CEMENT STABILIZED SAND)

PART 1 GENERAL

1.01 DESCRIPTION

- A. Scope: Furnish all plant, labor, equipment, supervision, and tools for the furnishing and installation of Stabilized Backfill as shown on the Plans and as indicated in other sections of the Technical Specifications.
- B. Work Specified Elsewhere: Related work as called for on Plans or specified elsewhere in this or other Technical Specifications.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for Work performed under this Section. Include cost of such work in Contract unit prices for items listed in bid form requiring stabilized backfill material.

1.03 REFERENCES

- A. ASTM C 33 Standard Specification for Concrete Aggregates (Fine Aggregate).
- B. ASTM C 40 Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
- C. ASTM C 94 Standard Specification for Ready-Mixed Concrete.
- D. ASTM C 123 Standard Test Method for Lightweight Particles in Aggregate.
- E. ASTM C 142 Standard Test Method for Clay Lumps and Friable Particles in Aggregates.
- F. ASTM C 150 Specification for Portland Cement.
- G. ASTM D 558 Standard Test Method for Moisture-Density Relations of Soil Cement-Mixtures.
- H. ASTM D 1633 Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders.
- I. ASTM D 2487 Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- J. ASTM D 3665 Standard Practice for Random Sampling of Construction Materials.

K. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 SUBMITTALS

- A. Conform to requirements of Section 01 33 00 Submittal Procedures.
- B. Submit proposed target cement content and production data for sand-cement (native soil/manufactured materials-cement) mixture in accordance with requirements of Paragraph 2.03.

1.05 DESIGN REQUIREMENTS

- A. Cement Stabilized Sand: Use sand-cement mixture producing minimum unconfined compressive strength of 100psi in 48 hours and 500psi at 28-days.
 - 1. Design will be based on strength specimens molded in accordance with ASTM D 558 at moisture content within 3 percent of optimum and within 4 hours of batching.
 - 2. Determine minimum cement content from production data and statistical history. Provide no less than 1.5 sacks of cement per cubic yard of dry sand.
- B. Flowable Backfill: Flowable backfill shall consist of a mixture of native soils or manufactured materials, cement and/or fly ash, and water which produces a material with unconfined compressive strength of 300psi at 28-days.
 - 1. Any materials used shall be primarily granular, with a plasticity index <12 and with 100% passing a ³/₄-in. sieve.
 - 2. The flowable mixture shall be mixed in a pug mill, concrete mixer, or transit mixer and shall have a minimum slump of 5-in.
 - 3. The flowable mixture must be allowed to set prior to the placement of any overlying material.
 - 4. Design will be based on strength specimens molded in accordance with ASTM D 558 at moisture content within 3 percent of optimum and within 4 hours of batching.
- C. Modified Flowable Backfill: Modified flowable backfill in areas of possible future excavation such as utility installations shall consist of a mixture of native soils or manufactured materials, cement and/or fly ash, air-entraining material, and water which produces a material with unconfined compressive strength of between 100psi at 28-days.
 - 1. Modified flowable backfill in permanent areas such as abandoned pipe closures, abutments and embankments shall contain similar materials and shall have an unconfined compressive strength of greater than 150-psi after 28 days.

- 2. Any materials used shall be primarily granular, with a plasticity index <12 and with 100% passing a ³/₄-in. sieve.
- 3. The flowable mixture shall be mixed in-a pug mill, concrete mixer, or transit mixer and shall have a minimum slump of 5-in. The flowable mixture must be allowed to set prior to the placement of any overlying material.
- 4. Design will be based on strength specimens molded in accordance with ASTM D 558 at moisture content within 3 percent of optimum and within 4 hours of batching.
- PART 2 PRODUCTS
- 2.01 MATERIALS
 - A. Cement: Type I Portland cement conforming to ASTM C 150.
 - B. Sand: Clean, durable sand meeting grading requirements for fine aggregates of ASTM C 33, or requirements for bank run sand of Section 31 06 20.16 Utility Backfill Materials, and the following requirements:
 - 1. Classified as SW, SP, SW-SM, SP-SM, or SM by United Soil Classification System of ASTM D 2487.
 - 2. Deleterious materials:
 - a. Clay lumps, ASTM C 142; less than 0.5 percent.
 - b. Deleterious material, less than 2.0 percent.
 - c. Material removed by decantation; less than 5.0 percent.
 - d. Organic impurities, ASTM C 40, color no darker than standard color.
 - 3. Plasticity index of 4 or less when tested in accordance with ASTM D 4318.
 - 4. Flowable Fill Backfill and Modified Flowable Backfill Material: Any materials used shall be primarily granular, with a plasticity index <12 and with 100% passing a ³/₄-in. sieve.
 - C. Water: Potable water, free of oils, acids, alkalies, organic matter or other deleterious substances, meeting requirements of ASTM C 94.
- 2.02 MIXING MATERIALS
 - A. Add required amount of water and mix thoroughly in pugmill-type mixer.
 - B. Stamp batch ticket at plant with time of loading. Reject material not placed and compacted within 4 hours after mixing.

2.03 MATERIAL QUALIFICATION

- A. Determine target cement content of material as follows:
 - 1. Obtain samples of stabilized backfill material at production facility representing range of cement content consisting of at least three points.
 - 2. Complete molding of samples within 4 hours after addition of water.
 - 3. Perform strength tests (average of two specimens) at 48 hours and 7 days.
 - 4. Perform cement content tests on each sample.
 - 5. Perform moisture content tests on each sample.
 - 6. Plot average 48-hour strength vs. cement content.
 - 7. Record scale calibration date, sample date, sample time, molding time, cement feed dial settings, and silo pressure (if applicable).
- B. Test raw sand for following properties at point of entry into pug-mill:
 - 1. Gradation
 - 2. Plasticity index
 - 5. Organic impurities
 - 6. Clay lumps and friable particles
 - 5. Lightweight pieces
 - 6. Moisture content
 - 7. Classification
- C. Present data obtained in format similar to that provided in sample data form attached to this Section.
- D. The target content may be adjusted when statistical history so indicates. For determination of minimum product performance use formula:

f c % 1/2 standard deviation

PART 3 EXECUTION

3.01 PLACING

- A. Place stabilized backfill material in maximum 8-inch-thick loose lifts and compact to 95 percent of maximum density as determined in accordance with ASTM D 558, unless otherwise specified. Refer to related specifications for thickness of lifts in other applications. Target moisture content during compaction is -3 to 0 percent of optimum. Perform and complete compaction of stabilized backfill material within 4 hours after addition of water to mix at plant.
- B. Do not place or compact stabilized backfill material in standing or free water.

3.02 FIELD QUALITY CONTROL

- A. Testing will be performed under provisions of Section 01 45 29 Testing Laboratory Services.
- B. Samples of delivered product will be taken in field at point of delivery for testing in accordance with ASTM D 3665.
- C. Prepare and mold four specimens (for each sample obtained) in accordance with ASTM D 558, Method A, without adjusting moisture content. Samples will be molded at approximately same time material is being used, but no later than 4 hours after water is added to mix. Test two sample sets a minimum of every 50 square yards placed or for that days placement.
- D. After molding, specimens will be removed from molds and sealed in plastic bag or similar material to minimize moisture loss. Specimens will be cured at room temperature between 60 and 80 degrees F until tested.
- E. Specimens will be tested for compressive strength in accordance with ASTM D 1633, Method A. Two specimens will be tested at 48 hours plus or minus 2 hours and two specimens will be tested at 7 days plus or minus 4 hours.
- F. A strength test will be average of strengths of two specimens molded from same sample of material and tested at same age. Average daily strength will be average of strengths of all specimens molded during one day's production and tested at same age.

- G. Precision and Bias: Test results shall meet recommended guideline for precision in ASTM D 1633 Section 9.
- H. Reporting: Test reports shall contain, as a minimum, the following information:
 - 1. Supplier and plant number
 - 2. Time material was batched
 - 3. Time material was sampled
 - 4. Test age (exact hours)
 - 5. Average 48-hour strength
 - 6. Average 7-day strength
 - 7. Specification section number
 - 8. Compliance / non-compliance
 - 9. Mixture identification
 - 10. Truck and ticket numbers
 - 11. The time of molding
 - 12. Moisture content at time of molding
 - 13. Required strength
 - 14. Test method designations
 - 15. Compressive strength data as required by ASTM D 1633

3.03 ACCEPTANCE

- A. Strength level of material will be considered satisfactory if:
- 1. The average 48-hour strength is greater than 75-percent of the design strength with no individual strength test below 50-percent of the design strength.
- B. Material will be considered deficient when 7-day individual strength test (average of two specimens) is less than 75-percent of the design strength. See Paragraph 3.04 Adjustment for Deficient Strength.
- C. The material will be considered unacceptable and subject to removal and replacement at Contractor's expense when individual strength test has 7-day strength less than 75-percent of the design strength.
- D. When moving average of three daily 48-hour averages falls below 75-percent of the design strength, discontinue shipment to project until plant is capable of producing material, which exceeds 75-percent of the design strength at 48 hours. Total of five 48-hour strength tests shall be made in this determination with no individual strength tests less than 75-percent of the design strength.
- E. Testing laboratory shall notify Contractor, Owner, and material supplier by facsimile of tests indicating results falling below specified strength requirements.

3.04 ADJUSTMENT FOR DEFICIENT STRENGTH

- A. When mixture produces 48-hour compressive strength less than 75-percent of the design strength, then Contractor has option to remove and replace material or request that Owner have second set of samples broken at 7 days.
- B. When mixture produces 7-day compressive strength greater than or equal 75-percent of the design strength, then material will be considered satisfactory and bid price will be paid in full.
- C. When mixture produces 7-day compressive strength less than 75-percent of the design strength and greater than or equal to 50-percent of the design strength, material shall be accepted contingent on credit in payment. Compute credit by the following formula:

Credit per Cubic Yard = $\frac{30.00 \times 2 (100 \text{ psi} - \text{Actual psi})}{100}$

D. When mixture produces 7-day compressive strength less than 50-percent of the design strength, then remove and replace stabilized backfill material and paving and other necessary work at no cost to Owner.

END OF SECTION

Section 31 32 13.19

LIME TREATMENT FOR SUBGRADE

PART 1 GENERAL

1.01 DESCRIPTION

This item shall consist of treating the existing subgrade, base, and pavement by the pulverizing, addition of lime, mixing, and compacting the mixed material to the required density. This item applied to natural ground, embankment, or existing pavement structure and shall be constructed as specified herein and in conformity with the typical sections, lines, and grades as shown on the plans or as established by the Engineer.

PART 2 PRODUCTS

2.01 MATERIALS

- The lime shall meet the requirements of the Item, "Lime Slurry", for the type of specified.
 When Type B, Commercial Lime Slurry, is specified, the Contractor shall select, prior to construction, the class to be used and shall notify the Engineer in writing before changing from one class to another.
- 2. If the minimum design strength or percent of lime to be used for the treatment subgrade, existing subbase, or existing base is specified, it will be determined by preliminary tests performed in accordance with Test Method Tex-121-E. The percentage lime test (lime curve) is to be conducted by an approved testing laboratory prior to the addition of lime to the subgrade. A soil sample shall be made available to the testing laboratory at least ten days prior to application. The lime percentage (lime curve) test shall be paid for by the Owner. The bid schedule is based on 5% lime (by weight) stabilized subgrade at the depth specified in the bid item description. If the lime percentage tests show that less than 5% is to be used then the contractor shall notify the engineer of the difference in writing.

2.02 EQUIPMENT

- 1. The machinery, tools, and equipment necessary for proper execution of the work shall be on the project and approved by the Engineer prior to the beginning of construction operations. All machinery, tools, and equipment used shall be maintained in a satisfactory and workmanlike manner.
- 2. Hydrated lime shall be stored and handled in closed weatherproof containers until immediately before distribution on the road. If storage bins are used they shall be

completely enclosed. Hydrated lime in bags shall be stored in weatherproof buildings with adequate protection from ground dampness.

- 3. If lime is furnished in trucks, each truck shall have the weight of lime certified on public scales.
- 4. If lime is furnished in bags, each bag shall bear the manufacturer's certified weight. Bags varying more than 5 percent from that weight may be rejected and the average weight of bags in any shipment, as shown by weighing 50 bags taken at random, shall not be less than the manufacturer's certified weight.

PART 3 EXECUTION

3.01 CONSTRUCTION METHODS

A. General. It is the primary requirement of this specification to secure a completed course of treated material containing a uniform lime mixture, free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth and with a smooth surface suitable for placing subsequent courses. It shall be the responsibility of the Contractor to regulate the sequence of his work, to use the proper amount of lime, maintain the work and rework the courses as necessary to meet the above requirements.

The paving areas shall be constructed and shaped to conform to the typical sections, lines and grades as shown on the plans or as established by the Engineer. The material, either before or after lime is added, shall be excavated to the secondary grade (proposed bottom of lime treatment) and removed or windowed to expose the secondary grade. Any wet or unstable materials below the secondary grade shall be corrected, as directed by the Engineer, by scarifying, adding lime, and compacting, or other methods until satisfactory stability is obtained.

If the Contractor elects to use a cutting and pulverizing machine that will remove the subgrade material accurately to the secondary grade and pulverize the material at the same time, he will not be required to expose the secondary grade nor window the material. However, the Contractor shall be required to roll the subgrade, as directed by the Engineer, before using the pulverizing machine and correct any soft areas that this rolling may reveal. These methods will be permitted only where a machine is provided which will insure that the material is cut uniformly to the proper depth and which has cutters that will plane the secondary grade to a smooth surface over the entire width of the cut. The machine shall be of such design that a visible indication is given at all times that the machine is cutting to the proper depth.

B. Application. Lime shall be spread only on that area where the first mixing operations can be completed during the same working day.

The application and mixing of lime with the material shall be accomplished by the methods hereinafter described as "Dry Placing" or "Slurry Placing". When Type A,

Hydrated Lime, is specified, the Contractor may use either method, unless otherwise noted on the plans.

1. Dry Placing. The lime shall be spread by an approved spreader or by bag distribution at the rates shown on the plans or as directed by the Engineer.

The lime shall be distributed at a uniform rate and in such manner as to reduce the scattering of lime by wind to a minimum. Lime shall not be applied when wind conditions, in the opinion of the Engineer, are such that blowing lime becomes objectionable to traffic or adjacent property owners. A motor grader shall not be used to spread the lime.

The material shall be sprinkled as directed by the Engineer, until the proper moisture content has been secured.

2. Slurry Placing. When Type A Hydrated Lime is specified and slurry placement is to be used, the Type A Hydrated Lime shall be mixed with water to form a slurry of the solids content designated by the Engineer.

Where Type B, Commercial Lime Slurry is to be used, it shall be of the minimum solids and purity for the applicable grade being used. The distribution of lime at the rates shown on the plans or as directed by the Engineer shall be attained by successive passes over a measured section of roadway until the proper moisture and lime content has been secured.

C. Mixing. The mixing procedure shall be the same for "Dry Placing" or Slurry Placing" as herein described.

The material and lime shall be thoroughly mixed by approved road mixers or other approved equipment, and the mixing continued until, in the opinion of the Engineer, a homogeneous friable mixture of material and lime is obtained, such that when all non-slaking aggregates retained on the 3/4" sieve are removed, the remainder of the material shall meet that following requirements when tested from the roadway in the roadway condition by laboratory sieves:

	Percent
Minimum passing 1 - 3/4" sieve	100%
Minimum passing 3/4" sieve	

The soil-time mixture shall be sprinkled during the mixing operation as directed by the Engineer to provide optimum moisture in the mixing.

During the interval of time between application and mixing, hydrated lime that has been exposed to the open air for a period of 6 hours or more or has had excessive loss due to washing or blowing will not be accepted for payment.

D. Compaction. Compaction of the mixture shall begin immediately after final mixing unless approval is obtained from the Engineer. The material shall be aerated or sprinkled as necessary to provide the optimum moisture. Compaction shall begin at the bottom and shall continue until the entire depth of mixture is uniformly compacted by the method of compaction hereinafter specified as the "Density Control" method as indicated on the plans.

If the total thickness of the material to be treated cannot be mixed in one operation, the previously mixed material shall be bladed to a window just beyond the area to be treated and the next layer mixed with lime as specified in Section (C). The first layer of the treated material shall be compacted in such a manner that the treated material will not be mixed with the underlying material.

When the "Density Control" method of compaction is indicated on the plans the following provisions shall apply:

The course shall be sprinkled as required and compacted to the extent necessary to provide the density specified below as determined by the use of the compaction ratio method:

Description	(Standard Proctor)
For lime treated subgrade, existing subbase or existing base that will receive subsequent subbase, base course, or sand cushion.	Not less than 95 except when otherwise shown on plans.

In addition to the requirements specified for density, the full depth of the material shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section is completed, tests as necessary will be ordered by the Engineer. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these requirements. Throughout this entire operation the shape of the course shall be maintained by blading, and the surface upon completion shall be smooth and in conformity with the typical section shown on the plans and to the established lines and grades. Should the material, due to any reason or cause, lose the required stability, density, and finish before the next course is placed or the work is accepted, it shall be reprocessed and refinished at the expense of the Contractor.

3.02 FINISHING, CURING, & PREPARATION FOR SURFACING

After the final layer of the lime treated subgrade, subbase or base has been compacted, it shall be brought to the required lines and grades in accordance with the typical sections. The completed section shall then be finished by rolling as directed with a pneumatic tire or other suitable roller sufficiently light to prevent hairline cracking. The completed section shall be moist-cured for minimum of 7 days before further courses are added or any traffic is permitted, unless otherwise directed by the Engineer. In cases where

subgrade treatment or subbase sets up sufficiently to prevent objectionable damage from traffic, such layers may be opened to construction and/or access traffic, and covered by other courses, the day following compaction, unless otherwise directed by the Engineer. If the plans provide for the treated material to be sealed or covered by other courses of material, such seal or course shall be applied within 14 days after final mixing is completed, unless otherwise directed by the Engineer.

PART 4 MEASUREMENT AND PAYMENTS

Lime treatment of the subgrade, existing subbase, existing base, and salvage pavement and base shall be measured by the square yard to the lines shown on the typical sections.

When Type A Hydrated Lime is used, the quantity of lime shall be measured by the ton of 2,000 pounds, dry weight.

When Type B, Commercial Lime Slurry is used, the quantity of lime will be calculated from the required minimum percent solids based upon the use of Grade 1, Grade 2, or Grade 3 as follows:

- Grade 1: The "Dry Solids Content" shall be at least 31% by weight of the slurry and the quantity of lime will be calculated by the ton of 2,000 pounds based on the 31%, as delivered on the road.
- Grade 2: The "Dry Solids Content" shall be at least 35% by weight of the slurry and the quantity of lime will be calculated by the ton of 2,000 pounds based on the 35%, as delivered on the road.
- Grade 3: The "Dry Solids Content" shall be at least 46% by weight of the slurry and the quantity of lime will be calculated by the tone of 2,000 pounds based on the 46%, as delivered on the road.

END OF SECTION

SECTION 31 32 19.16

GEOTEXTILE

PART 1 GENERAL

1.01 REFERENCES

- A. The following is a list of standards that may be referenced in this section:
 - 1. ASTM International (ASTM):
 - a. D737, Standard Test Method for Air Permeability of Textile Fabrics.
 - b. D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
 - c. D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - d. D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - e. D4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
 - f. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - g. D4716, Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
 - h. D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
 - i. D4833, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
 - j. D4884, Standard Test Method for Strength of Sewn or Thermally Bonded Seams of Geotextiles.
 - k. D4886, Standard Test Method for Abrasion Resistance of Geotextiles (Sand Paper/Sliding Block Method).
 - 1. D5199, Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
 - m. D5261, Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
 - n. D6193, Standard Practice for Stitches and Seams.

1.02 DEFINITIONS

- A. Fabric: Geotextile, a permeable geosynthetic comprised solely of textiles.
- B. Maximum Average Roll Value (MaxARV): Maximum of series of average roll values representative of geotextile furnished.
- C. Minimum Average Roll Value (MinARV): Minimum of series of average roll values representative of geotextile furnished.

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D.	Nondestructive Sample: Sample representative of finished Work destruction of Work	, prepared for testing without

- E. Overlap: Distance measured perpendicular from overlapping edge of one sheet to underlying edge of adjacent sheet.
- F. Seam Efficiency: Ratio of tensile strength across seam to strength of intact geotextile, when tested according to ASTM D4884.

1.03 SUBMITTALS

- A. Action Submittals:
 - 1. Shop Drawings:
 - a. Manufacturer material specifications and product literature.
 - b. Installation drawings showing geotextile sheet layout, location of seams, direction of overlap, and sewn seams.
 - c. Description of proposed method of geotextile deployment, sewing equipment, sewing methods, and provisions for holding geotextile temporarily in place until permanently secured.
 - 2. Samples:
 - a. Geotextile: One-piece, minimum 18 inches long, taken across full width of roll of each type and weight of geotextile furnished for Project. Label each with brand name and furnish documentation of lot and roll number from which each Sample was obtained.
 - b. Field Sewn Seam: 5-foot length of seam, 12 inches wide with seam along center, for each type and weight of geotextile.
 - c. Securing Pin and Washer: One each.
- B. Informational Submittals:
 - 1. Certifications from each geotextile manufacturer that furnished products have specified property values. Certified property values shall be either minimum or maximum average roll values, as appropriate, for geotextiles furnished.
 - 2. Field seam efficiency test results.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver each roll with sufficient information attached to identify it for inventory and quality control.
- B. Handle products in manner that maintains undamaged condition.
- C. Do not store products directly on ground. Ship and store geotextile with suitable wrapping for protection against moisture and ultraviolet exposure. Store geotextile in way that protects it from elements. If stored outdoors, elevate and protect geotextile with waterproof cover.

1.05 SCHEDULING AND SEQUENCING

A. Where geotextile is to be laid directly upon ground surface, prepare subgrade as specified in Section 31 23 13, Subgrade Preparation, first.

B. Notify Engineer whenever geotextiles are to be placed. Do not place geotextile without Engineer's approval of underlying materials.

PART 2 PRODUCTS

2.01 NONWOVEN GEOTEXTILE

- A. Stabilization Geotextile The geotextile component of the MSL shall be TriAx TX5 or TX7 and shall be integrally formed and produced from a punched sheet of polypropylene, which is then oriented in three substantially equilateral directions. The resulting ribs shall have a high degree of molecular orientation, which continues at least in part through the mass of the integral nodes.
- **B.** The resulting geotextile structure shall have apertures that are triangular in shape, and shall have ribs with a depth-to-width ratio greater than 1.0.
- C. The geotextile shall have the nominal characteristics shown in the table below, and shall be certified in writing by the manufacturer to be the product shown on the contract drawings and incorporated in the MSL design by the Engineer:

TX5				
Properties	Longitudinal	Diagonal	Transverse	General
Rib pitch, mm (in)	40 (1.60)	40 (1.60)	-	
Mid-rib depth, mm (in)	-	1.3 (0.05)	1.2 (0.05)	
Mid-rib width, mm (in)	-	0.9 (0.04)	1.2 (0.05)	
Rib shape Aperture shape				rectangular triangular

TX7			
Longitudinal	Diagonal	Transverse	General
40 (1.60)	40 (1.60)	-	
-	2.0 (0.08)	1.6 (0.06)	
-	1.0 (0.04)	1.3 (0.05)	
			rectangular
	T2 Longitudinal 40 (1.60) - -	TX7 Longitudinal Diagonal 40 (1.60) 40 (1.60) - 2.0 (0.08) - 1.0 (0.04)	TX7 Diagonal Transverse 40 (1.60) 40 (1.60) - - 2.0 (0.08) 1.6 (0.06) - 1.0 (0.04) 1.3 (0.05)

B. Alternate Structural Soil Reinforcement Materials – Alternate structural soil reinforcement materials will be considered if submitted at least 15 days prior to bid letting in accordance with the following conditions:

- 1. Geotextile materials shall not be considered as an alternate to geotextile materials for subgrade improvement or base/subbase reinforcement applications. A geotextile may be used in the cross-section to provide separation, filtration or drainage; however, no structural contribution shall be attributed to the geotextile.
- 2. Alternate geotextile materials shall not be used unless submitted to and pre-approved in writing by the Engineer. Consideration of alternate geotextile products will not be evaluated based solely upon index and strength properties outlined in Section 2.02.A. In the event that material index properties of an alternate product do not satisfy the requirements set forward in this specification, then a separate design incorporating the alternate geotextile product must be submitted for approval by the Engineer. Submittal packages for alternate geotextile materials must be in the form of an engineered design certified by a licensed professional engineer. Submittal must include, but not limited to, the following items:
 - a. Design pavement/unpaved surface typical section including the alternate geotextile product
 - b. Letter summary of the alternate design describing the basis for design sealed by a licensed professional engineer.
 - c. Research documentation of relevant and comparable full-scale evidence which quantifies the performance of the alternate geotextile material with repetitive loading applied by a passing wheel load of at least 4,500 pounds per single wheel or 9,000 pounds per dual wheel.
 - d. A list of 5 comparable projects that are similar in terms of size and application, are located in the United States, and where the results of using the specific alternate geotextile material can be verified after a minimum of 1 year of service life.
 - e. A sample (meeting the requirements of sub-part 1.05A of this Section) of the alternate geotextile material and certified specification sheets.
 - f. Recommended installation instructions.

2.02 SECURING PINS

- A. Steel Rods or Bars:
 - 1. 3/16-inch diameter.
 - 2. Pointed at one end.
 - 3. With head on other end sufficiently large to retain washer.
 - 4. Minimum Length: 12 inches.
- B. Steel Washers for Securing Pins:
 - 1. Outside Diameter: Not less than 1.5 inches.
 - 2. Inside Diameter: 1/4 inch.
 - 3. Thickness: 1/8 inch.
- C. Steel Wire Staples:
 - 1. U-shaped.
 - 2. 10 gauge.
 - 3. Minimum Length: 6 inches.

PART 3 EXECUTION

3.01 LAYING GEOTEXTILE

A. Lay and maintain geotextile smooth and free of tension, folds, wrinkles, or creases.

3.02 SHEET ORIENTATION ON SLOPES

A. Orient geotextile with long dimension of each sheet parallel to direction of slope.

3.03 JOINTS

- A. Unseamed Joints:
 - 1. Overlapped as per manufacture recommendations.
- B. Sewn Seams: Made wherever stress transfer from one geotextile sheet to another is necessary. Sewn seams, as approved by Engineer, also may be used instead of overlap at joints for applications that do not require stress transfer.
 - 1. Seam Efficiency:
 - a. Minimum 70 percent.
 - b. Verified by preparing and testing minimum of one set of nondestructive Samples per acre of each type and weight of geotextile installed.
 - c. Tested according to ASTM D4884.
 - 2. Types:
 - a. Preferred: "J" type seams.
 - b. Acceptable: Flat or butterfly seams.
 - 3. Stitch Count: Minimum three to maximum seven stitches per inch.
 - 4. Stitch Type: Double-thread chainstitch according to ASTM D6193.
 - 5. Sewing Machines: Capable of penetrating four layers of geotextile.
 - 6. Stitch Location: 2 inches from geotextile sheet edges, or more, if necessary to develop required seam strength.

3.04 SECURING GEOTEXTILE

- A. Secure geotextile during installation as necessary with sandbags or other means approved by Engineer.
- B. Secure Geotextile with Securing Pins or Staples:
 - 1. Insert securing pins with washers through geotextile.
 - 2. Securing Pin Alignment:
 - a. Midway between edges of overlaps.
 - b. 6 inches from free edges.
 - 3. Spacing of Securing Pins:

Slope	Maximum Pin Spacing
Steeper than 3:1	2 feet
3:1 to 4:1	3 feet
Flatter than 4:1	5 feet

- 4. Install additional pins across each geotextile sheet as necessary to prevent slippage of geotextile or to prevent wind from blowing geotextile out of position.
- 5. Push each securing pin through geotextile until washer bears against geotextile and secures it firmly to subgrade.

6. Where staples are used instead of securing pins, install in accordance with alignment and spacing above. Push in to secure geotextile firmly to subgrade.

3.05 PLACING PRODUCTS OVER GEOTEXTILE

- A. Before placing material over geotextile, notify Engineer. Do not cover installed geotextile until after Engineer provides authorization to proceed.
- B. If tears, punctures, or other geotextile damage occurs during placement of overlying products, remove overlying products as necessary to expose damaged geotextile. Repair damage as specified in Article Repairing Geotextile.

3.06 INSTALLING GEOTEXTILE IN TRENCHES

- A. Place geotextile in a way to completely envelope granular drain material to be placed in trench and with specified overlap at joints. Overlap geotextile in direction of flow. Place geotextile in a way and with sufficient slack for geotextile to contact trench bottom and sides fully when trench is backfilled.
- B. After granular drain material is placed to required grade, fold geotextile over top of granular drain material, unless otherwise shown. Maintain overlap until overlying fill or backfill is placed.

3.07 REPAIRING GEOTEXTILE

- A. Repair or replace torn, punctured, flawed, deteriorated, or otherwise damaged geotextile.
- B. Repair Procedure:
 - 1. Place patch of undamaged geotextile over damaged area and at least 18 inches in all directions beyond damaged area.
 - 2. Remove interfering material as necessary to expose damaged geotextile for repair.
 - 3. Sew patches or secure them with heat fusion tacking or with pins and washers, as specified above in Article Securing Geotextile, or by other means approved by Engineer.

3.08 REPLACING CONTAMINATED GEOTEXTILE

A. Protect geotextile from contamination that would interfere, in Engineer's opinion, with its intended function. Remove and replace contaminated geotextile with clean geotextile.

END OF SECTION 31 32 19.16

SECTION 31 34 19.13 GEOGRID SOIL REINFORCEMENT

PART 1 GENERAL

1.01 DESCRIPTION

The geogrid shall be manufactured from a punched polypropylene sheet, which is then oriented in three substantially equilateral directions so that the resulting ribs have a high degree of molecular orientation, which continues at least in part through the mass of the integral node. For pavement sections, where indicated in the drawings, geogrid shall be placed between the finished subgrade and the crushed limestone aggregate base course.

1.02 MATERIALS

Geogrid Index Properties	Longitudinal	Diagonal	Transverse	General
Rib pitch	1.6 in.	1.60 in.	n/a	n/a
Mid-rib depth	n/a	0.06 in.	0.05 in.	n/a
Mid-rib width	n/a	0.04 in.	0.04 in.	
Rib shape	n/a	n/a	n/a	rectangular
Aperture shape.	n/a	n/a	n/a	triangular

Products: TriAx TX5 Geogrid by Tensar International, or approved equal.

1.03 CONSTRUCTION METHODS

Subgrade shall be lime-treated, compacted, shaped and approved by the engineer. Geogrid shall be placed flat upon approved subgrade in strict accordance with manufacturer's recommendations. Adjoining geogrid mats shall be overlapped by a minimum 24 inches. Crushed limestone aggregate base course materials shall be placed and compacted directly upon the geogrid mats.

END OF SECTION 31 34 19

SECTION 32 01 00 PAVEMENT REPAIR AND RESURFACING

PART 1 GENERAL

- 1.01 SECTION INCLUDES
 - A. Repairing and resurfacing streets, highways, driveways, sidewalks, and other pavements that have been cut, broken, or otherwise damaged during construction.

1.02 DELETED

PART 2 PRODUCTS

2.01 MATERIALS

- A. Subgrade:
 - Provide backfill material as required by applicable excavation and fill sections of Section 31 23 16.16 - Excavation & Backfill for Structures
 - Provide material for stabilization as required by applicable portions of Section 32 11 13.13 - Lime Treatment for Subgrade and Section 32 11 33 - Cement-Treated Base Courses.
- B. Base: Provide base material as required by applicable portions of Section 32 12 16.13 Hot Mix Asphaltic Concrete and Section 32 11 23 - Crushed Limestone Flexible Base.
- Pavement: Provide paving materials as required by applicable portions of Section 32 12
 16.13 Hot Mix Asphaltic Concrete, Section 32 13 13 Concrete Paving and Section 32 16
 00 Concrete Curb and Gutter, Driveways, and Sidewalks.

PART 3 E X E C U T I O N

3.01 PREPARATION

- A. Conform to requirement of Section 02 41 00 Demolition, for removals existing pavements and structures.
- B. Saw cut pavement 18 inches wider than width of trench needed to install utilities unless otherwise indicated on Drawings.
- C. Protect edges of existing pavement to remain from damage during removals, utility placement, backfill, and paving operations. For concrete pavement, leave and protect minimum of 18 inches of undisturbed subgrade on each side of trench to support replacement slab.

3.02 INSTALLATION

- A. Parking Areas, Service Drives, Driveways, and Sidewalks: Replace with material equal to or better than existing or as indicated on Drawings. Conform to applicable requirements of sections referenced in Paragraph 2.01, Materials.
- B. Street Pavements and Curbs, Curbs and Gutters: Replace subgrade, base, and surface course with like materials or as indicated on Drawings. Curbs and curbs and gutters shall match existing. Conform to requirements of sections referenced in Paragraph 2.01, Materials.
- C. For concrete pavement, install size and length of reinforcing steel and pavement thickness indicated on Drawings. Place types and spacing of joints to match existing or as indicated on Drawings.

- D. Where existing pavement consists of concrete pavement with asphaltic surfacing, resurface with minimum 2-inch depth asphaltic pavement.
- E. Repair State highway crossings in accordance with TxDOT permit and within 1 week after utility work is installed.
- 3.03 WASTE MATERIAL DISPOSAL
 - A. Dispose of waste material in accordance with local and state laws and the responsibility of the Contractor.
- 3.04 PROTECTION
 - A. Maintain pavement in good condition until completion of the Work.
 - B. Replace damaged pavement.

END OF SECTION 32 01 00

Section 32 11 23

AGGREGATE BASE COURSES (Crushed Limestone Flexible Base)

PART 1 GENERAL

1.01 DESCRIPTION

This item shall govern the materials, placement compaction of Crushed Limestone Base to the lines and grades that are shown on the construction drawings. Crushed Limestone Base thickness for various pavement types are shown on the plans.

1.02 MATERIAL

- 1. The flexible base shall be Type A Grade 1 by the Texas Department of Transportation "Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges 2014", Item 247. Meeting in the following requirement:
- 2. Triaxial Class 1: Min. compressive strength, 45 psi at 0 psi lateral pressure and 175 psi at 15 psi lateral pressure.

RETAINED ON SQUARE SIEVE NUMBER	PERCENT RETAINED
1-3/4" (44 mm)	0
7/8" (22.23 mm)	10-35
3/8" (9.5 mm)	30-50
NUMBER 4 (4.75 mm)	45-65
NUMBER 40 (0.425mm)	70-85

Material passing the Number 40 Sieve shall be known as "Binder Materials" and shall meet the following requirements:

Maximum Liquid Limits (L.L)	=	35
Maximum Plasticity Index (P.I.)	=	10
Wet Ball Mill (max)	=	40
California Bearing Ratio (min.)	=	100

All aggregate retained on the Number 10 Sieve shall be comprised of only crushed limestone.

The Contractor shall not place crushed limestone on the road bed until the Engineer has accepted the shaped and compacted subgrade.

The Contractor must maintain the roadbed free of holes, ruts and depressions and in condition to receive the crushed limestone.

The Contractor upon request shall provide certification that the material supplied meets the above requirements prior to delivery to the job site. Samples for testing of the material must be taken prior to the compaction operations.

1.03 CONSTRUCTION METHODS

The flexible base material shall be placed on the approved subgrade in courses not to exceed six (6) inches compacted depth. It shall be the responsibility of the contractor that the required amount of material be delivered and uniformly spread and shaped. All materials has been cut into the windrows, it shall be sprinkled, spread, shaped, and rolled in proper sequence to prevent segregation and as necessary for required compaction.

The surface on completion shall be smooth and in conformity with typical sections and to the established lines and grades. Any deviation in excess of 1/4 inch in cross-section and in length of 16 feet measured longitudinally shall be corrected.

Flexible base shall be compacted to an apparent dry density of not less than 98 percent of the maximum dry density as determined in accordance with A.S.T.M. Test method D698 (Standard Proctor). Tests for density will be made within 24 hours after compaction operations are completed. If the material fails to meet the density specified, it shall be reworked as necessary to meet the density required. Prior to placing any succeeding course of flexible base or surfacing on a previously completed course the density and moisture of the top three (3) inches of flexible base shall be checked and if the tests show the density to be more than 2 percent below the specified compaction and moisture content, it shall be reworked as necessary the density and moisture required.

The first density and depth test at a specific location will be made by commercial testing laboratory designated by the Owner and said tests shall be paid for the Owner. If the test fails, all other tests at the location shall be paid for by the Contractor, by deducting from the final payment.

END OF SECTION

Section 32 11 23.1 FLEXIBLE BASE TYPE A GRADE 2 (CALICHE)

PART 1 GENERAL

1.01 DESCRIPTION

The work covered by this section consists of the hauling, placing, spreading, sprinkling, shaping, and compaction of Flexible Base Material on the approved subgrade in accordance with specification requirements herein outlined and in conformity with the required lines, grades, and typical cross sections shown on the plans.

PART 2 PRODUCTS

2.01 MATERIAL

- (A) Flexible Base: The flexible base shall be Type A Grade 2 by the Texas Department of Transportation "Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges 2004", Item 247. Meeting in the following requirement:
 - 1). Triaxial Class 1 to 2.3 Min. compressive strength 35 at 0 psi lateral pressure and 175 at 15 psi lateral pressure.

2).	Gradation		
	Retained on 2 ¹ / ₂ " sieve	0%	
	1 3/4 sieve	0% to 10%	
	Retained on #4 sieve (4.75 mm)	45% to 75%	
	Retained on #40 sieve (0.425 mm)	60% to 85%	
	Maximum Liquid Limit	40	
	Maximum Plastic Index	12	

- 3). Shall have a minimum "CBR" of 50 when tested in accordance to ASTM D-1883. Flexible base will be sampled at work site.
- 4). Wet Ball Mill (Tex-116-E) maximum 45%, Wet Ball Mill 20% maximum increase passing the No. 40 sieve.

PART 3 EXECUTION

3.01 CONSTRUCTION METHODS

Immediately before placing the base material, the subgrade shall be check as to conformity with grade and section.

The material shall be delivered in approved vehicles of a uniform capacity and it shall be the charge of the Contractor that the required amount of specified material shall be delivered in each

100-foot station. Material deposited upon the subgrade shall be spread and shaped the same day, unless otherwise directed by the Engineer in writing. In the event inclement weather or other unforeseen circumstances render impractical the spreading of the material during the first 24-hour period, the material shall be scarified and spread as direct by the Engineer. The material shall be sprinkled, if directed, and shall then be bladed, dragged and shaped to conform to typical section as shown on the plans. All areas and "nests" of segregated course or fine material shall be corrected or removed and replaced with well graded material, as directed by the Engineer. If additional binder is considered desirable or necessary after the material is spread and shaped, it shall be furnished and applied in the amount directed by the Engineer. Such binder material shall be carefully and evenly incorporated with the material in place by scarifying, harrowing, brooming, or by other approved methods.

The course shall be sprinkled as required and compacted to the extent necessary to provide not less than the present density as hereinafter specified in the Plans. In addition to the requirements specified for density, the full depth of flexible base shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section of flexible base is completed, tests as necessary will be made by the Engineer. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these requirements. Throughout this entire operation the shape of the course shall be maintained by blading, and the surface upon completion shall be smooth and in conformity with the typical sections shown on the plans and to the established lines and grades. In that area on which pavement is to be placed, any deviation in excess of 1/4 inch in cross section and in a length of 12 feet measured longitudinally shall be corrected by loosening, adding, or removing material, reshaping and recompacting by sprinkling and rolling. All irregularities, depressions, or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding suitable by sprinkling and rolling. Should the base course, due to any reason or cause, lose the required stability, density, and finish before the surfacing is complete, it shall be recompacted and refinished at the sole expense of the Contractor.

PART 4 MEASUREMENT AND PAYMENTS

"Flexible Base" will be measured by the square yard, complete in place as planned, detailed, and specified. This item will be paid for at the Contract Unit Price Bid for "Flexible Base", which prices shall include full compensation for all materials, equipment, tools, labor, and any incidentals necessary to complete the work.

END OF SECTION

Section 32 12 16

ASPHALTIC PAVING (Hot Mix Asphaltic Concrete Pavement)

PART 1 GENERAL

1.01 DESCRIPTION

This item shall consist of a base course, a leveling-up course, a surface course, or any combination of these courses as shown on the plans, each to be composed of a compacted mixture of mineral aggregate and asphaltic material.

The pavement shall be constructed on the previously completed and approved subgrade, base, existing pavement, bituminous surface or in the case of a bridge, on the prepared floor slab, as herein specified and in accordance with the details shown on the plans.

1.02 MATERIAL

Hot Mix Asphaltic Concrete, Type "D" (Fine graded surface course) (Modified). The hot mix asphaltic concrete shall conform to the requirements of the Texas State Department of Highway & Special Provisions 340-115, with anti-stripping agent in accordance with Special Specifications Item 3373. The successful bidder shall submit an asphalt mix design within thirty (30) days prior to installation from a geotechnical laboratory demonstrating that the hot mix asphaltic concrete to be used meets these specifications. The asphalt to be used shall be A.C. 20. Special Modifications to Standard Specification Item 2\340, for this project are as follows:

1. Asphalt Content. Asphaltic Material (AC-20) shall form from 5.0 to 8.0 percent of the mixture by weight.

2. Retained Stability. The paving mixture shall have a retained stability of not less than 70 percent when tested in accordance with ASTM Standard Procedure D1075.

- 3. Hveem Stability. Hveem stability shall not be less than 30.
- 4. Aggregate retained on No. 10 Sieve shall be 100% Crushed Limestone.

Tack Coat. "Tack Coat" shall consist of an application of asphaltic material on the existing pavement in accordance with these specifications as directed by the Inspector. The asphalt material for tack coat shall meet the requirement for Cut-Back Asphalt, RC-250, Item 300, "Asphalt, Oils, and Emulsions" of the Texas Highway Department Standard Specifications 2014 Edition.

Phase 1 Olmito Park	Olmito, TX
Land Development	11/10/2023

"Prime Coat" shall consist of an application of asphaltic material on the completed base course and/or other approved areas in accordance with these specifications as directed by the Inspector. The asphalt material for prime coat shall meet the requirement for Cut-Back Asphalt, MC-30, Item 300, "Asphalt, Oils, and Emulsions" of the Texas Highway Department Standard Specifications 2014 Edition.

1.03 CONSTRUCTION METHODS

For Hot Mix Asphaltic Concrete Pavement being placed on Flexible Base Material: When the area and/or base is satisfactory to receive the prime coat, the surface shall be cleaned by sweeping or other approved methods as directed by the Inspector. If directed by the Inspector, the surface shall be lightly sprinkled with water just prior to application of the asphaltic material. The asphaltic material shall be applied on the clean surface by an approved distributor at a rate of 0.2 gallons per square yard of surface, evenly, and smoothly, under a pressure necessary for proper distribution.

For Hot Mix Asphaltic Concrete Pavement being placed on Existing HMAC Material: When the existing pavement is satisfactory to receive the tack coat, the surface shall be cleaned by sweeping or other approved methods as directed by the Inspector. The asphaltic material shall be applied on the clean surface by an approved distributor at a rate not to exceed 0.11 or below 0.05 gallons per square yard of surface, evenly, and smoothly, under a pressure necessary for proper distribution.

During the application of Prime and Tack coat, care shall be taken to prevent splattering of adjacent curb and gutter or structures. Prime and Tack coat shall not be applied when the air temperature is below 60°F and falling, but may be applied when the air temperature is about 50°F and is rising; the air temperature being taken in the shade and away from artificial heat. Asphaltic material shall not be placed when general weather conditions, in the opinion of the Inspector, are not suitable.

Construction methods used in Hot Mix Asphaltic Concrete Pavement shall meet the requirements as set forth in Item 340 "Hot Mix Asphaltic Concrete Pavement" of the DHPT Standard Specification, with the following additions:

If the temperature of the asphaltic mixture of a load of any part of a load becomes less than 225°F or more than 350°F after being dumped from the mixer and prior to passing through the lay-down machine, all or any part of the load may be rejected.

1. Transporting Asphaltic Concrete. The asphaltic mixture, prepared as specified above, shall be hauled to the work in tight vehicles previously cleaned of all foreign material. The dispatching of the vehicles shall be arranged so that all material delivered may be places, and all rolling shall be completed during daylight hours. In cool weather or for long hauls, canvas covers and insulating of the truck bodies may be required. The inside of the truck body may be given a light coating of oil, lime slurry, or other material satisfactory to the Engineer, if necessary, to prevent mixture from adhering to the body.
- 2. Placing
 - a. Generally, the asphaltic mixture shall be dumped and spread on the approved prepared surface with specified spreading and finishing machine, in such manner that when properly compact the finished pavement will be smooth, of uniform density and will meet the requirements of the typical cross sections and the surface tests. During the application of asphaltic material, care shall be taken to prevent splattering of adjacent pavement, curb, gutter and structures.
 - b. In placing a level-up course with the spreading and finishing machine, binder twine or cord shall be set to line and grade established by the Engineer. If approved by the Engineer, level-up courses may be spread with a motor grader.
 - c. When the asphaltic mixture is placed in a narrow strip along the edge of an existing pavement, or used to level up small areas of an existing pavement or placed in small irregular areas where the use of a finishing machine is not practical, the finishing machine may be eliminated when authorized by the Engineer, provided a satisfactory surface can be obtained by other approved methods.
 - d. Flush Structures. Adjacent to flush curbs, gutters, liners, and structures, the surface shall be finished uniformly high so that when compacted it will be slightly above the edge of the curb or flush structure.
- 3. Conditions for Placement. The asphaltic mixture when placed with a spreading and finishing machine, shall not be placed when the air temperature is below 50°F and is falling, but it may be when the air temperature is above 50°F and is rising. The air temperature shall be taken in the shade away from artificial heat. It is further provided that the asphaltic mixture shall be placed only when the humidity, general weather conditions, and temperature and moisture conditions of the base, in the opinion of the Engineer, are suitable.
- 4. Compacting
 - a. Rolling with the three wheel and tandem rollers shall start longitudinally at the sides and proceed toward the center of the pavement, overlapping on successive trips by at least half the width of the rear wheel unless otherwise directed by the Engineer. Alternative trips of the roller shall be slightly different in length. On super-elevated curves, rolling shall begin at the low side and progress toward the high side unless otherwise directed by the Engineer. Rolling with pneumatic-tire roller shall be done as needed. Rolling shall be continued until no further compression can be obtained and all roller makers are eliminated. One tandem roller, one pneumatic-tire roller and at least one three wheel roller as specified

Phase 1 Olmito Park	Olmito, TX
Land Development	11/10/2023

above shall be provided for each job. If the Contractor elects, he may substitute the three axle tandem roller for the two axle tandem roller and/or the three when roller; but in no case shall less than three rollers be in use on each job. Additional rollers shall be provided if needed. The motion of the roller shall be slow enough at all times to avoid displacement of the mixture. If any displacement occurs, it shall be corrected at once by the use of rakes and of fresh mixtures when required. The roller shall not be allowed to stand on pavement which has not been fully compacted. To prevent adhesion of the surface mixture to the roller, the wheels shall be kept thoroughly moistened with water, but an excess of water will not be permitted. All rollers must be in good mechanical condition. Necessary precautions shall be taken to prevent the dropping of gasoline, oil, grease, or other foreign matter on the pavement, either when the rollers are in operation or when standing.

In lieu of the rolling equipment specified, the Contractor may, upon written permission from the Engineer, operate other compacting equipment that will produce equivalent relative compaction as the specified equipment. If the substituted compaction equipment fails to produce the desired compaction as would be expected of the specified equipment, as determined by the Engineer, its use shall be discontinued.

b. Hand Tamping. The edges of the pavement along curbs, headers, and similar structures, and all places not accessible to the roller, or in such positions as will not allow thorough compaction may be compacted using lightly oiled tamps.

5. Opening to Traffic. The pavement shall be opened to traffic when directed by the Engineer. The Contractor's attention is directed to the fact that all construction traffic allowed on pavement open to public will be subject to the laws governing traffic on Public Roads and Streets.

If the surface ravels or presents a rough appearance, it will be the Contractor's responsibility to correct this condition at his expense. A fog seal and/or sand seal will be applied.

6. Density Test. Acceptance Sampling and Testing of Hot Mix Asphaltic Concrete (Compaction):

Hot Mix Asphaltic Concrete will be accepted for density on a lot basis. A lot will consist of 500 feet of one paving street. One test shall be made for each lot.

Each lot of pavement will be accepted, with respect to density, when the average field density is equal to or greater than 92% of the average maximum theoretical density as determined in accordance with ASTM D2725, and when no individual determination is less than 90% of the average maximum theoretical density. Four field density determinations

Phase 1 Olmito Park	Olmito, TX
Land Development	11/10/2023

will be made for each lot. The number of tests will be determined by this specification or by request of the engineer. An asphalt sample specimen shall be provided to the testing laboratory for determining the maximum theoretical density. If heating is necessary, the specimen shall be heated to the lowest temperatures required for proper preparation of the sample.

TABLE 8SLIDING SCALE PAY FACTORS(DENSITY BASED ON PERCENT OF MAXIMUM THEORETICAL)

AVERAGE PERCENT DENSITY

RECOMMENDED PERCENT PAYMENT

92% or Above	100
90.0 - 91.9	90 **
Below 90.0	Reject ***

- * Average of 4 samples
- ** If the Owner agrees to accept densities between 90.0-91.9% a seal coat will be required at the costs of the contractor.
- *** If the Owner agrees to accept densities below 90.0%, the pay factor for density shall be 50%.
- 7. Surface Tests. Tests for conformity with the specified crowns and grade shall be made by the Contractor immediately after final rolling. Any variation exceeding the specified tolerances shall immediately be corrected by removing the defective work and replacing with new material, as directed by the Engineer. Any correction required shall be at the sole expense of the Contractor.

For surface course, the finished surface shall not very more than 1/4 inch (6.3mm), when tested with a 16 foot straightedge applied parallel with, or at right angles to, the centerline.

The finished surfaces of hot mix asphaltic concrete shall not vary from the gradeline, elevations and cross sections shown on the plans by more than 1/2 inch (12.7 mm). The Contractor shall correct pavement areas varying in excess of this amount by removing and replacing the defective work. Skin patching shall not be permitted for correction of low areas nor shall be permitted for correction of high areas.

8. Sampling Pavement. Samples for determination of thickness and density of completed pavements shall be obtained by the Owner. The size, number, and locations of the samples will be as directed by the Engineer.

All tests necessary to determine conformance with the specified requirements will be performed without cost to the Contractor; however, any required retests shall be performed at the Contractor's cost.

Upon delivery of the Hot Mix Asphaltic Concrete to the site, the Owner will hire a reputable commercial testing laboratory to sample the material and run laboratory tests to verify that the mixture conforms to project specifications (Gradation, Extraction, Hveem Stability and Retained Stability).

END OF SECTION

Section 32 13 13

CONCRETE PAVEMENT

PART 1 GENERAL

1.01 DESCRIPTION

This specification covers the requirements for concrete pavement. Concrete shall be composed of portland cement concrete and shall be placed in accordance with the lines and grades established by the Engineer and in conformance with the details shown on the plans.

1.02 PRODUCTS

- a. SAND BEDDING : Bedding material shall be placed over approved, limed subgrade, as specified in the drawing details. Sand shall be Bank Run Sand or River Sand, as follows: Durable bank run sand classified as SP, SW, or SM by the Unified Soil Classification System (ASTM D 2487) meeting the following requirements:
 - 1. Less than 15 percent passing the number 200 sieve when tested in accordance with ASTM D 1140. The amount of clay lumps or balls not exceeding 2 percent.
 - 2. Material passing the number 40 sieve shall meet the following requirements when tested in accordance with ASTM D 4318:
 - a. Liquid limit: not exceeding 25 percent.
 - b. Plasticity index: not exceeding 7.

Contractor shall provide reports to the Owner and the Engineer from an independent testing laboratory that backfill materials to be placed in the Work meet applicable specification requirements. Contractor shall assist Owner, Owner's representative and Testing Lab in obtaining samples, from the delivered materials, for verification testing.

b. CONCRETE: Concrete shall conform to the details in the plans except as otherwise specified. Concrete shall have a minimum compressive strength of 4000 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches. In climates where freezing is not a factor but where air entrainment is used in local commercial practice to improve the workability and place ability of concrete, concrete having air content percent of 4-1/2 plus or minus 1-1/2 percent may be specified as Contractor's option to non air-entrained concrete. Mixtures may have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer. The desired slump will be inserted. Suggested limits are 3 inches plus or minus 1 inch for hand placed concrete or

for slip formed concrete. The concrete slump shall be 3 inches where determined in accordance with ASTM C 143.

c. REINFORCING STEEL: Provide Grade 60 deformed steel for bar reinforcement in accordance with TXDOT Item 440, "Reinforcing Steel." Provide approved positioning and supporting devices (baskets and chairs) capable of securing and holding the reinforcing steel in proper position before and during paving. Provide corrosion protection when shown on the plans.

DOWELS: Provide smooth, straight dowels of the size shown on the plans, free of burrs, and conforming to the requirements of Item 440, "Reinforcing Steel." Coat dowels with a thin film of grease or other approved de-bonding material. Provide dowel caps on the lubricated end of each dowel bar used in an expansion joint. Provide dowel caps filled with a soft compressible material with enough range of movement to allow complete closure of the expansion joint.

Tie Bars. Provide straight deformed steel tie bars. Provide either multiple-piece tie bars or single-piece tie bars as shown on the plans. Provide multiple-piece tie bars composed of 2 pieces of deformed reinforcing steel with a coupling capable of developing a minimum tensile strength of 125% of the design yield strength of the deformed steel when tensile-tested in the assembled configuration. Provide a minimum length of 33 diameters of the deformed steel in each piece. Use multiple-piece tie bars from the list of "Prequalified Multiple Piece Tie Bar Producers" maintained by the Construction Division, or submit samples for testing in accordance with Tex-711-I

d. JOINT FILLER STRIPS & SEALANTS: Expansion Joints at maximum 40 foot spacing. Expansion joint filler shall consist of hard-pressed fiberboard. Joint sealant, cold-applied shall be a rubberized asphalt sealant or equal approved by the engineer.

1.03 CONSTRUCTION METHODS

Placing During Warm Weather: The temperature of the concrete as placed shall not exceed 100 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing air temperature exceed 103 degrees F.

FORM WORK: Form work shall be designed and constructed to insure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 2-inch nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 -12 feet. Radius bends may be formed with 3/4-inch boards,

CONCRETE PAVEMENT

laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 10 feet with a minimum of two welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

FORM SETTING: Forms shall be carefully set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of three stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to insure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory. Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10-foot long section. After forms are set, grade and alignment shall be checked with a 10-foot straightedge. Forms shall have a transverse slope [as indicated] 1/4-inch per foot with the low side adjacent to the roadway. Side forms shall not be removed for 18 hours after finishing has been completed.

CONCRETE PLACEMENT AND FINISHING: Concrete shall be placed in the forms in one layer of such thickness that when consolidated and finished the sidewalks will be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a wood float, bull float, or darby, edged and broom finished. After straight edging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic. All slab edges, including those at formed joints, shall be finished carefully with an edger having a radius of 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished. All slab edges, including those at formed joints, shall be sealed with a rubberized asphalt sealant to control

water damage to the subgrade and control of weed and grass growth in the edges and joints.

Tolerances: Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch.

Contraction Joints: Maximum 10' spacing. The contraction joints (dummy joints) shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8-inch blade to the depth indicated. Isolation-joint filler will be required between curbs that abut the sidewalk longitudinally. Joint filler in contraction joints surrounding structures and features within the pavement may consist of preformed filler material conforming to ASTM D 1752 or building paper. Isolation joints shall be formed with 3/4 inch fiber board with 3/4 inch joint tack strips. At the end of the curing period, contraction joints shall be carefully cleaned and filled with rubberized asphalt sealant or equal approved by the engineer.

CURING AND PROTECTION: Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

Protection: Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

FIELD QUALITY CONTROL: The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

Strength Testing: The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 150 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31 by an approved testing laboratory. Each strength test result shall be the average of two test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. At least one concrete cylinder should be made to determine an early 7 day strength so further construction can be conducted. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test result falls below the specified strength by more than 500 psi.

Slump Test: One slump tests shall be made on randomly selected batches of each class of concrete for every 150 cubic yards, or fraction thereof, of concrete placed during each shift. All slump tests are to be done on the middle third of the concrete within the concrete truck. Additional tests will be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noticed along the edges of slip-formed concrete. Additional tests can be requested by the engineer or the testing laboratory at any time of the concrete job.

Surface Evaluation: The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks. Exposed surfaces of the finished work will be inspected by the Engineer and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

1.04 MEASUREMENT & PAYMENT

Unless prescribed elsewhere in the Contract documents, Unit Prices as follows:

Payment of the quantities of reinforced concrete pavement measured as specified will be at the contract unit price per square foot of the thickness specified.

END OF SECTION

CONCRETE PAVEMENT

SECTION 32 16 00

CONCRETE CURBS, GUTTERS, DRIVEWAYS & SIDEWALKS

PART 1 GENERAL

1.01 DESCRIPTION

This guide specification covers the requirements for concrete sidewalks, driveways, and concrete curbs and gutters. Concrete shall be composed of portland cement concrete in accordance with the lines and grades established by the Engineer and in conformance with the details shown on the plans.

1.02 PRODUCTS

CONCRETE: Concrete shall conform to the details in the plans except as otherwise specified. Concrete shall have a minimum compressive strength of 3000 psi at 28 days. Maximum size of aggregate shall be 1-1/2 inches. In climates where freezing is not a factor but where air entrainment is used in local commercial practice to improve the workability and place ability of concrete, concrete having air content percent of 4-1/2 plus or minus 1-1/2 percent may be specified as Contractor's option to non air-entrained concrete. Mixtures may have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer. The desired slump will be inserted. Suggested limits are 3 inches plus or minus 1 inch for hand placed concrete or for slip formed concrete. The concrete slump shall be 3 inches where determined in accordance with ASTM C 143.

JOINT FILLER STRIPS & SEALANTS: Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard. Joint sealant, cold-applied shall be a rubberized asphalt sealant or equal approved by the engineer.

1.03 CONSTRUCTION METHODS

Placing During Warm Weather: The temperature of the concrete as placed shall not exceed 100 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing air temperature exceed 103 degrees F.

FORM WORK: Form work shall be designed and constructed to insure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 2-inch nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 10 -12 feet. Radius bends may be formed with 3/4-inch boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a **nominal** length of 10 feet with a minimum of two welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

Concrete Curb and Gutter, Driveways, and Sidewalks

FORM SETTING: Forms shall be carefully set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of three stakes per form placed at intervals not to exceed 4 feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to insure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory. Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 1/8 inch in any 10-foot long section. After forms are set, grade and alignment shall be checked with a 10-foot straightedge. Forms shall have a transverse slope [as indicated] 1/4-inch per foot with the low side adjacent to the roadway. Side forms shall not be removed for 18 hours after finishing has been completed.

CONCRETE PLACEMENT AND FINISHING: Concrete shall be placed in the forms in one layer of such thickness that when consolidated and finished the sidewalks will be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a wood float, bull float, or darby, edged and broom finished. After straight edging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic. All slab edges, including those at formed joints, shall be finished carefully with an edger having a radius of 1/8 inch. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished. All slab edges, including those at formed joints, shall be sealed with a rubberized asphalt sealant to control water damage to the subgrade and control of weed and grass growth in the edges and joints. Tolerances: Finished surfaces shall not vary more than 1/4 inch from the testing edge of a 10-foot straightedge. Permissible deficiency in section thickness will be up to 1/4 inch. Expansion Joints: The Expansion joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8-inch blade to the depth indicated. Isolation-joint filler will be required between curbs that abut the sidewalk longitudinally. Joint filler in expansion joints surrounding structures and features within the sidewalk may consist of performed filler material conforming to ASTM D 1752 or building paper. Isolation joints shall be formed with 3/4 inch fiber board with 3/4 inch joint tack

Phase 1 Olmito Park	Olmito, TX
Land Development	11/10/2023

strips. At the end of the curing period, expansion joints shall be carefully cleaned and filled with joint sealer.

CURING AND PROTECTION: Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

Protection: Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

FIELD QUALITY CONTROL: The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

Strength Testing: The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 150 cubic yards of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31 by an approved testing laboratory. Each strength test result shall be the average of two test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. At least one concrete cylinder should be made to determine an early 7 day strength so further construction can be conducted. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 500 psi.

Slump Test: One slump tests shall be made on randomly selected batches of each class of concrete for every 150 cubic yards, or fraction thereof, of concrete placed during each shift. All slump tests are to be done on the middle third of the concrete within the concrete truck. Additional tests will be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noticed along the edges of slip-formed concrete. Additional tests can be requested by the engineer or the testing laboratory at any time of the concrete job.

Surface Evaluation: The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks. Exposed surfaces of the finished work will be inspected by the Engineer and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

END OF SECTION

SECTION 32 17 23.13 – PAINTED PAVEMENT PARKINGS (*ITEM 666 - TxDOT 2004 - REFLECTORIZED PAVEMENT MARKINGS*)

666.1. Description. Furnish and place reflectorized pavement markings.

666.2. Materials.

- A. Type I Marking Materials. Furnish in accordance with DMS-8220, "Hot Applied Thermoplastic."
- **B. Type II Marking Materials.** Furnish in accordance with DMS-8200, "Traffic Paint." (Contains chlorinated rubber. Do not use water-based material).
- C. Glass Traffic Beads. Furnish drop-on glass beads conforming to DMS-8290, "Glass Traffic Beads."
 - 1. **Type I Markings.** Furnish Type III drop-on glass beads. Furnish Type II or double-drop of Type II and Type III drop-on glass beads where each type bead is applied separately in equal portions (by weight), only when specified in the plans. When furnishing a double-drop system, apply the Type III beads before applying the Type II beads.
 - 2. Type II Markings. Furnish Type III drop-on glass beads or other beads specified on the plans.
- **D.** Labeling. Use clearly marked containers that indicate color, mass, material type, manufacturer, and batch number.

666.3. Equipment.

- A. General Requirements. Use equipment that:
 - is maintained in satisfactory condition,
 - meets or exceeds the requirements of the National Board of Fire Underwriters and the RRC for this application,
 - uses an automatic bead dispenser attached to the pavement marking equipment, and
 - can provide continuous mixing and agitation of the pavement marking material.

Provide a hand-held thermometer capable of measuring the temperature of the marking material when applying Type I material.

B. Material Placement Requirements. Use equipment that can place:

- at least 40,000 ft. of 4-in. solid or broken markings per day at the specified thickness;
- linear markings up to 8 in. wide in a single pass;
- markings other than solid or broken lines;
- a center-line and no-passing barrier-line configuration consisting of 1 broken line with 2 solid lines at the same time to the alignment, spacing, and thickness shown on the plans, for 3-line application;
- white line from both sides;
- lines with clean edges, uniform cross section and thickness, and reasonably square ends;

- skip lines between 10 and 10-1/2 ft., an approximate stripe-to-gap ratio of 1 to 3, and a stripe-gap cycle between 39-1/2 ft. and 40-1/2 ft., automatically;
- beads uniformly and almost instantly on the marking as the marking is being applied;
- beads uniformly during the application of all lines (each line must have an equivalent bead yield rate and embedment); and
- double-drop bead applications using both Type II and Type III beads from separate independent bead applicators, if double-drop bead application is used.

666.4. Construction. Place markings before opening to traffic unless short-term or work zone markings are allowed.

A. General. Obtain approval for the sequence of work and estimated daily production. On roadways already open to traffic, place markings with minimal interference to the operations of that roadway. Use traffic control as shown on the plans or as approved. Protect all markings placed under open-traffic conditions from traffic damage and disfigurement.

Establish guides to mark the lateral location of pavement markings as shown on the plans or as directed, and have guide locations verified. Use material for guides that will not leave a permanent mark on the roadway.

Apply markings on pavement that is completely dry and passes the following tests:

- Type I Marking Application—Place a sample of Type I marking material on a piece of tarpaper placed on the pavement. Allow the material to cool to ambient temperature, and then inspect the underside of the tarpaper in contact with the pavement. Pavement will be considered dry if there is no condensation on the tarpaper.
- Type II Marking Application—Place a 1-sq. ft. piece of clear plastic on the pavement, and weight down the edges. The pavement is considered dry if, when inspected after 15 min., no condensation has occurred on the underside of the plastic.

Apply markings:

- that meet the requirements of Tex-828-B,
- using widths and colors shown on the plans,
- at locations shown on the plans,
- in proper alignment with the guides without deviating from the alignment more than 1 in. per 200 ft. of roadway or more than 2 in. maximum,
- without abrupt deviations,
- free of blisters and with no more than 5% by area of holes or voids,
- with uniform cross section and thickness,
- with clean and reasonably square ends,
- that are reflectorized, and
- using personnel skilled and experienced with installation of pavement markings.

Remove all applied markings that are not in alignment or sequence as stated in the plans or as stated in the specifications at the Contractor's expense in accordance with Item 677, "Eliminating Existing Pavement Markings and Markers," except for measurement and payment.

- **B.** Surface Preparation. Unless otherwise shown on the plans, prepare surfaces in accordance with this section.
 - 1. Cleaning for New Asphalt Surfaces and Retracing of All Surfaces. For new asphalt surfaces (less than 3 years old) and retracing of all surfaces, air-blast or broom the pavement

surface to remove loose material, unless otherwise shown on the plans. A sealer for Type I markings is not required unless otherwise shown on the plans.

- 2. Cleaning for Old Asphalt and Concrete Surfaces (Excludes Retracing). For old asphalt surfaces (more than 3 years old) and all concrete surfaces, clean in accordance with Item 678, "Pavement Surface Preparation for Markings," to remove curing membrane, dirt, grease, loose and flaking existing construction markings, and other forms of contamination.
- 3. Sealer for Type I Markings. For asphalt surfaces more than 3 years old or for concrete, apply a pavement sealer before placing Type I markings on locations that do not have existing markings, unless otherwise approved. The pavement sealer may be either a Type II marking or an acrylic or epoxy sealer unless otherwise shown on the plans. Follow the manufacturer's directions for application of acrylic or epoxy sealers. When the sealer becomes dirty after placement, clean by washing or in accordance with Section 666.4.B.1, "Cleaning for New Asphalt Surfaces and Retracing of All Surfaces," as directed. Place the sealer in the same configuration and color (unless clear) as the Type I markings unless otherwise shown on the plans.
- **C. Application.** Apply markings during good weather unless otherwise directed. If markings are placed at Contractor option when inclement weather is impending and the markings are damaged by subsequent precipitation, the Contractor is responsible for all costs associated with replacing the markings if required.
 - 1. **Type I Markings.** Place the Type I marking after the sealer cures. Apply within the temperature limits recommended by the material manufacturer. If during a spray application, operations cease for 5 min. or longer, flush the spray head by spraying marking material into a pan or similar container until the material being applied is at the recommended temperature.

Apply on clean, dry pavements passing the moisture test described in Section 666.4.A, "General," and with a surface temperature above 50°F when measured in accordance with Tex-829-B.

Apply Type I markings with a minimum thickness of:

- 0.100 in. (100 mils) for new markings and retracing water-based markings on surface treatments involving Item 316, "Surface Treatments," or Item 318, "Hot Asphalt-Rubber Surface Treatments,"
- 0.060 in. (60 mils) for retracing on thermoplastic pavement markings, or
- 0.090 in. (90 mils) for all other Type I markings.

The maximum thickness for Type I markings is 0.180 in. (180 mils). Measure thickness for markings in accordance with Tex-854-B using the tape method.

2. Type II Markings. Apply on surfaces with a minimum surface temperature of 50°F. Apply at least 20 gal. per mile on concrete and asphalt surfaces and at least 22 gal. per mile on surface treatments for a solid 4-in. line. Adjust application rates proportionally for other

widths. When Type II markings are used as a sealer for Type I markings, apply at least 15 gal. per mile using Type II drop-on beads.

- **3. Bead Coverage.** For Type I and Type II markings, provide a uniform distribution of beads across the surface of the stripe, with 40 to 60% bead embedment.
- D. Performance Period. All markings and replacement markings must meet the requirements of Tex-828-B for at least 30 calendar days after installation. Unless otherwise directed, remove pavement markings that fail to meet requirements, and replace at the Contractor's expense. Replace failing markings within 30 days of notification.

666.5. Measurement. This Item will be measured by the foot; by each word, symbol, or shape; or by any other unit shown on the plans. Each stripe will be measured separately.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal unless modified by Article 9.2, "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

Acrylic or epoxy sealer, or Type II markings when used as a sealer for Type I markings, will be measured by the foot; by each word, symbol, or shape; or by any other unit shown on the plans.

666.6. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Pavement Sealer" of the size specified or "Reflectorized Pavement Markings" of the type and color specified and the shape, width, size, and thickness (Type I markings only) specified as applicable. This price is full compensation for materials, application of pavement markings, equipment, labor, tools, and incidentals.

Surface preparation of new concrete and asphalt concrete pavements more than 3 years old, where no stripe exists, will be paid for under Item 678, "Pavement Surface Preparation for Markings." Surface preparation of all other asphalt and old concrete pavement, except for sealing, will not be paid for directly but is subsidiary to this Item.

Work-zone pavement markings (Type II, paint and beads) used as a sealer for Type I markings (thermoplastic) will be paid for under Item 662, "Work Zone Pavement Markings."

If the Engineer requires that markings be placed in inclement weather, repair or replacement of markings damaged by the inclement weather will be paid for in addition to the original plans quantity.

END OF SECTION 32 17 23.13

SECTION 32 31 13 – CHAIN LINK FENCES AND GATES PART 1 GENERAL

1.1 **REFERENCES**

- A. The following is a list of standards which may be referenced in this section:
 - 1. ASTM International (ASTM):
 - a. A121, Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
 - b. A313/A313M, Standard Specification for Stainless Steel Spring Wire.
 - c. A392, Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
 - d. A491, Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
 - e. A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
 - f. A615/A615M, Standard Specification for Deformed and Plain Billet- Steel Bars for Concrete Reinforcement.
 - g. A780, Standard Specification for Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings.
 - h. A824, Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence.
 - i. A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High- Strength Low-Alloy with Improved Formability.
 - j. C94/C94M, Standard Specification for Ready-Mixed Concrete.
 - k. C150, Standard Specification for Portland Cement.
 - I. C387, Standard Specifications for Packaged, Dry, Combined Materials for Mortar and Concrete.
 - m. F552, Standard Terminology Relating to Chain Link Fencing.
 - n. F567, Standard Practice for Installation of Chain-Link Fence.
 - o. F626, Standard Specification for Fence Fittings.
 - p. F668, Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric.
 - q. F900, Standard Specification for Industrial and Commercial Swing Gates.
 - r. F934, Standard Specification for Standard Colors for Polymer- Coated Chain Link Fence Materials.

- s. F1043, Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
- t. F1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc- Coated (Galvanized) Welded, for Fence Structures.
- u. F1183, Standard Specifications for Aluminum Alloy Chain Link Fence Fabric.
- v. F1184, Standard Specifications for Industrial and Commercial Horizontal Slide Gates.
- w. F1379, Standard Terminology Relating to Barbed Tape.
- x. F1911, Standard Practice for Installation of Barbed Tape.
- y. F1916, Standard Specification for Selecting Chain Link Barrier Systems with Coated Chain Link Fence Fabric and Round Posts for Detention Applications.
- 2. Institute of Electrical and Electronic Engineers (IEEE), Inc.: C2, National Electrical Safety Code.
- 3. National Electrical Manufacturers Association (NEMA): 250, Enclosures for Electrical Equipment (1,000 volts max.).

1.2 DEFINITIONS

A. Terms as defined in ASTM F552.

1.3 SUBMITTALS

- A. Action Submittals:
 - 1. Shop Drawings:
 - a. Product Data: Include construction details, material descriptions, dimensions of individual components, and finishes for chain link fences and gates.
 - 1) Fence, gate posts, rails, and fittings.
 - 2) Chain link fabric.
 - 3) Gates and hardware.
 - 4) Gate operators, motors, and mounting arrangements, switches, and controls; include
 - 5) Gate access system, including access control features, power and control wiring diagrams, and operating instructions.
 - 6) Accessories: Barbed wire.

2. Samples:

- a. Chain Link Fabric: Approximately 12 inches square.
- b. Posts, Rails, Braces, Wire, and Ties: Approximately 12 inches long.
- c. Fittings: 1 each.
- d. PVC or Polymer Coated Fabric Including Manufacturer's Color Selections: Approximately 12 inches square.

- e. Privacy Slats Including Manufacturer's Color Selections: Approximately 6 inches long.
- 3. Test Reports: Field test result for compliance of installation of chain link fence, gates, and gate operators.
- B. Informational Submittals:
 - 1. Manufacturer's recommended installation instructions.
 - 2. Evidence of Supplier and installer qualifications.
- 1.4 QUALITY ASSURANCE
 - A. Qualifications:
 - 1. Automatic Gate Operator System Supplier: 5 years' experience in gate operator systems.
 - 2. Automatic Gate Operator System Installer: Experienced installer who has completed chain link fences and gates similar in material, design, and extent to those indicated for Project and whose work has resulted with a record of successful in-service performance with a minimum 3 years' experience.
 - B. Design, supply of equipment and components, installation, and on-call service shall be product of individual company with record of installations meeting requirements specified.
 - C. Preinstallation Conference: Conduct conference at project Site with gate installer to verify layout and operations of automatic gate operating system.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver materials to Site in undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.
- 1.6 SCHEDULING AND SEQUENCING
- A. Complete necessary Site preparation and grading before installing chain link fence and gates.
- B. Interruption of Existing Utility Service: Notify owner of utility 72 hours prior to interruption of utility services. Do not proceed with interruption of utility service without written permission from utility owner.
- 1.7 SPECIAL GUARANTEE
 - A. Provide manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of the Owner, removal and replacement of the following items found defective during a period of 1 year after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in the General Conditions.
 - 1. Faulty operations of gate operators and controls.
 - 2. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 3. Deflection of fence fabric beyond limits.

PART 2 PRODUCTS

2.01 GENERAL

A. Match style, finish, and color of each fence component with that of other fence components.

2.0 CHAIN LINK FENCE FABRIC

- 2
- A. Galvanized fabric conforming to ASTM A392, Type II; galvanized after weaving.
- B. PVC-coated or Polymer-coated galvanized fabric conforming to ASTM F668, Class 1 or Class 2a over metallic-coated steel wire.
 - 1. Color: Dark Green, complying with ASTM F934.
- C. Height: 96 inches, unless otherwise shown.

- D. Core Wire Gauge: No. 9. Pattern:
- E. 2-inch diamond-mesh.
- F. Diamond Count: Manufacturer's standard and consistent for fabric furnished of same height.
- G. Loops of Knuckled Selvages: Closed or nearly closed with space not exceeding diameter of wire.
- H. Wires of Twisted Selvages:
 - 1. Twisted in a closed helix three full turns.
 - 2. Cut at an angle to provide sharp barbs that extend minimum 1/4 inch beyond twist.

2.3 POSTS

- A. General:
 - 1. Strength and Stiffness Requirements: ASTM F1043; heavy industrial fence, except as modified in this section.
 - 2. Round Steel Pipe, Schedule 40: ASTM F1083.
 - 3. Roll-Formed Steel Shapes: Roll-formed from ASTM A1011/A1011M, Grade 45, High-Strength Low-Alloy steel.
 - 4. Lengths: Manufacturer's standard with allowance for minimum embedment below finished grade of 34 inches.
 - 5. Protective Coatings:
 - a. Zinc Coating: ASTM F1043, Type A external and internal coating.
 - 6. Color Coating: ASTM F1043, minimum 10 mils thickness over zinc coating to match color of chain link fabric.
- B. Line Posts:
 - 1. Round Steel Pipe:
 - a. Outside Diameter: 1.5 inches.
- C. End, Corner, Angle, and Pull Posts:
 - 1. Round Steel Pipe:
 - . Outside Diameter: 2.875 inches.
- D. Posts for Removable Fence Panels: As specified for end, corner, angle, and pull posts.
- E. Posts for Swing Gates Over 8 Feet High: As recommended by fence manufacturer.
- F. Posts for Horizontal Sliding Gates: As recommended by fence manufacturer.

2.4 TOP AND BRACE RAILS

- A. Galvanized Round Steel Pipe:
 - 1. ASTM F1083.
 - 2. Outside Diameter: 1.5 inches.
- B. Protective Coatings: As specified for posts.
- C. Color Coating: ASTM F1043, minimum 10-mil thickness over zinc coating to match color of chain link fabric.
- D. Strength and Stiffness Requirements: ASTM F1043, top rail, heavy industrial fence.

2.5 FENCE FITTINGS

- A. General: In conformance with ASTM F626, except as modified by this article. Post
- B. and Line Caps: Designed to accommodate passage of top rail through cap,

where top rail required.

C. Tension and Brace Bands: No exceptions to ASTM F626. Tension Bars:

D.

- 1. One-piece
- 2. Length not less than 2 inches shorter than full height of chain link fabric.
- 3. Provide one bar for each gate and end post, and two for each corner and pull post.
- E. Truss Rod Assembly: 3/8-inch diameter, steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.
- F. Tie Wires, Clips, and Fasteners: According to ASTM F626.
- G. Barbed Wire Supporting Arms: Pressed steel or Aluminum Alloy 36 with clips, slots, or other means for attaching strands of barbed wire integral with post cap for each post, with single vertical arms for supporting one strand of barbed wire. Arms shall withstand 250 pounds of downward pull at outermost ends of the arms without failure.

2.6 TENSION WIRE

- A. Zinc-coated steel marcelled tension wire conforming to ASTM A824 C, Type I.
- 2.07 BARBED WIRE
- A. Zinc-Coated Barbed Wire: ASTM A121, Chain Link Fence Grade:
- B. Aluminum-Coated Steel Barbed Wire: ASTM A121, Type I.
 - 1. Line Wire: Single strand of No. 12-1/2 gauge.
 - 2. Barbs:
 - a. Number of Points: Four.
 - b. Length: 3/8 inch minimum.
 - c. Shape: Round.
 - d. Diameter: No. 14 gauge.
 - e. Spacing: 5 inches.

2.8 GATES

- A. General:
 - 1. Gate Operation: Opened and closed easily by one person.
 - 2. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F1043 and ASTM F1083 for materials and protective coatings.
 - 3. Frames and Bracing: Fabricate members from round galvanized steel tubing with outside dimension and weight according to ASTM F900.
 - 4. Gate leaves more than 8-feet wide shall have intermediate tubular members and diagonal truss rods to provide rigid construction, free from sag or twist.
 - 5. Gate Fabric Height: Same as for adjacent fence height.
 - 6. Welded Steel Joints: Paint with zinc-based paint.

- 7. Chain Link Fabric: Attached securely to gate frame at intervals not exceeding 15 inches.
- 8. Gate Posts and Frame Members: Extend gateposts and frame end members above top of chain-link fabric at both ends of gate frame to attach barbed wire assemblies.
- 9. Latches: Arranged for padlocking so padlock will be accessible from both sides of gate.
- B. Swing Gates: Comply with ASTM F900 for double swing gate types.
 - 1. Leaf Width: As shown in the design plans.
 - 2. Hinges: Offset type, malleable iron.
 - a. Furnished with large bearing surfaces for clamping in position.
 - b. Designed to swing either 180 degrees outward, 180 degrees inward, or 90 degrees in or out, as shown, and not twist or turn under action of gate.
 - 3. Latches: Plunger bar arranged to engage stop, except single gates of openings less than 10 feet wide may each have forked latch.
 - 4. Gate Stops: Mushroom type or flush plate with anchors, suitable for setting in concrete.
 - 5. Locking Device and Padlock Eyes: Integral part of latch, requiring one padlock for locking both leaves of double gate.
 - 6. Hold-Open Keepers: Designed to automatically engage gate leaf and hold it in open position until manually released.
- C. Rolling Gate:
 - 1. Track Rollers: Malleable iron or heavy pressed steel with provision for grease lubrication.
 - 2. Ground Rollers: Malleable iron or heavy pressed steel with provision for grease lubrication.
 - 3. Support Posts: Spaced on maximum 7-foot centers.
 - 4. Gates more than 8 feet in height shall have three tracks.
 - 5. Frames: ASTM F1184, Type I.
 - 6. Gate Accessories: ASTM F1184.

2.9 CONCRETE

- A. Materials: ASTM C387, packaged, dry, combined ingredients with Type I cement.
- B. Mixing: In a clean metal container, mix package of dry materials by hand or machine. Following manufacturer's instructions, add clean water in sufficient quantity to produce a slump of 2 inches to 3 inches.

2.10 FENCE GROUNDING

- A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - 1. Material above Finished Grade: Copper.
 - 2. Material on or below Finished Grade: Copper.
 - 3. Bonding Jumpers: Braided copper tape, 1-inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- B. Connectors and Grounding Rods: Comply with UL 467.

- 1. Connectors for Below-Grade Use: Exothermic welded type.
- 2. Grounding Rods: Copper-clad steel.

PART 3 EXECUTION

3.1 GENERAL

- A. Install chain link fences and gates in accordance with ASTM F567, except as modified in this section, and in accordance with fence manufacturer's recommendations, as approved by Engineer. Erect fencing in straight lines between angle points.
- B. Provide necessary hardware for a complete fence and gate installation.
- C. Any damage to galvanized surfaces, including welding, shall be repaired with paint containing zinc dust in accordance with ASTM A780.
- D. Drainage Crossings: Where the chain-link fence must cross drainage ditches or swales, the main fence shall be carried across a ditch or swale with additional fence added below.
 - 1. Frames and Bracing: The fence added below shall be fabricated with galvanized round steel pipe conforming to the requirements for top and brace rails.
 - 2. The construction of the frame shall be welded or assembled with corner fittings. The frame shall be rigid and to the extent necessary to maintain a 2- inch clearance between bottom of the frame and finish grade. If necessary to maintain rigidity, attach to the frame a series of 3/8-inch diameter galvanized steel pipe stakes that are embedded a minimum of 2 feet to the sides and bottom of the ditch.
 - 3. Attach chain link fabric securely to frame at intervals not exceeding 12 inches.

3.2 PREPARATION

- Clear area on either side of fence to the extent specified in Section 31 10 00,
 Site Clearing. Eliminate ground surface irregularities along fence line to the extent necessary to maintain a 2-inch clearance between bottom of fabric and finish grade.
- B. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 POST SETTING

- A. Drill or hand-excavate holes for posts to diameters and spacing indicated, in firm, undisturbed soil. Driven posts are not acceptable. Postholes shall be clear of loose materials. Waste materials from postholes shall be removed from Site or regraded into slopes on Site.
- B. Posthole Depth:
 - 1. Minimum 3 feet below finished grade.
 - 2. 2 inches deeper than post embedment depth below finish grade.
- C. Set posts with minimum embedment below finished grade of 34 inches and with top rail at proper height above finished grade. Verify posts are set plumb, aligned, and at correct height and spacing. Brace posts, as necessary, to maintain correct position and plumbness until concrete sets.
- D. Backfill postholes with concrete to 2 inches above finished grade. Vibrate or tamp concrete for consolidation. Protect above ground portion of posts from concrete splatter.
- E. Before concrete sets, crown and finish top of concrete to readily shed water.

- F. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.
- G. Line Posts: Space line posts uniformly at 10 feet on centers between terminal end, corner, and gate posts.
- 3.4 POST BRACING
 - A. Install according to ASTM F567, maintaining plumb position, and alignment of fencing. Install braces at gate, end, pull, and corner posts diagonally to adjacent line posts to ensure stability. Install braces on both sides of corner and pull posts.
 - 1. Locate horizontal braces at mid-height of fabric or higher, on fences with top rail, and 2/3-fabric height on fences without top rail. Install so posts are plumb when diagonal truss rod assembly is under proper tension.

3.5 TOP RAILS

A. Install according to ASTM F567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps and terminating into rail end attached to posts or posts caps fabricated to receive rail at terminal posts. Install top rail sleeves with springs at 105 feet maximum spacing to permit expansion in rail.

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3.6 BARBED WIRE SUPPORTING ARMS
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A. Barbed wire supporting arms shall be installed as indicated and as recommended by manufacturer. Bolt or rivet supporting arm to top of post in a manner to prevent easy removal with hand tools. Angle single arms to outside of fence.

3.7 TENSION WIRE

- A. Install according to ASTM F567 and ASTM F1916, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with tie wires at a maximum spacing of 24 inches on center.
- B. Install tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

3.8 CHAIN LINK FABRIC

- A. Do not install fabric until concrete has cured minimum 7 days.
- B. Apply fabric to outside of enclosing framework. Pull fabric taut to provide a smooth and uniform appearance free from sag, without permanently distorting fabric diamond or reducing fabric height. Tie fabric to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- C. Splicing shall be accomplished according to ASTM F1916 by weaving a single picket into the ends of the rolls to be joined.
- D. Leave 2 inches between finish grade or surface and bottom selvage, unless otherwise indicated.
- E. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches on center.
- F. Tie Wires: Fasten ties to wrap a full 360 degrees around rail or post and a minimum of one complete diamond of fabric. Twist ends of tie wire three full twists, and cut off protruding ends to preclude untwisting by hand.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches on center and to brace and top rails at 24 inches on center.

3.9 BARBED WIRE

- A. Install barbed wire uniformly in configurations of a single strand of barbed wire on supporting arms. Pull wire taut and install securely to supporting arms and secure to end terminal post or terminal arms.
- 3.10 GATES
 - A. Install gates according to manufacturer's written instructions, level, plumb and secure for full opening without interference. Attach fabric and hardware to gate using tamper-resistant or concealed means. Adjust hardware for smooth operation and lubricate where necessary so gates operate satisfactorily from open or closed position.
 - B. Set gate stops in concrete to engage center drop rod or plunger bar.
- 3.11 ELECTRICAL GROUNDING
 - A. Ground fences at a maximum interval of 1,000 feet in accordance with applicable requirements of IEEE C2, National Electrical Safety Code.
 - B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.
 - C. Grounding Method: At each grounding location, drive a grounding rod vertically until top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
- 3.12 FIELD QUALITY CONTROL
 - Post and Fabric Testing: Test fabric tension and line post rigidity according to ASTM F1916.
 - B. Gate Tests:
 - 1. Prior to acceptance of installed gates, demonstrate proper operation of gates under each possible open and close condition specified.
 - 2. Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range.
 - 3. Confirm that latches and locks engage accurately and securely without forcing and binding.
- 3.13 CLEANUP
 - A. Remove excess fencing materials and other debris from Site.

END OF SECTION 32 31 13

SECTION 33 05 05.31

HYDROSTATIC TESTING OF PIPELINES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Field hydrostatic testing of newly installed water pipelines.
- B. Specifications identify requirements for both small-diameter (less than or equal to 20 inches) water mains and large-diameter (greater than 20 inches) water mains. When specifications for large-diameter water mains differ from those for small- diameter water mains, paragraphs for large-diameter mains will govern for large-diameter pipe.

1.02 MEASUREMENT AND PAYMENT

- A. No payment will be made for hydrostatic testing of pipelines under this Section. Include cost in unit price of pipelines being tested.
- PART 2 P R O D U C T S Not Used
- PART 3 E X E C U T I O N

3.01 PREPARATION

- A. Disinfect water system pipelines prior to hydrostatic testing.
- B. Hydrostatically test newly installed water pipelines after disinfection, if required, and before connecting to Owner's water distribution system.
- C. Water for testing will be charged to Contractor in accordance with the Owner's Rules. Prior to hydrostatic testing, Contractor's meter shall be tested and approved by the Owner.
- D. For large-diameter water mains, test pipelines in lengths between valves, or plugs, of not more than 4400 feet.
- E. Small-diameter pipelines shall be tested in lengths between valves, or plugs, of not more than 2800 feet.
- F. Conduct hydrostatic tests in presence of a representative from the Owner.

3.02 TEST PROCEDURES

A. Furnish, install, and operate connections, pump, meter and gages necessary for hydrostatic testing.

- B. Allow pipeline to sit a minimum of 24 hours from time it is initially disinfected until testing begins, to allow pipe wall or lining material to absorb water. Periods of up to 7 days may be required for mortar lining to become saturated.
- C. For small-diameter pipelines, expel air and apply a minimum test pressure of 150 psi. For large-diameter water mains, expel air and apply a minimum test pressure of 150 psi.
- D. Begin test by 4:00 p.m. unless otherwise approved by the Owner. Maintain test pressure until 8 a.m. the following morning. If a large quantity of water is required to maintain pressure during test, testing shall be discontinued until cause of water loss is identified and corrected.
- E. Keep valves inside pressure reducing stations closed during hydrostatic pressure test.

3.03 ALLOWABLE LEAKAGE FOR WATER MAINS

- A. During hydrostatic tests, no leakage will be allowed for sections of water mains consisting of welded joints.
- B. Maximum Pressure Loss: A maximum of 5-psi pressure loss over a 16-hour period is allowed. If this pressure requirement is failed 3 (three) times, use the AWWA Standard C600 Section 4 "Hydrostatic Testing" latest revision.
- 3.04 CORRECTION FOR FAILED TESTS
 - A. Repair joints showing visible leaks on surface regardless of total leakage shown on test. Check valves and fittings to ensure that no leakage occurs that could affect or invalidate test. Remove any cracked or defective pipes, fittings, and valves discovered during pressure test and replace with new items.
 - B. The Owner may require failed lines to be disinfected after repair and prior to retesting. Conduct and pay for subsequent disinfection operations in accordance with requirements of Section 33 13 00 - Disinfection of Water Lines. Contractor shall pay for water required for additional disinfection and retesting.
 - C. Repeat test until satisfactory results are obtained.

3.05 COMPLETION

A. Upon satisfactory completion of testing, remove risers remaining from disinfection and hydrostatic testing, and backfill excavation promptly.

END OF SECTION 33 05 05.31

SECTION 33 11 00

WATER MAINS

PART 1 GENERAL

- 1.01 SECTION INCLUDES
 - A. Installation of water mains.
 - B. Leads for fire hydrant relocation.
 - C. Specifications identify requirements for both small-diameter water mains and large-diameter water mains. When specifications for large-diameter water mains differ from those for small-diameter water mains, large-diameter specifications will govern for large-diameter pipe.

1.02 MEASUREMENT AND PAYMENT

- A. Payment for water mains installed by open-cut or augered with or without casing is on a linear foot basis for each size of pipe installed. Separate pay items are used for open-cut and augered installation.
 - a. Mains: Measure along axis of pipe and include fittings.
 - b. Branch Pipe: Measure from axis of main to end of branch.
- 2. Payment of fire hydrant branches from the centerline axis of the main fitting to the centerline of the fire hydrant will be considered under the Fire Hydrant Assembly unit price item. Payment of fire hydrant branch for relocated fire hydrant will be from the centerline axis of the existing main or the centerline of the existing valve to the centerline of the relocated fire hydrant along the center of branch.
- 3. For large-diameter water mains, payment for an interconnection (tie-in) is on a lump sum basis for each interconnection required. Payment will include tapping sleeve and fittings and all other related work necessary for construction as shown on Drawings as specified.
- 4. When directed by the Engineer to install extra fittings as required to avoid unforeseen obstacles, payment will be based on the following:
 - a. Each extra fitting requested by the Engineer and delivered to jobsite will be paid according to the unit price for "Extra Fittings in Place."
 - b. Payment will include and be full compensation for all items necessary for installation and operation of the water line.

1.03 REFERENCES

Water Mains

- A. ANSI/NSF Standard 61.
- B. ASTM A 126 Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
- C. ASTM B 21 Specification for Naval Brass Rod, Bar, and Shapes.
- D. ASTM B 98 Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
- E. ASTM B 584 Specification for Copper Alloy Sand Castings for General Applications.
- F. AWWA C 206 Standard for Field Welding of Steel Water Pipe.
- G. AWWA C 207 Standard for Steel Pipe Flanges for Waterworks Service Sizes 4 Inches through 144 Inches.
- 1.04 SUBMITTALS
 - A. Submittals shall conform to requirements of Section 01 33 00 Submittal Procedures.
 - B. Conform to submittal requirements of applicable Section for type of pipe used.

PART 2 P R O D U C T S

2.01 PIPE MATERIALS

- A. Install pipe materials which conform to following:
 - 1. Section 33 11 13.13 Ductile Iron Pipe and Fittings.
 - 2. Section 33 05 31.13 Polyvinyl Chloride Pressure Pipe.
- B. Conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and have certified by an organization accredited by ANSI.
- C. Type of pipe materials used are Contractor's option unless specifically identified on Drawings.
- 2.02 WELDED JOINT PROTECTION FITTING (NOT USED)
- 2.03 RESTRAINED JOINTS
 - A. PVC Pipe:
 - 1. Fittings: Mega Lug by Ebaa Iron Inc. or JCM 610 Sur-Grip Fitting Restrainer by JCM Industries, Inc., or approved equal.
 - 2. Bell and Spigot: Mega Lug by Ebaa Iron Inc. or JCM 610 Sur-Grip Fitting Restrainer by JCM Industries, Inc., or approved equal.

2.04 COUPLINGS AND APPURTENANCES FOR LARGE-DIAMETER WATER MAIN

- A. Flexible (Dresser-type) Couplings.
 - 1. Install where shown on Drawings or where allowed by the Engineer for Contractor's convenience. Use galvanized flexible couplings when installed on galvanized pipe which is cement lined, or when underground. Provide gaskets manufactured from Neoprene, Buna-N, or approved equal.
 - 2. For steel pipe; sleeve-type flexible couplings, Smith-Blair type, or approved equal. Thickness of middle ring equal to or greater than thickness of pipe wall.
 - 3. Flanged adapter couplings for steel pipe; Dresser Style 128, Rockwell Type 913, or approved equal.
 - 4. Use Type 316 stainless steel bolts, nuts and washers where flexible couplings are installed underground. Coat entire coupling with 20-mil of T.C. Mastic as manufactured by the Tape Coat Company, Inc., Bitumastic No. 50 as manufacturer by Koppers Company, Inc., or approved equal.
- B. Victaulic Joints. Make joint with Victaulic Style 77 coupling fitted with Grade H molded synthetic rubber gasket or approved equal.

PART 3 E X E C U T I O N

3.01 PREPARATION

- A. Conform to applicable installation specifications for types of pipe used.
- B. Employ workmen who are skilled and experienced in laying pipe of type and joint configuration being furnished. Provide watertight pipe and pipe joints. Lay pipe with bell ends facing in direction of laying.
- C. Lay pipe to lines and grades shown on Drawings. Use adequate surveying methods and equipment; employ personnel competent in use of this equipment. Horizontal and vertical deviations from alignment as indicated on Drawings shall not exceed 0.10 feet. Measure and record "as-built" horizontal alignment and vertical grade at maximum of every 100-feet on record drawings.
- D. Confirm that separation from gravity sanitary sewers and manholes or from force mains have minimum clearance as specified in this Section and conforming to TCEQ Chapter 290 and 217 rules or 9 feet in all directions unless a special design is provided on the Drawings:
 - 1. Parallel water line and gravity sanitary sewer, force main or manhole with no leaks: Minimum 9 foot horizontal clearance from outside wall of water line to outside wall of gravity sanitary sewer, force main, or manhole.

- 2. Water line crossing above a gravity sanitary sewer or force main with no leaks: Minimum 2 foot vertical clearance.
- E. Where above clearances cannot be attained, and a special design has not been provided on Drawings, obtain direction from the Engineer before proceeding with construction.
- F. Inform the Engineer if any un-metered connections exist which are not shown on Drawings. Make transfer only after approval by the Engineer.
- G. Keep pipe trenches free of water which might impair pipe-laying operations. Prevent pipe bells from coming in contact with subgrade. Grade pipe trenches to provide uniform support along bottom of pipe. Excavate for bell holes for proper sealing of pipe joints after bottom has been graded and in advance of placing pipe. Lay not more than 300 feet of pipe in trench ahead of backfilling operations. Cover or backfill laid pipe if pipe laying operations are interrupted and during non-working hours. Place backfill carefully and simultaneously on each side of pipe to avoid lateral displacement of pipe and damage to joints. If adjustment of pipe is required after it has been laid, remove and re-lay as new pipe.
- H. If asbestos-cement pipe is encountered, follow safety practices outlined in the Asbestos-Cement Pipe Producers Association publication, Recommended Work Practices for A/C Pipe. Strictly adhere to recommended practices contained in this publication.
- I. For pipe diameters 36 inches and greater, clearly mark each section of pipe and fitting with a unique designation on the inside of the pipe. Minimum letter height is 4 inches.
- J. Laying Large-diameter Water Main
 - 1. Lay not more than 50 feet of pipe in trench ahead of backfilling operations.
 - 2. Dig trench proper width as shown. When Contractor's operations cause trench width below top of pipe to become 4 feet wider than specified, install higher class of pipe or improved bedding, as determined by the Engineer. No additional payment will be made for higher class of pipe or improved bedding.
 - 3. Prevent damage to coating when placing backfill. Backfill material shall be free of large rocks or stones, or other material which could damage coatings.
 - 4. Before assembling couplings, lightly coat pipe ends and outside of gaskets with cup grease or liquid vegetable soap to facilitate installation. Groove pipe to manufacturer's specifications.
- K. Contractor is responsible for assuring the chosen manufacturer fulfills requirements for extra fittings and, therefore, is responsible for all costs due to downtime if requirements are not met.
- F. Detectable warning metallic tape with "Waterline Below" shall be buried above pipe at a depth of 18 inches below finished grade for surface locating purposes. The width of the metallic tape shall be 6-inches wide as manufacturer by Presco Detectable Waring Tape or approved equal.

3.02 HANDLING, CLEANING AND INSPECTION

A. Handling:

- 1. Place pipe along project site where storm water or other water will not enter or pass through pipe.
- 2. Load, transport, unload, and otherwise handle pipe and fittings to prevent damage of any kind. Handle and transport pipe with equipment designed, constructed and arranged to prevent damage to pipe, lining and coating. Do not permit bare chains, hooks, metal bars, or narrow skids or cradles to come in contact with coatings. Where required, provide pipe fittings with sufficient interior strutting or cross bracing to prevent deflection under their own weight.
- 3. Hoist pipe from trench side into trench by means of sling of smooth steel cable, canvas, leather, nylon or similar material.
- 4. For large-diameter water mains, handle pipe only by means of a sling of canvas, leather, nylon, or similar material. The sling shall be a minimum 36 inches in width. Do not tear or wrinkle tape layers.
- 5. Use precautions to prevent injury to pipe, protective linings and coatings.
 - a. Package stacked pipe on timbers. Place protective pads under banding straps at time of packaging.
 - b. Pad fork trucks with carpet or other suitable material. Use nylon straps around pipe for lift when relocating pipe with crane or backhoe.
 - c. Do not lift pipe using hooks at each end of pipe.
 - d. Do not place debris, tools, clothing, or other materials on pipe.
- 6. Repair damage to pipe or protective lining and coating before final acceptance.
- 7. Permit no visible cracks longer than 6 inches, measured within 15 degrees of a line parallel to pipe longitudinal axis in the cores of finished pipe with the following exceptions:
 - a. In the surface laitance of centrifugally cast concrete.
 - b. In sections of pipe with steel reinforcing collars or wrappers.
 - c. Within 12 inches of pipe ends.
- 8. Reject pipe with visible cracks (not meeting exceptions) and remove from project site.

- B. Cleaning: Thoroughly clean and dry interior of pipe and fittings of foreign matter before installation, and keep interior clean until the Work has been accepted. Keep joint contact surfaces clean until jointing is completed. Do not place debris, tools, clothing or other materials in pipe. After pipe laying and joining operations are completed, clean inside of pipe and remove debris.
- C. Inspection: Before installation, inspect each pipe and fitting for defects. Reject defective, damaged or unsound pipe and fittings and remove them from site.

3.03 EARTHWORK

- A. Conform to applicable provisions of Section 31 23 33 Excavation and Backfilling for Utilities.
- B. Bedding: Use bedding materials in conformance with Section 31 23 23.13 Utility Backfill Materials.
- C. Backfill: Use bank run sand or earth or native soil as specified in Section 31 23 23.13 Utility Backfill Materials. Backfill excavated areas in the same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.
- D. Place material in uniform layers of prescribed maximum loose thickness and wet or dry material to approximately optimum moisture content. Compact to prescribed density. Field density tests may be made at a frequency determined by the Engineer. Water tamping is not allowed.
- E. Pipe Zone: Including 6-inch pipe bedding and backfill to 12 inches above top of pipe.

3.04 PIPE CUTTING

A. Cut pipe 12 inches and smaller with standard chop saw. Cut pipe larger than 12 inches in manner approved by the Engineer. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

3.05 PIPING INSTALLATION

- A. Do not lay pipe unless subgrade is free of water. Make adjustments of pipe to line and grade by scraping away subgrade or filling in with granular material. Wedging or blocking up bell will not be acceptable.
- B. Do not install pipe at greater depth than its design allows.
- C. Protection of Pipeline: Securely place stoppers or bulkheads in openings and in end of line when construction is stopped temporarily and at end of each day's work.

3.06 JOINTS AND JOINTING

A. Rubber Gasketed Bell-and-Spigot Joints (Concrete Cylinder Pipe, PVC, Steel, and DIP):

- 1. After rubber gasket is placed in spigot groove of pipe, equalize rubber gasket cross section by inserting tool or bar recommended by manufacturer under rubber gasket and moving it around periphery of pipe spigot.
- 2. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined. Push the lubricated spigot past the gasket into the bell until the insertion line on the spigot is even with the edge of the bell. DO NOT OVER INSERT BEYOND THE INSERTION LINE.
- 3. Fit pipe units together in manner to avoid twisting or otherwise displacing or damaging rubber gasket.
- 4. After the pipe sections are joined, check gaskets to ensure that no displacement of gasket has occurred. If displacement has occurred, remove pipe section and remake joint as for new pipe. Remove old gasket, inspect for damage and replace if necessary before remaking joint.
- 5. Where preventing movement of 16-inch-diameter or greater pipe is necessary due to thrust, use restrained joints.
- B. Flanged Joints (Concrete Cylinder Pipe, DIP, Steel):
 - 1. AWWA C 207. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe and equipment. Align bolt holes to straddle vertical, horizontal or north-south centerline. Do not exceed 3/64 inch per foot inclination of flange face from true alignment.
 - 2. Use full-face gaskets for flanged joints. Provide 1/8-inch-thick cloth inserted rubber gasket material. Cut gaskets at the factory to proper dimensions.
 - 3. Use stainless steel 304 or 316 nuts and bolts to match flange material. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
- C. Joint Testing:
 - 1. In addition to testing individual joints with feeler gauge approximately 1/2-inch wide and 0.015-inch thick, use any other joint testing procedure approved or recommended by pipe manufacturer which will help ensure watertight installation prior to backfilling. These tests shall be made at no additional cost to the Owner.
 - 2. Test 100 percent of welded joints including any joint or seam welded after successful hydrostatic testing by methods as described in Paragraph 3.06C, Welded Joints. The Owner reserves right to require additional tests if tests performed indicate an unacceptable weld. Repair rejected weld.
- D. Make curves and bends by deflecting joints or other method as recommended by manufacturer and approved by the Engineer. Contractor may submit details of other methods of providing
curves and bends for consideration by the Engineer, and if accepted, shall be installed at no additional cost to the Owner.

- 1. Deflection of pipe joints shall not exceed maximum deflection recommended by pipe manufacturer, unless otherwise indicated on Drawings.
- 2. If deflection exceeds that specified but is less than 5 percent, repair entire deflected pipe section such that maximum deflection allowed is not exceeded.
- 3. If deflection is equal to or exceeds 5 percent from that specified, remove entire portion of deflected pipe section and install new pipe.
- 4. Replace, repair, or reapply coatings and linings as required.
- 5. Assessment of deflection may be measured by the Engineer at any location along pipe. Arithmetical averages of deflection or similar average measurement methods will not be deemed as meeting intent of standard.
- 6. When rubber gasketed pipe is laid on a curve, join pipe in a straight alignment and then deflect to curved alignment.
- E. Closures and Field Modifications to Steel, Concrete Cylinder Pipe, and Fittings: These requirements also apply to standard pipe joints which exceed manufacturer's recommended deflection.
 - 1. Apply welded-wire fabric reinforcement to interior and exterior of exposed interior and exterior surfaces greater than 6 inches in diameter. Welded-wire fabric: minimum W1; maximum spacing 2 inches by 4 inches; 3/8 inch from surface of steel plate or middle third of lining or coating thickness for mortar thickness less than 3/4 inch.
 - 2. Fill exposed interior and exterior surfaces with non-shrink grout.
 - 3. For large-diameter water mains, perform field welds on interior and exterior of pipe.
 - 4. For large-diameter water mains, provide minimum overlap of 2 inches of butt strap over adjacent piece on butt-strap closures.

3.07 CATHODIC PROTECTION APPURTENANCES

- A. Where identified on Drawings, modify pipe for cathodic protection as detailed on Drawings and specified. Unless otherwise noted, provide insulation kits at connections to existing water system or at locations to isolate one type of cathodic system from another type, between water main, access manhole piping and other major openings in water main, or as shown on Drawings.
- B. Bond joints for pipe installed in tunnel or open cut, except where insulating flanges are provided. Weld strap or clip between bell and spigot of each joint. No additional bonding required where joints are welded for thrust restraint.

C. Bonding Strap or Clip: Free of foreign material that may increase contact resistance between wire and strap or clip.

3.08 SECURING, SUPPORTING AND ANCHORING

- A. Support piping as shown on Drawings and as specified in this Section, to maintain line and grade and prevent transfer of stress to adjacent structures.
- B. Where shown on Drawings, anchor pipe fittings and bends installed on water main by welding consecutive joints of pipe together to distance each side of fitting. Restrained length, as shown on Drawings, assumes that installation of pipe and subsequent hydrostatic testing begin upstream and proceed downstream, with respect to normal flow of water in pipe. If installation and testing differs from this assumption, submit for approval method of restraining pipe joints upstream and downstream of device used to test against (block valve, blind flange or dished head plug).
- C. Use adequate temporary blocking of fittings when making connections to distribution system and during hydrostatic tests. Use sufficient anchorage and blocking to resist stresses and forces encountered while tapping existing water line.

3.09 THRUST RESTRAINT

- A. For new water lines 16 inches in diameter and larger, restrain joints as specified in Paragraph 3.06A.5 of this Section.
- B. For existing water lines and water lines less than 16 inches in diameter, restrain pipe joints with concrete thrust blocks and provide joints as specified in Paragraph 3.06A.5 of this Section.
- C. Prevent any lateral movement of thrust restraints throughout pressure testing and operation. Place 2500 psi concrete conforming to Section 03 30 00 Concrete for Utility Construction, for blocking at each change in direction of existing water lines, to brace pipe against undisturbed trench walls. Finish placement of concrete blocking, made from Type I cement, 4 days prior to hydrostatic testing of pipeline. Test may be made 2 days after completion of blocking if Type II cement is used.
- D. Thrust restraint lengths shown on Drawings are minimum anticipated lengths. These lengths are based on deflections indicated and on use of pre-stressed concrete cylinder pipe. Adjustments in deflections or use of other pipe material may result in reduction or increase of thrust lengths. Perform calculations by pipe manufacturer to verify proposed thrust restraint lengths. Submit calculations for all pipe materials sealed by a registered Professional Engineer for review by the Engineer. Make adjustments in thrust restraint lengths at no additional cost to the Owner.
- E. Passive resistance of soil will not be permitted in calculation of thrust restraint.
- F. Use minimum 20-foot length of pipe in and out of joints made up of beveled pipe where restraint joint lengths are not identified on Drawings. Otherwise, provide welded restraint joints for a minimum length of 20 feet on each side of beveled joints.

3.10 POLYETHYLENE WRAP

- A. Double wrap pipe and appurtenances (except fire hydrants) with 8-mil polyethylene film.
- B. Conform to requirements of Section 33 05 33 Polyethylene Wrap.
- 3.11 CLEANUP AND RESTORATION
 - A. Provide cleanup and restoration crews to work closely behind pipe laying crews, and where necessary, during chlorination, testing, service transfers, abandonment of old mains, backfill and surface restoration.
 - B. Upon completion of section not exceeding 4000 feet per crew, chlorinate and pressure test. Begin transfer of services no later than 7 calendar days after successful completion of chlorination and pressure testing.
 - C. After transfer of services, but no later than 21 calendar days after successful completion of chlorination and pressure testing, begin abandonment of old mains, including re-sodding and placement of sidewalks and pavements.
 - D. Do not begin construction of additional sections if above conditions are not met.
 - E. For large-diameter water mains, do not install more than 2000 feet of main, without the previous 2000 feet being cleaned up and site fully restored. Schedule paving crews so repaving work will not lag behind pipe laying work by more than 1000 feet. Failure to comply with this requirement will result in a "Notice of Nonconformance".
- 3.12 CLEANING PIPING SYSTEMS
 - A. Remove construction debris or foreign material and thoroughly clean and flush piping systems. Provide temporary connections, equipment and labor for cleaning.
- 3.13 DISINFECTION OF WATER LINES
 - A. Conform to requirements of Section 33 13 00 Disinfection of Water lines.
- 3.14 FIELD HYDROSTATIC TESTS
 - A. Conform to requirements of Section 33 05 05.13 Hydrostatic Testing of Pipelines.

END OF SECTION 33 11 00

SECTION 33 12 13

WATER TAP AND SERVICE LINE INSTALLATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tapping existing mains and furnishing and installing new service lines for water.
- B. Relocation of existing small water meters.
- C. Specifications identify requirements for both small-diameter (less than or equal to 20 inches) water mains and large-diameter (greater than 20 inches) water mains. When specifications for large-diameter water mains differ from those for small- diameter water mains, paragraphs for large-diameter mains will govern for large-diameter pipe.

1.02 DELETED

1.03 REFERENCES

A. AWWA C 800 - Underground Service Line Valves and Fittings.

1.04 **DEFINITIONS**

- A. Short Side Connection: Service line connecting proposed curb stop, located inside water meter box, to water main on same side of street.
- B. Long Side Connection: Service line connecting proposed curb stop, located inside water meter box, to water main on opposite side of street or from center of streets where supply main is located in street center such as boulevards and streets with esplanades.

PART 2 PRODUCTS

2.01 MATERIALS

A. Copper Tubing: In accordance with Section 33 12 13.10 - WATER SERVICE CONNECTIONS. Polyethylene tubing is not permitted.

- B. Corporation Stops: AWWA C 800 as modified in this Section:
 - 1. Inlet End: AWWA standard thread.
 - 2. Valve Body: Tapered plug type, O-ring seat ball type, or rubber seat ball type.
 - 3. Outlet End: Flared-copper connection for use with Type K, soft copper or compression type fitting.
- C. Provide taps for water main types and sizes in accordance with the pipe tapping schedule located at the end of this Section.
- D. Single Strap Saddles: Red brass body and straps.
- E. Taps for PVC Water Mains: Use single, wide-band strap saddles which provide full support around circumference of pipe and bearing area of sufficient width along axis of pipe, 2 inches minimum, ensuring that pipe will not be distorted when saddle is tightened. Romac Series 101N wide-band, stainless-steel tapping saddle with AWWA standard thread (Mueller thread), or approved equal.
- F. Taps for Steel Pipe: Not allowed, unless specifically approved by Utility Owner. Use saddle only if tap is approved on steel pipe.
- G. Curb Stops and Brass Fittings: AWWA C 800 as modified in this Section.
 - 1. Inlet End: Flared copper connection or compression-type fitting.

2. Valve Body: Straight-through or angled, meter-stop design equipped with the following:

- a. O-ring seal straight plug type.
- b. Rubber seat ball type.
- 3. Outlet End: Female, iron-pipe thread or swivel-nut, meter-spud thread on 3/4inch and 1-inch stops and 2-hole flange on 1-1/2 and 2-inch sizes.
- 4. Fittings: Mueller or approved equal. Use same size open end wrenches and tapping machines as used with respective Mueller fittings.

- 5. Factory Testing of Brass Fittings:
 - a. Submerge in water for 10 seconds at 85 psi with stop in both closed and open positions.
 - b. Reject any fitting that shows air leakage. Utility Owner may confirm tests locally. Entire lot from which samples were taken will be rejected when random sampling discloses unsatisfactory fittings.
- H. Angle Stops: In accordance with AWWA C 800; ground-key, stop type with bronze lock-wing head stop cap; inlet and outlet threads conform to application tables of AWWA C 800; and inlets flared connection or Mueller 110 compression.
 - 1. Outlet for 3/4-inch and 1-inch size: Meter swivel nut with saddle support.

2. Outlet for 1-1/2-inch through 2-inch size: O-ring sealed meter flange, iron pipe threads.

- I. Fittings: In accordance with AWWA C 800 and the following:
 - 1. Castings: Smooth, free from burrs, scales, blisters, sand holes, and defects which would make them unfit for intended use.
 - 2. Nuts: Smooth cast and have symmetrical hexagonal wrench flats.
 - 3. Flare-Joint Fittings: Smooth cast. Seating surfaces for metal-to-metal seal shall be machined to proper taper or curve, free from any pits or protrusions.
 - 4. Thread fittings, of all types, shall have N.P.T. or AWWA threads, and male threaded ends shall be protected in shipment by plastic coating, or approved equal.
 - 5. Compression tube fittings shall have Buna-N beveled gasket.
 - 6. Stamp of manufacturer's name or trademark and of fitting size on body.

PART 3 EXECUTION

3.01 APPLICATION

- A. Set service taps at right angles to proposed meter location and locate taps in upper pipe segment within 0 degrees of pipe springline.
- B. DELETED
- C. Tapped collars of appropriate sizes: Approved in new construction only provided they are set at right angles to proposed meter location.
- D. Use tapping machine manufactured for pressure tapping purposes for 2-inch and smaller service taps on pressurized water mains.
- E. Install service lines in open-cut trench in accordance with 31 23 33 Excavation & Backfill for Utilities except that service lines under paved roadways, other paved areas and areas indicated on Drawings shall be installed in cased bored hole in accordance with paragraph 3.01G.
- F. Lay service lines with minimum of 48 inches of cover as measured from top of curb or, in absence of curbs, from centerline elevation of crowned streets or roads. Provide minimum of 18 inches of cover below flow line of ditches to service lines.
- G. Service lines across existing street (push-unders): Pull service line through prepared hole under paving. Only full lengths of tubing shall be used. Take care not to damage copper tubing when pulling it through hole. A compression-type union is only permitted if Contractor cannot span underneath pavement with a full length of tubing. Contractor is allowed one compression-type union for each full length of tubing, provided it is not under the pavement.
- H. Maintain service lines free of dirt and foreign matter.
- I. Install service lines so that top of meter will be 3 to 6 inches below finished grade.
- J. Locate water meters one foot inside property line, or if this is not feasible, one foot inside street right-of-way. Contact Utility Owner when major landscaping or trees conflict with service line and meter box location.

K. New location and installation of existing small meter shall conform to requirements of this Section.

3.02 CURB STOP INSTALLATION

A. Set curb stops or angle stops at outer end of service line inside of meter box. Secure opening in curb stop to prevent unwanted material from entering. In close quarters, make an S-curve in the field. Do not flatten tube. In 3/4-inch and 1-inch services, install meter coupling, swivel-nut, or curb stop ahead of meter. Install straight meter coupling on outlet end of meter.

3.03 SEQUENCE OF OPERATIONS

- A. Open trench for proposed service line in accordance with Section 31 23 33 Excavation and Backfill for Utilities.
- B. Install curb stop on meter end of service line.
- C. With curb stop open and prior to connecting service line to meter in slack position, open corporation stop and flush service line thoroughly. Close curb stop, leaving corporation stop in full-open position.
- D. Check service line for apparent leaks. Repair any leaks before proceeding.
- E. Schedule inspection with the Utility Owner prior to backfilling. After inspection, backfill in accordance with Section 31 23 33 Excavation and Backfill for Utilities.
- F. Install meter box centered over meter with top of lid flush with 2-inches above finished grade. Meter box: Refer to Section 33 12 33 - Valve Boxes, Meter Boxes, and Meter Vaults.

END OF SECTION

SECTION 33 12 13.10

WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Copper tubing for water service lines.

1.02 DELETED

1.03 REFERENCES

- A. ASTM B 88 Standard Specification for Seamless Copper Water Tube.
- B. AWWA C 800 Underground Service Line Valves and Fittings.

1.04 SUBMITTALS

- A. Submittals shall conform to the requirements of Section 01 33 00 Submittal Procedures.
- B. Submit certified test results of ASTM B 88.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide Type K annealed, seamless, copper tubing, 3/4-inch to 2-inch in diameter conforming to requirements of ASTM B 88.
- B. Provide 3/4-inch and 1-inch tubing in coils of a minimum 60 feet in length, and 1-1/2-inch and 2-inch tubing in coils 40 feet in length.
- C. Provide tubing manufactured in United States of America. Tubing shall be inspected and tested by a laboratory designated by the Engineer at point of manufacture or locally.
 Furnish tubing, at no additional cost to designated testing laboratory along with mill compliance certificates.

D. Provide flared or compression-type brass fittings for use with Type K annealed copper tubing in accordance with AWWA C 800.

PART 3 EXECUTION

3.01 INSTALLATION

A. Conform to installation requirements of Section 33 12 13 - Water Tap and Service Line Installation, except as modified in this Section.

3.02 JOINTS

- A. Minimum joint spacing for 3/4-inch and 1-inch tubing shall be 60 feet and for 1-1/2-inch and 2-inch tubing shall be 40 feet.
- B. Cut copper tubing squarely by using cutting tools designed specifically for the purpose and avoid procedures that cause pipe to bend or pipe walls to flatten.
- C. After tubing has been cut, but before flaring, use reamer to remove inside rolled lip from tubing. Expand flared ends by use of flaring tool using care to avoid splitting, crimping, or overstressing metal. Provide at least 10 inches of straight pipe adjacent to fittings.
- D. When compression fittings are used, cut copper tubing squarely prior to insertion into the fitting. Final assembly shall be in accordance with manufacturer's recommended procedure.

3.03 BENDS

- A. Bend tubing by using appropriate sized bending tool. No kinks, dents, flats, or crimps shall be permitted, and should such occur, the damaged section shall be cut out and replaced. Install no bends with radius smaller than radius of coil of tubing as packaged by manufacturer. Copper tubing shipped in straight lengths conform to following:
 - 1. For 2-inch diameter: Maximum of one 45-degree bend per 4-foot section.
 - 2. For 1-1/2-inch diameter: Maximum of one 45-degree bend per 3-foot section.

END OF SECTION

SECTION 33 12 16

WATER UTILITY DISTRIBUTION VALVES

PART 1 GENERAL

- 1.01 SECTION INCLUDES
 - A. Gate valves.

1.02 DELETED

1.03 REFERENCES

- A. ASTM A 307 Carbon Steel Externally Threaded Standard Fasteners.
- B. ASTM B 62 Composition Bronze or Ounce Metal Casting.
- C. ASTM D 429 Test Methods for Rubber Property-Adhesion to Rigid Substrates.
- D. ASTM B 763 Copper Alloy Sand Casting for Valve Application.
- E. AWWA C 500 Gate Valves, 3 Through 48 in. NPS, for Water and Sewage Systems.
- F. AWWA C 509 Resilient-seated Gate Valves, 3 through 12 NPS, for Water and Sewage Systems.
- G. AWWA C 550 Protective Epoxy Interior Coatings for Valves and Hydrants.

1.04 SUBMITTALS

- A. Submittals shall conform to requirements of Section 01 33 00 Submittal Procedures.
- B. Submit manufacturer's product data for proposed valves for approval.

1.05 QUALITY CONTROL

A. Submit manufacturer's affidavit that gate valves are manufactured in the United States and conform to stated requirements of AWWA C 500, AWWA C 509, and this Section, and that they have been satisfactorily tested in the United States in accordance with AWWA C 500 and AWWA C 509.

PART 2 PRODUCTS

2.01 MATERIALS

- Gate Valves: AWWA C 500, AWWA C 509 and additional requirements of this Section. Direct bury valves and those in subsurface vaults open clockwise; aboveground and plant valves open counterclockwise.
- B. If type of valve is not indicated on Drawings, use gate valves as line valves for sizes less than 16-inches. If type of valve is indicated, no substitute is allowed.
- C. Gate Valves 1-1/2 Inches in Diameter and Smaller: 125 psig; bronze; rising-stem; singlewedge; disc type; screwed ends; such as Crane No. 428, or approved equal.
- D. Coatings for Gate Valves 2 Inches and Larger: AWWA C 550; Indurall 3300 or approved equal, non-toxic, imparts no taste to water, functions as physical, chemical, and electrical barrier between base metal and surroundings, minimum 10-mil-thick, fusionbonded epoxy. Prior to assembly of valve, apply protective coating to interior and exterior surfaces of body.
- E. Gate Valves 2 Inches in Diameter: Cast Iron body, non-rising stem, 500-psi test, 2 inch square nut operating clockwise to open.
- F. Gate Valves 4 Inches to 12 Inches in Diameter: Non-directional, resilient seated (AWWA C 509), 200 psig, bronze mounting, Mechanical Joint ends, and nut-operated unless otherwise specified. Provide resilient seated valves manufactured by Mueller 2360 Series, or approved equal. Comply with following requirements:

- 1. Design: Fully encapsulated rubber wedge or rubber seat ring mechanically attached with minimum 304 stainless-steel fasteners or screws; threaded connection isolated from water by compressed rubber around opening.
- 2. Body: Cast iron, flange bonnet and stuffing box together with 304 SS or 316 SS bolts. Manufacturer's initials, pressure rating, and year manufactured shall be cast in body.
- 3.. Bronze: Valve components in waterway to contain not more than 15 percent zinc and not more than 2 percent aluminum.
- 4. Stems: ASTM B 763 bronze, alloy number 995 minimum yield strength of 40,000 psi; minimum elongation in 2 inches of 12 percent, non-rising.
- 5. O-rings: AWWA C 509, sections 2.2.6 and 4.8.2.
- 6. Stem Seals: Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar.
- 7. Stem Nut: Independent or integrally cast of ASTM B 62 bronze.
- 8. Resilient Wedge: Molded, synthetic rubber, vulcanized and bonded to cast or ductile iron wedge or attached with 304 stainless steel screws tested to meet or exceed ASTM D 2000; seat against epoxy-coated surface in valve body.
- 9. Bolts: AWWA C 509 Section 4.4; 304 or 316 stainless steel only.
- G. Gate Valves 14 Inches to 24 Inches in Diameter: AWWA C 500; push-on bell ends with rubber rings and nut-operated unless otherwise specified, double disc, 150 psi, and comply with the following:
 - Body: Cast or ductile iron; flange together bonnet and stuffing box with ASTM A 307 Grade B bolts. Manufacturer's initials, pressure rating, and year manufactured shall be cast in body. Equip with rollers, tracks, and scrapers.
 - 2. Stems: Machined from ASTM B 62 bronze rod with integral forged thrust collar machined to size; non-rising.

- 3. Stem Seals: Consist of one O-ring above and one O-ring below thrust collar with anti-friction washer located above thrust collar for operating torque.
- 4. Stem Nut: Independent or integrally cast of ASTM B 62 bronze.
- 5. Discs: Cast iron with bronze disc rings securely pinned into machined dovetailed grooves.
- 6. Wedging Device: Solid bronze or cast-iron, bronze-mounted wedges. Thin plates or shapes integrally cast into cast-iron surfaces are acceptable. Other moving surfaces integral to wedging action shall be bronze monel or nickel alloy-to-iron.
- 7. Bronze Mounting: Built as integral unit mounted over, or supported on, cast-iron base and of sufficient dimensions to be structurally sound and adequate for imposed forces.
- 8. Gear Cases: Cast iron; furnished on 18-inch and larger valves and of extended type with steel side plates, lubricated, gear case enclosed with oil seal or O-rings at shaft openings.
- 9. Stuffing Boxes: Located on top of bonnet and outside gear case.
- H. Gate Valves 20 Inches and Larger: Furnish and equip with bypass valves.
 - Sizes: Provide 3-inch bypass valves for 16-inch through 20-inch gate valves. Provide 4-inch bypass valves for 24-inch gate valves.
- I. Valves 4 Inches through 12 Inches for Installation in Vertical Pipe Lines: Double disc, square bottom.
- J. Valves 14 Inches and Larger for Installation in Horizontal Pipe Lines: Equipped with bronze shoes and slides.
- K. Gate Valves Installed at Greater than 4 foot Depth: Provide non-rising, extension stem having coupling sufficient to attach securely to operating nut of valve. Upper end of extension stem shall terminate in square wrench nut no deeper than 4 feet from finished grade.

- L. Gate Valves in Factory Mutual (Fire Service) Type Meter Installations: Conform to provisions of this specification; outside screw and yoke valves; carry label of Underwriters' Laboratories, Inc.; flanged, Class 125; clockwise to close.
- M. Provide flanged joints when valve is connected to steel or PCCP.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Earthwork. Conform to applicable provisions of Section 31 23 33 Excavation and Backfilling for Utilities.
- B. Operation. Do not use valves for throttling without prior approval of manufacturer.

3.02 SETTING VALVES AND VALVE BOXES

- A. Remove foreign matter from within valves prior to installation. Inspect valves in open and closed positions to verify that parts are in satisfactory working condition.
- B. Install valves and valve boxes where shown on Drawings. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of 4 feet, or to undisturbed trench face if less than 4 feet. Install valves completely closed when placed in water line.
- C. For pipe section of each valve box, use only cast iron, ductile iron, or DR18 PVC pipe cut to proper length. Size to allow future operation of valve. Assemble and brace box in vertical position as indicated on Drawings.

3.03 DISINFECTION AND TESTING

 A. Assist the Utility Owner with disinfection of valves and appurtenances as required by Section 02514 - Disinfection of Waterlines and test as required by Section 02511 - Water Mains.

- B. Double-Disc Gate Valves: Apply hydrostatic test pressure equal to twice the rated working pressure of valve between discs. The valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied between discs. The valve shall show no leakage through metal, flanged joints, or stem seals. Do not exceed a leakage rate of 1 oz/hr/inch of nominal valve size.
- C. Solid-Wedge Gate Valves: Apply hydrostatic pressure equal to twice rated working pressure of valve with both ends bulk headed and gate open. The valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied through bulkheads alternately to each side of closed gate with opposite side open for inspection. The valve shall show no leakage through metal, flanged joints, or stem-seals. Do not exceed a leakage rate of 1 oz/hr/inch of nominal valve size.
- D. Repair or replace valves which exceed the leakage rate.

3.04 PAINTING OF VALVES

A. Paint valves in vaults, stations, and above ground using ACRO Paint No. 2215, or approved equal.

END OF SECTION

SECTION 33 12 16.13

TAPPING SLEEVES AND VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tapping sleeves and valves for connections to existing water system.

1.02 DELETED

1.03 REFERENCES

- A. ANSI B 16.1 Cast Iron Pipe Flanges and Flanged Fittings.
- B. AWWA C 110 Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and other Liquids.

C. AWWA C 111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

- D. AWWA C 200 Steel Water Pipe 6 in. And Larger.
- E. AWWA C 207 Steel Pipe Flanges for Waterworks Service Sizes 4 in. through 144 in.
- F. AWWA C 500 Gate Valves, 3 through 48 in. NPS, for Water and Sewage Systems.

1.04 SUBMITTALS

- A. Submit product data in accordance with requirements of Section 01 33 00 Submittal Procedures.
- B. Submit results of tapping sleeves NPT test opening.
- C. Submit manufacturer's affidavit stating that valves for tapping into existing water lines conform to Section 02521 Gate Valves and to requirements of AWWA C 500 and that they have been satisfactorily tested in accordance with AWWA C 500.

1.05 DELIVERY, STORAGE AND HANDLING

A. Ship steel sleeves in wooden crates that provide protection from damage to epoxy coating during transport and storage.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Tapping Sleeves:
 - 1. Tapping Sleeve Bodies: Tapping valves will be Mueller SS Series Stainless Steel Service Saddle with all 304SS exterior bolts, or approved equal. Flange bolts must be 304 SS or 316 SS.
 - 2. Branch Outlet of Tapping Sleeve:

a. Flanged, machined recess, AWWA C 207, Class D, ANSI 150 pound drilling.

- b. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.
- 3. Use cast iron split sleeve where fire service from 6-inch main is approved.
- B. Welded-steel tapping-sleeve bodies may be used in lieu of cast or ductile iron bodies for following sizes and with following restrictions:
 - 1. Flange: AWWA C 207, Class D, ANSI 150 pound drilling.
 - 2. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.
 - 3. Steel sleeves are restricted to use on pipe sizes 6 inches and larger.
 - 4. Body: Heavy, welded-steel construction; top half grooved to retain neoprene O ring seal permanently against outside diameter of pipe.
 - 5. Bolts: AWWA C 500 Section 3.5; coated with 100 percent vinyl resin or corrosive resistant material.

- 6. Steel Sleeves Finish: Fusion-bonded epoxy coated to minimum 12 mil thickness.
- 7. Finished Epoxy Coat: Free of laminations and blisters; and remain pliant and resistant to impact with non-peel finish.

8. Steel tapping sleeves shall be Smith Blair No. 622, JCM No. 412, or approved equal.

- 9. Tapping Sleeves: Provide with 3/4-inch NPT test opening for testing prior to tapping. Provide 3/4-inch bronze plug for opening.
- 10. Do not use steel sleeves for taps greater than 75 percent of pipe diameter.

C. Tapping Valves: Meet requirements of Section 02521 - Gate Valves with following exceptions:

- 1. Inlet Flanges:
 - a. AWWA C 110; Class 125.
 - b. AWWA C 110; Class 150 and higher: Minimum 8-hole flange.
- 2. Outlet: Standard mechanical or push-on joint to fit any standard tapping machine.
- 3. Valve Seat Opening: Accommodate full-size shell cutter for nominal size tap without any contact with valve body; double disc.
- Valve Boxes: Standard A valve box conforming to requirements of Section 33 12 33 -Valve Boxes, Meter Boxes, and Meter Vaults.

PART 3 EXECUTION

3.01 APPLICATION

A. Install tapping sleeves and valves at locations and of sizes shown on Drawings. Install sleeve so valve is in a horizontally level position.

- B. Clean tapping sleeve, tapping valve, and pipe prior to installation and in accordance with manufacturer's instructions.
- C. Hydrostatically test installed tapping sleeve to 150 psig for a minimum of 15 minutes. Inspect sleeve for leaks, and remedy leaks prior to tapping operation.
- D. When tapping concrete pressure pipe, size on size, use shell cutter one standard size smaller than water line being tapped.
- E. Do not use Large End Bell (LEB) increasers with a next size tap unless existing pipe is asbestos-cement.

3.02 INSTALLATION

- A. Tighten bolts in proper sequence so that undue stress is not placed on pipe.
- B. Align tapping valve properly and attach to tapping sleeve.
- C. Make tap with sharp, shell cutter:
 - 1. For 12-inch and smaller tap, use minimum cutter diameter one-half inch less than nominal tap size.
 - 2. For 16-inch and larger tap, use manufacturer's recommended cutter diameter.
- D. Withdraw coupon and flush cuttings from newly-made tap.
- E. Wrap completed tapping sleeve and valve in accordance with Section 02511 Water Mains.
- F. Place concrete thrust block behind tapping sleeve (not over tapping sleeve and valve).
- G. Request inspection of installation prior to backfilling.
- H. Backfill in accordance with Section 31 23 33 Excavation and Backfill for Utilities.

END OF SECTION

SECTION 33 12 33

VALVE BOXES, METER BOXES, AND METER VAULTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Valve boxes for water service.
- B. Meter boxes for water service.
- C. Meter vaults for water service.

1.02 DELETED

1.03 REFERENCES

- A. ASTM A 48 Standard Specification for Gray Iron Castings.
- B. ASTM D 256 Standard Test Methods for Impact Resistance of Plastics and Electrical Insulating Materials.
- C. ASTM D 638 Standard Test Method for Tensile Properties of Plastics.

D. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load.

E. ASTM D 2790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.04 SUBMITTALS

- A. Submittals shall conform to requirements of Section 01 33 00 Submittal Procedures.
- B. Submit manufacturer's product data for following items for approval:
 - 1. Each type of valve box and lid.

- 2. Each type of meter box and cover.
- 3. Each type of meter vault frame and cover.
- C. Submit design calculations and shop drawings for precast vault elements, sealed by an Engineer registered in the State of Texas.
- D. Submit shop drawings for cast-in-place meter vaults for approval if proposed construction varies from Drawings.
- E. Submit manufacturer's certification that plastic meter boxes meet the requirements of Paragraph 2.05, Plastic Meter Boxes.

PART 2 PRODUCTS

2.01 VALVE BOXES

- A. Provide Type A, cast-iron, slide-type, American Made, valve boxes or pre-approved equal. Provide Type B when 6-inch plain and cast-iron pipe will not enclose stuffing box section of gate valve. Design of valve box shall minimize stresses on valve imposed by loads on box lid.
- B. Cast a letter "W" into lid, 1/2 inch in height and raised 3/32 inch, for valves serving potable water lines.
- C. Coat boxes, bases, and lids by dipping in hot bituminous varnish.
- D. Provide 6-inch PVC, Class 160, Class 200, or DR 18 riser pipes.
- E. Concrete for valve box placement:
 - 1. For locations in new concrete pavement, provide strength and mix design of new pavement.
 - 2. For other locations, provide Class A concrete, with minimum compressive strength of 3000 psi, conforming to requirements of Section 33 05 16 Concrete for Utility Construction.

2.02 METER BOXES

- A. Provide meter boxes for 5/8-inch through 1-inch meters of the following materials:
 - 1. Non-traffic bearing locations: Cast iron, concrete or plastic.
 - 2. Traffic bearing locations: Cast iron.
- B. Provide meter boxes for 1-1/2-inch and 2-inch meters of cast iron.
- C. Provide meter box with reading lid. Provide lids with key-operated, spring-type, locking device. Lids shall contain sufficient metal that meter box can be easily located with metal detector.
- D. Meter box dimensions shall conform to the following approximate dimensions:
 - 1. Length: At top 15-1/2 inches; at bottom 20 inches.
 - 2. Width: At top 12-1/2 inches; at bottom 14-3/4 inches.
 - 3. Height: 12 inches.
- E. Extensions: Meter box extensions 3 inches and 6 inches in height shall be available from the manufacturer as a standard item.

2.05 PLASTIC METER BOXES

 Plastic Meter Boxes: Shall be oval black plastic meter box model DFW 12" D1200-0-LCIRSS with cast iron reader lid with stainless steel hinge pin. The meter box must meet high density polyethylene conforming to the following ASTM standards:

<u>ASTM</u>	Requirement
D 256	Impact Strength = 1.9 ft-lb/inch (Izod, Notched)
D 256	Impact Strength = 6.4 ft-lb/inch (Izod, Un-Notched)
D 638	Tensile Strength (2.0 min.) = 3400 psi
D 648	Deflection Temperature = 170 degrees F
D 676	Shore D, Hardness, 55-65 Impact Strength, Falling Dart Method, 160
inch-lb.	
D 790	Flexural Modulus = 90,000 psi

- B. Meter boxes shall meet the following test requirements:
 - 1. Static Load: Not less than 2500 pounds using 6-inch disc with direct compression exerted at center of top of meter box with solid plastic lid.
 - 2. Deflection: Not less than 1000 pounds load required to deflect top edge of meter box 1/8 inch.
- C. Meter box body, without lid, shall weigh approximately 7 pounds.

2.06 METER VAULTS

- A. Meter vaults may be constructed of precast concrete, cast-in-place concrete or common brick masonry unless a specific type of construction is required by Drawings.
- B. Concrete for Meter Vaults: Class A concrete, conforming to requirements of Section 33 05 16 Concrete for Utility Construction with minimum compressive strength of 4000 psi at 28 days.
- C. Reinforcing steel for meter vaults: Conform to requirements of Section 33 05 16 -Concrete for Utility Construction.
- D. Grates and Covers: Conform to requirements of Section 33 39 13 Sanitary Utility Sewerage Manholes, Frames, and Covers.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Obtain approval from Public Works Director for location of meter vault.
- B. Verify lines and grade are correct.
- C. Verify compacted subgrade will support loads imposed by vaults.

3.02 VALVE BOXES

- A. Install riser pipe with suitable length for depth of cover indicated on Drawings or to accommodate actual finish grade.
- B. Install valve box and riser piping plumbed in a vertical position. Provide 6-inches telescoping freeboard space between riser pipe top butt end, and interior contact flange of valve box, for vertical movement damping. Riser may rest on valve flange, or provide stable footpiece to support riser pipe.
- C. After valve box has been set, aligned, and adjusted so that lid is level with final grade, pour a 24-inch by 24-inch by 8-inch-thick concrete block around valve box. Center valve box horizontally within concrete block.
- D. Paint covers of new valve boxes in fluorescent orange when installed. After completion and acceptance by City, repaint covers black.

3.03 METER BOXES

- A. Install cast iron or plastic boxes in accordance with manufacturer's instructions.
- B. Construct concrete meter boxes to dimensions shown on Drawings.
- C. Adjust top of meter boxes to conform to cover elevations specified in Paragraph 3.05, Frame and Cover for Meter Vaults.
- D. Do not locate under paved areas unless approved by Public Works Director. Use approved traffic-type box with cast iron lid when meter must be located in paved areas.

3.04 METER VAULTS

- A. Construct concrete meter vaults to dimensions shown on Drawings. Do not cast in presence of water. Make bottom uniform. Verify lines and grades are correct and compacted subgrade will support loads imposed by vaults.
- B. Precast Meter Vaults:

- Install precast vaults in accordance with manufacturers recommendations. Set level on a minimum 3-inch-thick bed of sand conforming to the requirements of Section 31 06 20.16 - Utility Backfill Materials.
- 2. Seal lifting holes with cement-sand mortar or non-shrink grout.
- C. Meter Vault Floor Slab:
 - 1. Construct floor slabs of 6-inch-thick reinforced concrete. Slope floor 1/4 inch per foot toward sump. Make sump 12 inches in diameter, or 12 inches square, and 4 inches deep, unless other dimensions are required by Drawings. Install dowels at maximum of 18 inches, center-to-center, or install mortar trench for keying walls to floor slab.
 - 2. Precast floor slab elements may be used for precast vault construction.
- D. Cast-in-Place Meter Vault Walls:
 - 1. Key walls to floor slab and form to dimensions shown on Drawings. Minimum wall thickness shall be 4 inches.
 - 2. Cast walls monolithically. One cold joint will be allowed when vault depth exceeds 12 feet.
 - 3. Set frame for cover while concrete is still green.

3.05 FRAME AND COVER FOR METER VAULTS

- A. Set cast iron frame in a mortar bed and adjust elevation of cover as follows:
 - 1. In unpaved areas, set top of meter box or meter vault cover 2 to 3 inches above natural grade.
 - 2. In paved areas, set top of meter box or meter vault cover flush with adjacent concrete but no higher than 1/2 inch.

3.06 BACKFILL

- Provide bank run sand in accordance with Section 31 06 20.16 Utility Backfill
 Materials, and backfill and compact in accordance with Section 31 23 33 Excavation & Backfill for Utilities.
- B. In unpaved areas, slope backfill around meter boxes and vaults to provide a uniform slope 1-to-5 slope from top to natural grade.
- C. In paved areas, slope concrete down from meter box or vault to meet adjacent paved area.

END OF SECTION

SECTION 33 13 00

DISINFECTION OF WATER LINES

PART 1 GENERAL

- 1.01 SECTION INCLUDES
 - A. Disinfection of potable water lines.
- 1.02 MEASUREMENT AND PAYMENT
 - A. Unit Prices.
 - 1. No separate payment will be made for disinfection of water lines under this Section. Include cost in unit price of water lines being disinfected.
- 1.03 REFERENCES
 - A. AWWA C 651 Disinfecting Water Mains.
- PART 2 P R O D U C T S Not Used
- PART 3 E X E C U T I O N
- 3.01 CONDUCTING DISINFECTION
 - A. Water lines constructed shall be promptly disinfected before any tests are conducted on water lines and before water lines are connected to the Utility Owner's water distribution system.
 - B. Water for disinfection and flushing will be furnished by the Utility Owner without charge.
 - C. Unless otherwise provided in Contract Documents, the Contractor will conduct disinfection operations.
 - D. Coordinate chlorination operations through the Utility Owner.
- 3.02 PREPARATION
 - A. Use required temporary blind flanges, cast-iron sleeves, plugs, and other items needed to facilitate disinfection of new mains prior to connection to the Utility Owner's water distribution system. Normally, each valved section of water line requires two each 3/4-inch taps. A 2-inch minimum blow-off is required for water lines up to and including 6-inch diameter.

- B. Fire hydrants shall be used as blow-offs to flush newly constructed water lines 8-inch diameter and above. Where fire hydrants are not available on water lines, locations and designs for blow-offs shall be as indicated on Drawings. Install temporary blow-off valves and remove promptly upon successful completion of disinfection and testing.
- C. Slowly fill each section of pipe with water in a manner approved by the Utility Owner. Average water velocity when filling pipeline should be less than one foot per second and shall not, under any circumstance, exceed 2 feet per second. Before beginning disinfection operations, expel air from pipeline.
- D. Excavations shall be backfilled immediately after installation of risers or blow-offs.
- E. Install blow-off valves at end of main to facilitate flushing of dead-end water mains. Install permanent blow-off valves according to Drawings.
- 3.03 DISINFECTION BY UTILITY PERSONNEL
 - A. Correct problems that may prevent disinfection operations prior to performing disinfection work. When disinfection work cannot be performed due to covered up valves, missing valve stacks, inoperative fire hydrants or other nonconforming construction, a charge will be levied against Contractor for each trip made by the Utility Owner.
 - B. Notify and coordinate with the Utility Owner a minimum of 48 hours before disinfection work is to be performed. Assist the Utility personnel during disinfection operations.
- 3.04 DISINFECTION BY CONTRACTOR
 - A. The following procedure will be used when disinfection by Contractor is required by Contract Documents:
 - 1. Use not less than 100 parts of chlorine per million parts of water.
 - 2. Introduce chlorinating material to water lines in accordance with AWWA C 651.
 - 3. After contact period of not less than 24 hours, flush system with clean water until residual chlorine is no greater than 1.0 part per million parts of water.
 - 4. Open and close valves in lines being sanitized several times during contact period.
 - 5. If a chemical compound is used for a sterilizing agent, it shall be placed in pipes as directed by the Utility Owner.

3.05 BACTERIOLOGICAL TESTING

A. After disinfection and flushing of water lines, bacteriological tests will be performed by the Utility or testing laboratory in accordance with Section 01 45 29 - Testing Laboratory Services. If test results indicate need for additional disinfection of water lines based upon Texas Department of Health requirements, assist the Utility with additional disinfection operations.

3.06 COMPLETION

A. Upon completion of disinfection and testing, remove risers except those approved for use in subsequent hydrostatic testing, and backfill excavation promptly.

END OF SECTION 33 13 00

Section 33 30 00

SANITARY SEWERAGE UTILITIES SANITARY SEWER PIPE WORK

PART 1 GENERAL

1.01 DESCRIPTION

Under this section is included the furnishing, laying, jointing and testing of all sewer pipe, including sewer pipe and sewer appurtenances, both in open cut and in tunnels, as shown on the drawings or as directed by the engineer.

PART 2 PRODUCTS

2.01 MATERIAL

- (A) Gravity Sewer Pipe
 - 1. Gravity sewer pipe may be of any of the following classifications. Any pipe found defective, not meeting the specifications, or improperly installed shall be rejected and so marked and shall be replaced by pipe approved by the engineer at no additional cost to PUB.
 - a. Pipe and fittings shall be manufactured in conformance with the materials and methods described in ASTM Specification D-3034. Joint seals shall be compression type rubber gaskets in compliance with the requirements of ASTM Specification D-1869.
 - b. Pipe and fittings shall be manufactured in conformance with the materials and methods described in ASTM Specification F-789 and UNI-B-10. Gaskets shall comply with the requirements of ASTM Specification F-477.
- (B) Force Mains
 - 1. Pressure sewer pipe will be the following classification. Any pipe found defective, not meeting the specifications, or improperly installed shall be rejected and so marked and shall be replaced by pipe approved by the engineer at no additional cost to PUB.
 - a. Polyvinyl chloride pipe for force mains shall conform to AWWA Standard "Polyvinyl Chloride (PVC) Pressure Pipe" C-900 - 750 Class 100 DR25 latest revision. Fittings for polyvinyl chloride (PVC) pipe shall be Ductile Iron Class 125 "Compact Fittings" short body, tar coated (not cement lined). Transition gaskets shall also be included, unless otherwise noted on the contract bid document or drawings.

(C) Watertight Joint Materials

- 1. The contractor must exert every reasonable effort to secure a watertight joint and prevent infiltration of ground water into or exfiltration of sewage out of all pipe sewers and property service connections. To achieve this, joint material shall be made of the materials as specified herein, unless otherwise set forth in Special Provisions or Proposal. Any joint materials found to be defective or not meeting the specifications shall be rejected and replaced by approved joint materials at no additional cost to PUB.
- (D) Pipe Jointing
 - 1. In laying the sewer pipe to line and grade, the pipe shall be jointed in accordance with one of the approved jointing methods. PUB reserves the right, before construction is in progress, to change the type of joints if its engineer so directs.
- (E) Polyvinyl Chloride Pipe (PVC) Jointing
 - 1. The contractor shall make certain before jointing polyvinyl chloride pipe that the ring groove in the bell of the pipe is clean with no dirt or foreign material that could interfere with proper seating of the ring. Make sure pipe end is clean. Wipe with a clean dry cloth around the entire circumference from the end to one (1) inch beyond the reference mark. Lubricate the spigot end of the pipe, using only the lubricant supplied by the manufacturer. Be sure the entire circumference is covered. The coating shall be the equivalent of a brush coat of enamel paint. It can be applied by hand, cloth, pad, sponge, or glove. Do not lubricate the rubber ring or the ring groove in the bell because such lubricant could cause ring displacement. The level end is then inserted into the bell so that it is in contact with the ring. Brace the bell, while the level end is pushed in under the ring, so that previously completed joints in the line will not be closed up. The spigot end is pushed until the reference mark on the spigot end is flush with the end of the bell. If undue resistance to insertion of the level end is encountered or the reference mark does not reach the flush position, disassemble the joint and check the position of the ring. If it is twisted or pushed out of its seat, lean the ring, bell and level end and repeat the assembly steps.
 - 2. Water stop joints shall be Polyvinyl Chloride (PVC) or other similar approved joint materials.

(F) SERVICE CONNECTIONS

1. Property service connections shall be installed using Polyvinyl Chloride Pipe (PVC). The pipe shall be SDR-35 and shall be manufactured in accordance with ASTM D-3034. The joints shall be compression type rubber gasket joints conforming to ASTM D-1869. The location of all laterals and service lines shall be shown on the plans. Where no approved street grade has been established, the depth of the connection shall be based on the assumed future street grade or on the present street or ground surface, as determined by the engineer. At times when pipe laying is not in process, the open ends of the pipe shall be closed by a watertight plug or other approved means. This provision shall apply during

the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

PART 3 EXECUTION

3.01 CONSTRUCTION METHODS

- 1. After the trench is excavated to a subgrade as specified, it shall be filled to grade with a minimum 6-inch gravel layer. This material shall be mechanically tamped to a density minimum of 90%. This material shall provide a smooth and uniform pipe bed for the entire length of the sewer pipe barrel. Ditching and pipe laying shall be uniformly in a straight line and to uniform elevations unless otherwise specified on the plans. Pipe and fittings shall be carefully handled to avoid damage. Before placing pipe into the trench, the outside of the spigot and the inside of the bell shall be wiped clean and dry, free from oil and grease. Every precaution shall be taken to prevent foreign material shall be placed into the pipe. After placing a length of pipe into the trench, the spigot end shall be centered in the bell, the pipe forced home, brought to the correct alignment and covered with an approved backfill material. When the pipe is installed, metallic tape shall be buried as directed by the PUB inspector, but no greater than 4' below the finished grade or less than 2' above the top of the pipe for location purposes.
- 2. Sewer Appurtenances Appurtenances to the sewer shall be provided and laid in accordance with the drawings and in the manner as specified herein. Appurtenances in addition to those required by the drawings or the proposal, as approved or directed by the engineer, shall be paid for under the appropriate items of the proposal.
- 3. Branches and Fittings Branches and fittings shall be provided and laid as and where directed. T-branches and Y-branches, placed in the sewer for property service connections, shall be located by the contractor, as directed by the engineer, at such points in the sewer so as to result in the property service connection having the shortest length possible between the sewer and property line or easement line, unless otherwise indicated on the drawing or directed by the engineer.
- 4. Stubs Stubs for future sewer pipe shall be installed as indicated by the drawings. If the specified length of the stub is exceeded, there will be no additional cost to PUB unless the extra length is ordered by the engineer. Existing sewer pipe stubs shall be removed as required, but only when directed by the engineer.
- 5. Stacks Stacks shall be constructed as and where directed. The height of the stack shall be as indicated on the drawings, set forth in the proposal, as determined by the engineer. The stack shall encased in-concrete in accordance with the "Typical Sewer Details" drawings.
- 6. Drop Inlets Drop inlets to the manhole shall be constructed as and where indicated by the drawings of either of the types shown on the "Typical Sewer Details" drawings, as directed by the engineer.

Sanitary Sewerage Utilities – Sanitary Sewer Pipework

- 7. Cleanouts Cleanouts on all service laterals shall be installed at the location shown on the plans and in accordance with the Wastewater Construction Standards.
- 8. Manholes - Manholes shall be constructed as shown on the "Typical Sewer Details" drawings to the elevations shown on the plan-profile sheets, or as directed. The manholes specified shall be Glass Fiber-Reinforced Polyester Manholes for use in sanitary sewer applications. They shall be a one-piece unit of one class, fabricated in a composite laminate. Walls shall be of uniform thickness and shall be free from thin spots and voids. Exterior surface shall be free of ridges and sharp protrusions and reinforcement. Interior surface shall also be smooth and free of ridges so as to facilitate self-cleaning. The exterior surface shall be covered with graded sand to facilitate bonding to the concrete base pad, cement stabilized sand backfill and cement grout used to seal around all incoming lines. The main line over which the manhole cut-out will be set shall be fitted with a seal ring as manufactured by Johns-Manville Manufacturing or equal (as per ASTM C-923 requirements). The manholes shall be Containment Solutions, Inc. Flowtite Fiberglass Manholes or approved equal that conforms to ASTM D. 3753-81, Standard Specifications for Glass Fiber-Reinforced Polyester Manholes and all noted applicable documents. The manufacturer shall submit written certification that their product meets the requirements of ASTM D. 3753-81 with test results of specified manholes included.
- 9. Stoppers and Bulkheads Open ends of pipes and branches smaller than 15 inches in diameter shall be sealed with stoppers, cemented into place in an acceptable manner using a rubber gasket between the stopper and socket. Openings 15 inches in diameter and larger shall be closed with brick bulkheads at least 4 inches thick or by other approved methods as authorized. All openings to the pipeline shall be satisfactorily protected from the entrance of earth, water or other material. If a temporary bulkhead is constructed to prevent sewage from backing into the trench excavation or to prevent foreign material from entering the sewer from the new sewer trench, the contractor shall be responsible for reconstructing, repairing, or replacing those portions of the existing sewers removed or damaged by his operations. Existing bulkheads shall be removed as indicated by the drawings or set forth in the proposal, but not until directed by the engineer.

3.02 EXECUTION

- 1. Air Testing This shall cover the testing of completed sections of installed sewer pipe using low air pressure. The contractor shall conduct low air pressure tests on completed sections of sewer mains. The air test results will be used to evaluate materials and construction methods on the pipe line sections, and successful air tests shall be mandatory for the acceptance of the lines. The Contractor shall furnish all labor and material required to complete all testing required by this specification.
- 2. Material for Air Testing The following materials will be furnished by the contractor and utilized for air testing sewer mains:

a. Compressor Air Supply: Any source which will provide at least three hundred (300) cubic feet per minute at one hundred (100) pounds per square inch. The compressor air supply shall be furnished by the contractor.

b. Plugs, valves, pressure gauges, air hose, connections and other equipment necessary to conduct the air test shall be furnished by the contractor. The test equipment for air testing will consist of valves, plugs, and pressure gauges used to control the rate at which air flows to the test section and to monitor the air pressure inside the plugs. Test equipment shall be assembled as follows:

- 1. hose connection
- 2. shut off valve
- 3. throttle valve
- 4 pressure reduction valve
- 5. gauge cock
- 6. monitoring pressure gauge
- 3. Test Procedures The following procedures will be utilized for air testing sewer mains:
 - a. Determine section of line to be tested.
 - b. Apply air pressure until the pressure inside the pipe reaches 4 psig.
 - c. Allow the pressure inside the pipe to stabilize, then bleed back to 3.5 psig.
 - d. At 3.5 psig, the time, temperature and pressure will be observed and recorded. A minimum of five (5) readings will be required for each test. If the time in seconds for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than that shown in the following table, the pipe shall be presumed to be free from defect. When these rates are exceeded, pipe breakage, joint leakage, or leaking plugs are indicated and an inspection must be made to determine the cause. The contractor shall effect such repairs as may be required to accomplish a successful air test.

Table 1 Minimum Test Time for Various Pipe Sizes

Nominal Pipe Size, in.	T(time) min/100 ft.	Nominal Pipe Size, in.	T(time) min/100 ft.
3	0.2	21	3.0
4	0.3	24	3.6
6	0.7	27	4.2
8	1.2	30	4.8
10	1.5	33	5.4
12	1.8	36	6.0
15	2.1	39	6.6
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18	2.4	42	7.3

- 4. Leakage Test A leakage test may be requested by the engineer at any time to determine whether or not there is excessive infiltration and to assure that the sewer section is substantially watertight. The engineer may order the contractor to make leakage tests of as many sections as may be necessary to determine whether the work complies with the criteria for the rate of leakage. A section shall consist of a reach from one manhole to the next manhole provided the manholes are at least 300 feet apart and preferably 400 feet. Leakage tests shall be conducted, and measurements made, for a minimum of one hour. The tests may be conducted over a longer period of time with no reduction in the rate of leakage.
 - a. Leakage into Sewer Leakage into the sewer including manholes, shall not exceed a rate of 50 gallons per 24 hours per inch diameter per mile of sewer. There shall be no gushing or spurting streams entering the sewer or manhole and where encountered they shall be repaired regardless of the rate of infiltration at no additional cost to PUB. Where practicable, the tests for leakage into the sewers shall be made at a time when the groundwater level is at a maximum, but it must be at least one foot above the top of the pipe of the highest elevation in the section being tested.
 - b. Leakage out of Sewer Where the groundwater level is less than one foot above the top of-the pipe and where conditions will permit, the sewers shall be subjected to an internal pressure by plugging the pipe at both ends and then filling the sewer and manholes with clean water to a height above the top of the pipe sufficient to obtain satisfactory measurements to determine the rate of leakage. The rate of leakage from the sewers may be determined by either the amount of subsidence in the water surface level of the amount of water required to maintain the original water surface level above the top of the pipe. Leakage from the sewers under test shall not exceed the requirement of leakage into sewers as specified in Section 4.7.1, except that an allowance of an additional 10 percent of gallonage shall be permitted for each additional 2 feet of head over a basic 2 foot minimum internal head.
 - c. Requirements of the Contractor The contractor shall construct such weirs or other means of measurements as may be required, shall furnish water and shall do all necessary pumping to enable the tests to be properly made. When a leakage test fails, the contractor shall do such other work as may be necessary until the rate of leakage meets the above requirements, as determined by additional leakage tests.
- 5. Deflection Testing for Gravity PVC Sewer Lines
 - a. No sooner than 30 days, nor later than 12 months after the pipe has been installed and backfilling has been completed, tests for deflection will be made. A deflection of more than 5 percent of the inside diameter of the pipe shall be cause for

rejection, and the line will be removed and replaced at the contractor's expense. A GO NO-GO Deflection Testing Mandrel, to be furnished by the contractor, and certified by the engineer, shall be used. The testing shall consist of the following:

- 1. Completely flush the line, if required, making sure the pipe is clean of any mud or debris that would hinder the passage of the mandrel.
- 2. During the final flushing of the line, attach a floating block or ball to the end of the mandrel pull rope and float the rope through the line.
- 3. After the rope is threaded through the line, connect the pull rope to the mandrel and place the mandrel in the entrance of the rope.
- 4. Connect a retrieval rope to the back of the mandrel to pull it back if necessary.
- 5. Remove all slack in the pull rope and place a tape marker on the rope at the ends of the pipe where the mandrel will exit, determining the location of the mandrel in the line.
- 6. Using manhole guide pulleys, draw mandrel through the sewer line, if any irregularity of pipe deformation exceeding the allowable 5 percent is encountered in the line, the line shall be uncovered at the point.
- 7. If an obstructed or over-deflected section is found, locate it; dig down and uncover pipe; inspect the pipe; if any damaged pipe is found, replace it. If pipe is not damaged, re-round the pipe, replace and thoroughly tamp the embedment and initial backfill; replace remainder of backfill.
- 8. Re-test this entire section for deflection.
- 9. Any pipe removed shall be replaced by use of gasketed repair couplings. Each and every deflection test shall be conducted in the presence of the owner's or engineer's representative.
- b. The Contractor shall furnish all labor and material required to clean and flush and complete all testing required by this specification. The owner, at their discretion, may televise the sewer lines in lieu of the mandrel test. Televising equipment will be furnished by the owner. The contractor shall furnish labor to assist PUB inspectors to operate televising equipment. Labor shall consist of a minimum of 2 persons. Televising work will normally be performed during other than normal working hours, including Saturdays and after 5 PM on weekdays.

If there are insufficient roadways within the project area, the contractor will furnish the equipment necessary to gain full access to the site.

- 6. Force Main Hydrostatic Testing
 - a. After the pipe and appurtenance have been installed, test line and drain. Prevent damage to the Work or adjacent areas. Use clean water to perform tests.
 - b. The Utility Owner may direct tests of relatively short sections of completed lines to minimize traffic problems or potential public hazards.

- c. Test pipe in the presence of the Utility Owner.
- d. Test pipe at 150 psig or 1.5 times design pressure of the pipe, whichever is greater. Design pressure of the force main shall be the rated total dynamic head of the lift station pump.
- e. Test pipe at the required pressure for a minimum of 2 hours according to requirements of Uni-B-3.
- f. Maximum allowable leakage shall be as calculated by the following formula:

 $L = (S) (D) (P^{0.5}) / 133,200$

Where: L	=	Leakage in gallons per hour.
S	=	Length of pipe in feet.
D	=	Inside diameter of pipe in inches.
Р	=	Pressure in pounds per square inch.

- g. Correct defects, cracks, or leakage by replacement of defective items or by repairs as approved by the Utility Owner.
- h. Plug openings in the force main after testing and flushing. Use cast iron plugs or blind flanges to prevent debris from entering the tested pipeline.
- 7. Pigging Test
 - 1. After completion of hydrostatic testing and prior to final acceptance, test force mains longer than 200 feet by pigging to ensure piping is free of obstructions.
 - 2. Pigs: Provide proving pigs manufactured of an open-cell polyurethane foam body, without any coating or abrasives which would scratch or otherwise damage interior pipe wall surface or lining. Pigs shall be able to pass through reductions of up to 65 percent of the nominal cross-sectional area of the pipe. Pigs shall be able to pass through standard fittings such as 45-degree and 90-degree elbows, crosses, tees, wyes, gate valves, or plug valves, as applicable to the force main being tested.
 - 3. Test Execution: Pigging test shall be conducted in the presence of the Utility Owner. Provide at least 48-hours notice of scheduled pigging of the force main prior to commencing the test.

Part 4 MEASUREMENT AND PAYMENT

- A. Unless prescribed elsewhere in the contract documents, Unit Prices as follows.
 - 1. Payment for normal depth sanitary sewer, up to 8 feet deep, by open-cut or augered with or without casing is on a linear foot basis for each size of pipe. Depth is measured from bottom of the pipe to the proposed natural ground.

Sanitary Sewerage Utilities - Sanitary Sewer Pipework

Separate pay items are used for open-cut and augered installation. Unit Prices shall include all materials, fittings, testing and labor necessary to install the sanitary sewer.

- 2. Payment for extra depth sanitary sewer by open-cut or augered is on a unit price basis per vertical foot for each foot of depth greater than 8 feet. Depth is measured from bottom of the pipe to the proposed natural ground.
- 3. Payment for normal depth manholes, up to 8 feet deep, is on a unit price basis for each manhole installed. Depth is measured from proposed top of cover to sewer invert. Unit Prices shall include all materials, fittings, testing and labor necessary to install the sanitary sewer manhole.
- 4. Payment for extra depth manholes is on a unit price basis per vertical foot for each foot of depth greater than 8 feet. Depth is measured from proposed top of cover to sewer invert.
- 5. Payment will be made for service connection at the unit price for each service connection installed for the various sizes itemized under this Section. Unit Prices shall include all materials, fittings, and labor necessary to install the service connection.
- 6. Payment for force mains installed by open-cut or augered with or without casing is on a linear foot basis for each size of pipe installed. Separate pay items are used for open-cut and augered installation. Unit Prices shall include all materials, fittings, testing and labor necessary to install the force main.

END OF SECTION

Section 33 32 00

SANITARY SEWER LIFT STATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

This section includes wastewater lift stations with submersible pumps housed in a fiberglass wet well with reinforced concrete base and top slabs. The design of the lift station shall be such that the pumping units can be easily removed from the wet well for inspection or service without disconnecting or disturbing the discharge piping. All lift station designs shall comply with the BPUB's lift station design criteria; Texas Administration Code (TAC) 30 Chapter 217 requirements; and other applicable regulatory codes, such as electrical, sanitary, safety, plumbing, etc.

PLANS provide lift station layout and construction details. Attachment A of this specification indicates size and type of specific lift station components. In cases where exceptions to this specification are approved by BPUB Engineering staff based on non-standard conditions (such as rehabilitation projects or very larger lift stations) information shown in the PLANS and project-specific specifications shall govern.

1.02 SUBMITTALS

A. Conform to requirements of Section 01300 - Submittal Procedures.

PART 2 PRODUCTS

- 2.01 LIFT STATION STRUCTURE The lift station structures shall be of the following type:
 - A. Structure shall be fabricated with a one-piece fiberglass reinforced polyester wet well embedded into reinforced concrete top and bottom slabs as shown on the PLANS. The floor of the wet well shall slope upward from the horizontal area at a minimum slope of 1:1 as shown on the PLANS.
 - B. Valve Vault shall be structurally independent of the wet well connected only by the discharge piping. This valve vault shall house the check valves, plug valves and blind tees shown on the lift station PLANS. The valve vault shall be topped with an aluminum hatch as shown on lift station PLANS. If the valve vault is six feet or greater depth, the access cover shall be Flygt "Safety Hatch or engineer approved equal.

2.02 VALVES AND PIPING

A. Each pump shall be equipped with a shut off valve and check valve. The shut off valves shall be non-lubricated full-port eccentric plug valves with cast iron construction and resilient faced plugs, for flanged connection. Plus valves shall include a position indicator

SANITARY SEWER LIFT STATIONS

to show if in the open or closed position. Check valves shall be of full-opening flexible disc swing type (flanged rubber flapper type) check valve with a top access cover and only one moving part, the valve disc. Check valves shall be Series 500 with backflow actuator by Val-Matic Valve and Manufacturing Corp. or approved equal. The discharge from the pump shall be connected to a flanged eccentric reducer to the discharge piping size as shown on the PLANS (if necessary). Discharge piping shall be ductile iron with flanged connections, or Certa-Lok Yelomine pipe PVC fittings, with dimensions a shown on the PLANS and specified in Attachment A to this Section. There shall be a flexible coupling in the discharge piping between the wet well and the valve box. EASY FLANGE ADAPTER shall be provided in the valve vault adjacent to each check valve. Final connection to the force main shall be by mechanical joint fitting. All mechanical joints and fittings shall used SS316 nuts and bolts.

- 2.02.1 All surfaces (except for the fiberglass wetwell, face of base elbow pump mating surface, power and control cables, and 316 stainless steel guide rails) shall be coated by the following coating:
 - a. a8mils of Raven 155 epoxy primer and 125 mils of Raven 405 100% solids, solvent-free ultra high-build epoxy system manufactured by Raven Lining Systems, Broken Arrow, Oklahoma,
 - b. or alternate coating system approved in advance by BPUB Engineering staff.

Surface preparation shall be per coating manufacture's recommendations.

2.02.2. All ductile iron pipe, fittings, valves, and flanges adapters outside the wetwell shall be protected by the following coating:

a. A two part epoxy coating of TNEMEC Series 1 Omnithane 6.0 to 8.0 dry mils plus TNEMEC Series N69 Hi-Build Epoxoline II 6.0 to 8.0 dry mils or alternate coating system approved in advance by BPUB Engineering staff.

b. Surface preparation shall be per coating manufacture's recommendations.

2.03 ACCESS COVERS, VENTING AND GRATING

A. Access covers and grating shall be of the dimensions and number specified on the PLANS. Cover doors and frames, as well as grating, shall be of all aluminum construction. Aluminum surfaces embedded in concrete or installed in contact with concrete shall be protected with bituminous coating material or isolated gaskets to prevent corrosion. All hardware, such as hinges, nuts, bolts, locking devices, etc., shall be 316 stainless steel. Each access cover shall have a safety latch to hold the cover in an open position. A "safety hatch" type accessory shall be included to provide fall-through and confined space access protection as required by OSHA. Cover frames shall be self-draining type and include provisions for mounting upper guide rail brackets and cable rack. A minimum 4-inch diameter vent pipe shall extend from the wet well, directly

SANITARY SEWER LIFT STATIONS

above the inlet piping, to a separate pole from the electrical power service and communications, terminating in a 3/16-inch stainless steel mesh screen on a gooseneck vent at a minimum height of 20 feet above the finish grade of the site mounted on a 30-foot wooden pole.

2.04 PUMPS

- A. General A minimum of two (2) pumps shall be provided per lift station. The pumps shall be heavy duty wastewater submersible non-clog type. Pump flow capacity and head, maximum horsepower and power consumption, electrical power requirements, and discharge size shall be as specified in Attachment A of this Section. Pump motor shall not overload at any point through the operation range of the pump. The BPUB engineering staff reserves the right to select the brand and model of pump to be employed based on preferred features and performance parameters. Pumps providing higher efficiencies shall be preferred. The operating range shall be from shut off head to at least 2.0 times the design operating flow rate in GPM.
- B. Pump Design The pumps shall be designed for handling raw, unscreened waste-water and all openings shall be large enough to permit the passage of solids 3 inches in diameter. Design should also be such that the pumping unit will be automatically and firmly connected to the discharge piping when lowered into place on a mating discharge connection, permanently installed in the wet-well. Connection shall be the result of a simple linear downward motion of the pumping unit guided by no less than two guide bars. No other motion in the pump, such as tilting or rotating shall be required. The connection shall be compatible to a Flygt or shall be dimensionally interchangeable with a Flygt connection. All pumps supplied shall fit a Flygt disconnection. Pumps with Flygt adapters will be accepted. Sealing of the discharge interface by means of a diaphragm or similar method of sealing shall not be considered acceptable nor equal to the metal to metal contact of the pump discharge flange and mating discharge connection specified herein.
- C. Pump Construction - All major parts such as the stator casing oil casing sliding bracket, volute and impeller shall be constructed of ASTM 48, Class 35B cast iron. All surfaces coming into contact with sewage shall be protected by a coating of epoxy paint. All exposed nuts and bolts shall be 316 stainless steel. The impeller shall be of a non-clog design, capable of passing solids, fibrous materials, heavy sludge and other materials commonly found in wastewater. It shall be constructed with a long throughlet without acute turns. It shall be slip fit to the shaft and key driven. All mating surfaces of the pump and motor housing shall be machined and fitted with nitrite o-rings where watertight sealing is required. Machining and fittings shall be such that sealing is accomplished by automatic compression in two planes and o-ring contact made of four surfaces, without the requirements of specific torque limits to affect this. Rectangular cross-sectional gasket requiring specific torque limits to achieve compression shall not be considered adequate or equal. Tolerances of all parts shall be such that would allow replacement of any part without additional machining required to insure sealing as described above. No secondary sealing compounds, greases or other devices shall be used.

Each pump shall be provided with a tandem double mechanical seal running in an oil reservoir having separate constantly hydro-dynamically lubricated seal faces. Each sealing unit shall consist of one stationary and one positively driven rotating tungsten carbide ring with each pair held in contact by a separate spring. The lower compression spring shall be protected against contact with or exposure to the pumped media. The seals shall require neither maintenance nor adjustment and shall be easily replaceable. Shaft seals without positively driven rotating members or conventional double mechanical seals with a common single or double spring action between the upper and lower units, requiring a pressure differential to offset external pressure and effect sealing shall not be considered acceptable nor equal to the dual independent seal system specified herein. The pump shall be capable of operating out of a liquid environment with no damage to the seals. The seal system shall not rely on the pump media for lubrication.

All motors shall be housed in an air-filled watertight casing and shall have moisture resistant Class H 180 deg C insulation. The motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The motor shall be NEMA Design B capable of continuous operation in a totally, partially or non-submerged condition. The cable entry seal design shall be such that specific torque requirements to insure a watertight and submersible seal are precluded. Epoxies, silicones or other secondary sealing systems shall not be required or used. Motor stator leads and power cable connections to the motor shall be the lug type connected to a terminal board in a junction chamber sealed and separated by a sealing gland to isolate the motor interior from foreign particles gaining access during field change of power cable or stator leads. Wire nut connections of power cable to power cable shall not be considered equal to lug and terminal type connections. Pump motor cable installed shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors and shall be of adequate size to allow motor voltage conversion without replacing cables. A sliding guide bracket shall be an integral part of the pump unit. The volute casing shall have a machined discharge flange to automatically and firmly connect with the cast iron discharge connection, which when bolted to the floor of the wet pit and discharge line, will receive the pump discharge connecting flange without the need of adjustments, fasteners, clamps or similar devices. The discharge connection shall be by Flygt or shall be dimensionally interchangeable with a Flygt discharge connection. All pumps supplied shall have sliding brackets to fit a Flygt discharge connection. Pumps with Flygt adapters will be acceptable. The guide bracket shall be coated gray iron and all bolts shall be stainless steel. All pump/motors shall be suitable for use in an NFPA-70 - National Electrical Code (NEC) Class I, Division 1, Group D classified location.

D. Pump Guarantee - In addition to the general guarantee required elsewhere in these specifications, the pump manufacturer shall furnish the owner with a written guarantee to warrant the pumps and all components against failure due to defective materials and workmanship for a period of 18 months after initial operation. The warranty shall include any shop labor to repair or replace any defective part or components for the same period. In addition, the guarantee shall include a declining 5 year, pro-rated warranty on the replacement cost of all major pump and motor components. The five year pro-rated warranty shall cover shop labor.

E. Factory Pump Test: For All pumps larger than 5 HP, the pump manufacturer shall perform the following inspections and test in accordance with Hydraulic Institute type standards.

(1) A check of the motor voltage and frequency shall be made as shown on the name plate.

(2) A motor and cable insulation test for moisture content or insulation defects shall be made per UL criteria.

(3) The pump shall be completely submerged and run to determine that the unit meets five pre-determined hydraulic performance points. The project engineer from the PUB Engineering staff shall at his option, witness this factory performance test.

(4) A written report shall be provided showing the aforementioned tests have been performed in accordance with the specifications.

2.05 STATION HARDWARE

- A. Guide Bars and Supports The guide bars shall be a dual rail 316 stainless steel schedule 40 pipe sized as indicated or as required but, not less than 2 inches, on the drawings and shall be held in place by upper and lower guide bar supports Upper guide bar supports shall be 316 stainless steel. Lower guide bar supports shall be an integrally cast boss on the discharge connection and arranged such that the guide bar is held in place by sliding over the boss. Hardware shall not be required in the wet pit to hold the guide bar in place except for intermediate guide bar supports where guide bars are more than 10 feet long. In this case; the intermediate grade bar support shall be of 316 stainless steel, providing support every 10 feet or less.
- B. Cable Rack The cable rack shall be 316 stainless steel and shall be attached to the access cover frame. The rack shall have provisions for holding in place and supporting the level control cables. Pump cable supports kellems shall not be hung on float cable rack. Pump cables shall be supporting by upper guide bar brackets or separate support hooks.
- C. Lifting Cable and Hoist Support The lifting cable shall be 316 stainless steel of strength sufficient to lift the pump, and should be attached to the pump lifting handle with a stainless steel shackle. The length of the lifting cable shall be such that it extends at least 10 feet above deck level.

2.06 PUMP CONTROL PANEL:

- A. The pumping equipment for each lift station shall include a Pump Control Panel (PCP) that shall conform to and include the following features:
- 1. Combination type motor circuit protector (MCP) motor starters (NEMA rated size-1 minimum) shall be provided for each pump. All circuit breakers shall be rated 18KAIC RMS of interrupting capacity at 480VAC. A NEMA rated magnetic starter shall be provided for each pump motor appropriately sized according to the motor horsepower

and line voltage. All starters shall be Siemens, Schneider Electric (Square-D), Allen Bradley, Eaton, or engineer accepted equivalent. Contactors shall be touch-safe design. Overload relays shall be 3-pole, ambient compensated and shall be quick-trip UL Class 20 trip with bimetallic heaters. Each overload relay shall include one normally open (NO) & one normally closed (NC) set of contacts. A manual reset pushbutton for each overload relay shall be mounted on the swing-out inner door in the PCP. The starters for Lift Station "A" shall be reduced voltage solid state (RVSS) and the starters for Lift Station "B" shall be full voltage across-the-line.

- 2. An electronic alternator with manual/auto provisions shall be furnished to alternate the lead and lag pumps after each cycle. The manual lead selection switch shall disable the alternator. The pump alternator shall be included in the Level Indicating Controller described herein below.
- 3. All relays shall be 600V heavy duty industrial type control relays. All relays shall be four pole double throw type with reversible contacts rated at 10A (resistive) and 120VAC or 24VAC coils. All relays shall incorporate an LED to indicate an energized state. Relay logic associated with the motor/pump over-temperature circuit shall include an adjustable time delay function to avoid false signals during power up conditions.
- 4. The PCP shall include a weatherproof alarm light (with shatterproof plastic red globe and cover guard) and an audible alarm that shall be located on the exterior of the PCP enclosure. The light and horn shall be energized by a relay controlled by a separate float switch in the wetwell when a high level condition occurs. The relay shall include an additional set of dry contacts that shall be used for an input to the SCADA system. A reset button shall be provided to clear alarm condition.
- 5. The PCP shall include a thermostatically controlled condensation heater with a manual isolation On/Off switch.
- 6. An electronic power monitor to prevent motor burnout caused by single phase power shall be provided for each motor starter and connected in the associated control circuit. The function may be included in the RVSS starter logic in lieu of a discrete component where RVSS starters are required.
- 7. Run time meters shall be furnished in the PCP for each pump motor. Heavy duty, NEMA rated, oil tight, three position maintained contact selector switches with Hand-Off-Auto escutcheon plates shall be furnished in the PCP for pump. Toggle switches shall not be considered as an acceptable equivalent. The lift pumps shall be controlled by a Level Indicating Controller as described per 2.07 & 2.08 below.
- 8. Pilot lights shall be heavy duty, oil tight, push-to-test, transformer type shall be furnished in the PCP for each pump with escutcheon plates for functions as follows:
 - a. Pump Run
 - b. Seal Fail
 - c. Motor Over-temperature

- 9. Provide relay logic to shut down the pump when Seal Failure and Motor Overtemperature conditions develop.
- 10. All control devices shall be mounted on a removable aluminum back panel inside the PCP enclosure.
- 11. Step down Control Power Transformers (CPT's) for 24 volt and/or 120 volt control power shall be provided in the PCP. Each CPT shall be provided with primary fuse3d over-current protection and circuit breakers on the secondary side.
- 12. The incoming power to each PCP shall be 480V, 3-phase, 60 HZ.
- 13. All control power entering the wetwell shall be 24 volt or less, or shall be intrinsically safe.
- 14. Within the main control panel the power and control components shall be mounted on a removable aluminum back-panel secured with collar studs. The enclosure shall feature an aluminum dead-front construction with a tamper-proof padlock-able external door and a swing-out inner door for all operator controls.
- 15. A current-to current converter complete with current transformers shall be supplied in the PCP and connected to convert the lift pump motor load current to a 4-20 mA signal. The load current analog signals shall be extended to the SCADA system and connected as inputs. Logic shall be provided to detect no load current in association with a call-to-run and generate a pump fail alarm for each pump.
- B. Wetwell Terminal Cabinet(s) An adequately sized Terminal Cabinet (TC) with insulated terminal blocks (ILSCO PDB) shall be furnished and installed between each PCP and the associated wetwell. Each TC shall be rated NEMA-4X non-metallic and shall be made from an FRP material. The terminal cabinets shall be sized and installed as shown on the contract drawings. Each pump power cable shall have its own independent conduit from the pumps to the terminal cabinet which shall be sealed to prevent entrance of sewer gases into the panel. If the seal failure and over-temperature sensor wires are not an integral part of the power cord, they shall be installed in a separate conduit, with their own seal as described above. A separate conduit shall be provided between the terminal cabinet and the wetwell for all of the float switch cables. All conduit penetrations into FRP boxes shall be accomplished using conduit hubs, Myers or engineer accepted equivalent.
- C. SCADA Hardware All lift station control panels shall include the capacity to interface with the existing BPUB SCADA system component hardware. All lift station hardware shall be compatible with the existing BPUB SCADA system where feasible.
- 1. Hardware Configuration:

- a. Devices originating the required output signals are to be provided in the PCP and/or the associated Remote Terminal Unit (RTU) as shown on the contract drawings.
- b. Each Level Indicating Controller (pump controller) shall be a Siemens IntraLink LC150 Pump Control-Telemetry Unit or ITT/Flygt APP 700 Series, or owner accepted equivalent. Depending on the applicability of the various signals required herein, an input/output (I/O) expansion module may be required and shall be as necessary.
- c. BPUB has standardized on the MDS iNET-II 900 (radio transceiver) for data transmission to the existing SCADA system, and each lift station control system shall incorporate this unit. It shall be furnished and installed by the contractor in a NEMA-4X-NM enclosure (RTU) as indicated on the contract drawings. The RTU shall include the MDS unit, a power supply, UPS, a gateway communication interface unit (MicroLogics 1400), coaxial cable SPD, coax bulkhead connector. The SCADA system coaxial cable, antenna, and antenna mounting bracket shall be furnished and installed as shown on the contract documents. Pump Controllers shall provide and/or receive all data signals identified herein to and/or from the MDS unit to accomplish the specified SCADA system functions.
- d. BPUB will perform all SCADA system integration for the remote monitoring at each lift station. Acceptance of the work performed by the contractor at each lift station shall be based on the positive receipt of required signals at BPUB's receiving location.
- 2. Inputs The following inputs shall be required at each lift station:
 - a. Analog (4-20 mA)
 - (1) Instantaneous flowrate, gpm (from discharge flow meter)
 - (2) Wetwell liquid depth, ft (sensed by submersible level transducer)
 - (3) Wetwell Level Indicating Controller Fail Alarm
 - (4) Current drawn, amps, individually for each pump
 - b. Discrete
 - (1) Pump running, individually for each pump
 - (2) Pump failure (common for overtemp, seal failure, failure to pump based on current-sensing relay), individually for each pump
 - (3) High wetwell level alarm (sensed by high water alarm float)
 - (4) Low wetwell level alarm (sensed by low level alarm float)
 - (5) Pump Control Panel open door alarm
- 3. Outputs The following outputs shall be required at each lift station:
 - a. Turn Pump On, individually for each pump
 - b. Turn Pump Off, individually for each pump

2.07 LEVEL CONTROL SYSTEM

A. Level Control System:

A submersible transducer and an associated Level Indicating Controller shall actuate the pumps on an alternating "lead-lag" with over-ride basis, with independently adjustable lead pump and lag pump start levels. One pump shall be actuated when the water level rises to the preset "lead pump on" level, and shall be shut down when the wet-well liquid

Phase 1 Olmito Park	Olmito, TX
Land Development	11/10/2023

has been pumped down to the preset "pumps off/alternate" level, automatically switching the "lead-lag" status of the pumps, unless the lead selection switch in the control panel is set for a fixed status. If the liquid level continues to fall below the pumps off level, a low-level lockout float shall be energized or de-energized to lock out operation of all pumps. If the liquid level continues to rise after the lead pump has been actuated, the lag pump shall be actuated when the liquid reaches the preset "lag pump on" level, and both pumps shall remain on until the liquid has been pumped down to the "pumps off/alternate" level. If the liquid level continues to rise after the lag pump has been actuated, the high level alarm LED light shall be energized when the liquid reaches the preset "high level alarm" level. Alternate level sensors and control devices will be considered but must be approved by the Water and Wastewater Engineering Department of the Public Utilities Board of Brownsville.

- B. Submersible level Transducer Performance:
 - 1. Range shall be 1 to 33 feet
 - 2. Accuracy shall be $\pm 0.25\%$ of range or 2 mm, whichever is greater.
 - 3. Resolution shall be 0.1% of range
 - 4. Maximum separation between transmitter and transducer shall be 1200 feet
 - 5. CSA approved for Class I Groups A, B, C, & D
 - 6. The transducer shall be as manufactured by Siemens ITT Flygt, or engineer accepted equivalent
- C. Indication:
 - 1. Display shall be a 4 digit LCD with .7" high characters
 - 2. Individual alarm status light
- D. Calibration:
 - 1. Calibration of the level transducer shall be accomplished by the entry of all operating data through a keypad on the controller. No additional equipment shall be required.
 - 2. Internal self-diagnostics shall be available to assist in maintenance of the level controller.
- E. Transmitter Function Details -The following functions shall be provided:
 - 1. The controller shall provide an isolated 4-20ma or 0-20ma signal (into a maximum of 750 ohms) proportional to level for extension to the SCADA system.
 - 2. The controller shall be capable of reading the level of the wetwell.
 - 3. The submersible level transducer shall be permanently mounted at the measuring site and shall be installed in accordance with the manufacturer's recommendations.
 - 4. The transducer shall transmit a signal to accurately measure the wetwell level.
 - 5. The output shall be proportional to level from 0 to 100 % with a resolution of 0.1%.

- 6. Operational range shall be adjustable by entering new data via keypad.
- 7. The controller shall be capable of zero to full scale simulation to assure proper operation with regards to pump control parameters.
- 8. There shall be no internal potentiometers or switches used in programming or adjusting the transmitter.
- 9. The power to operate the transducer shall come solely from the transmitter over the signal interconnection cable.
- 10. The pump control function shall be programmable for up to 5 pumps and shall be able to lead/lag all five if required. The controller shall be capable of logging individual run time for up to five pumps and the total run time of all five pumps.
- 11. The controller shall have an EEPROM memory and shall not require a battery to ensure protection of stored data.
- F. Back-Up Systems and Redundancy:

Failure of the control system level transducer shall cause the "backup" float switch system to engage. The float switch system shall be comprised of two mechanical tilt float switches; one at high level and one at the stop pumps level. The levels shall be as determined by the Engineer. Alternate level sensors and control devices will be considered but must be approved by the Water and Wastewater Engineering Department of the Public Utilities Board of Brownsville. The float switch system shall lock out all other controls and start the pumps at the high level float setting. The cycle shall repeat itself until the system is manually reset. The failure of the level controller shall generate a contact closure that shall be extended to the SCADA system and connected as an alarm input.

The emergency back-up level sensors shall be of the tilt-float switch type. Each encapsulated float switch shall be of the non-mercury mechanical type, J.E. Rhombus, or equivalent. Each float switch shall include a weight that shall be attached to the associated suspension cord.

The float switch cables shall be extended to the PCP via the Terminal Cabinet (TC). There shall be a separate, independent conduit from the PCP for all of the float switch cables.

PART 3. EXECUTION

- 3.01 INSTALLATION Lift station shall be assembled at the job site by the contractor or subcontractor's crews. Included shall be the assembly of all concrete structures, assembly or formwork for valve box (if required), internal piping, electrical connections and miscellaneous components as indicated on the PLANS and as called for in these specifications. Care shall be taken to prevent floating of wet-well structure due to soil and/or groundwater buoyancy forces. The inflow connection shall include a drop structure as shown on the PLANS. Chemical grout shall he used to seal into place the gravity line protruding into the wet-well. The contractor shall also be responsible for the following:
 - A. Excavation, dewatering, backfill, proper compaction and site preparation

SANITARY SEWER LIFT STATIONS

including the sand base for leveling and ballast concrete (if necessary.) as shown on the PLANS.

- B. Electric power supply that includes a pole and meter loop (including all required inspection approvals).
- C. Crane for unloading and setting the structures.
- D. Water supply inside lift station site, minimum 1" service line with reducedpressure zone type backflow preventer assembly and 3/'4" hose bib. Exposed water supply system components shall be freeze-protected (self-draining, insulated, and/or installed in thermal enclosure).

3.02 COATINGS

- A. All surfaces and piping within the wet well <u>except</u> for the fiberglass wet well surface; face of base elbow pump mating surface; power and control cables; and 316 stainless steel guide rails shall be coated with 100% solids, solvent-free ultra high-build epoxy coating system. Surfaces to be coated shall be cleaned by sandblasting or by water-blasting with 10% muriatic acid prior to coating. Coating system shall consist of 125 mils of Raven 405 epoxy coating, applied in accordance with manufacturer's recommendations, alternative coating system approved in advance by BPUB Engineering Staff.
- B. All pipe, valves, and fittings <u>outside of wet well</u>, <u>including within the valve vault</u>, shall receive after installation a two coat Epoxy coating system suitable for the environment. Coating shall be TNEMEC consisting of 6 mils DFT, or alternative coating system approved in advance by BPUB Engineering Staff.
- C. All coating shall be shop-applied after fabrication and prior to delivery, except for coating applied to cast-in-place concrete structures, and final touch-up of coatings required due to field-welding or minor damage to coatings during construction.
- 3.03 START UP AND FIELD INSPECTION After the pumps have been completely installed and wired, the contractor shall remove the pumps to the wet pit top deck and notify an authorized representative of the pump manufacturer to inspect each pump for proper installation. As part of the inspection the representative shall:
 - A. Measure resistance in each leg of motor to ground.
 - B. Megger each leg of motor to ground and each leg of motor to other leg.
 - C. Check proper rotation.
 - D. Check power supply voltage, each phase to ground.
 - E. Measure motor load current.
 - F. Check level control operation.

At the request of the engineer, all pumps shall be subjected to a "snore" test as proof of their capabilities to run continuously under pumping or "snore" conditions with the motor dry. "Snore" is the state when the liquid level has been pumped down to the point of exposing the pump inlet causing air and water to alternately enter the impeller. Liquid level shall be maintained to allow "snore." Motor exterior shall be kept dry. Test period shall run 1-4 hours or

longer, at the request of the Owner's Representative. The test shall be performed by the contractor and shall be supervised by an authorized representative of the pump manufacturer. The contractor shall notify the PUB of the final field inspection and testing so that an authorized PUB representative may be present as well. Failure of test shall constitute rejection of equipment.

3.04 PARTS AND INSTRUCTIONS

- A. Instruction Manuals and Parts Lists. O/M manuals and printed instructions relating to the proper maintenance, including lubrication, and parts list indicating the various parts by manufacturer, name, number, and diagram where necessary, shall be furnished for pumps, motors and all other equipment in a unit. Two copies shall be provided to the BPUB, along with one electronic copy in PDF and/or AutoCAD file format.
- B. Spare Parts, The following spare parts (where applicable) and all spare parts listed in Attachment A of this Section, or recommended by the pump manufacturer, shall be supplied for each lift station and each part shall be packed in a container and properly marked by item number, etc., to facilitate identification:
 - A. One impeller for each size pump.
 - B. One set of wearing rings or suction covers for each pump.
 - C. One set of all gaskets and o-rings required for each pump.
 - D. One set of seals for each pump.
 - E One set of bearings for each pump.

In addition, the following equipment will be required for the control equipment:

- A. One spare starter with overload and heaters for each size pump.
- B. Two float switches for each type used.
- C. One spare relay for each type used.
- D. Two spare fuses of each type used.
- E. One spare breaker of each type used.
- F. One spare alternator
- G. One spare motor circuit protector of each size used.
- H. One spare motor over-temp and seal failure relay.
- 3.05 GENERAL GUARANTEE The contractor or lift station manufacturer shall guarantee the materials, equipment, accessories and labor furnished on this project against failure due to defective workmanship or materials for a period of one (1) year after initial operation. The contractor's or lift station manufacturer's liability shall be limited to correcting defects in the equipment and labor supplied by the contractor or manufacturer, as appropriate. Guarantee of the pumping equipment furnished shall be the guarantee provided by the pump manufacturer, as specified in 2.04.D. A written copy of that guarantee shall be included in the O/M manual mentioned in 3.04.A.
- 3.05 LIFT STATION PROTECTION The lift station shall be protected by a fence along the perimeter of the lift station easement. The fence shall be as detailed on the construction PLANS.

SANITARY SEWER LIFT STATIONS

The surface area shall be cover with geotextile membrane and 2 inches of gravel or crushed rock to cover the lift station area. The geotextile membrane shall be installed on two inches of compacted sand bedding, and shall be sloped to drain away from the wet well.

Aggregate shall be crushed limestone or crushed natural gravel, free from lumps or balls of clay or other objectionable matter, and reasonably free from thin and elongated pieces of dirt. Aggregates shall consist of angular fragments, durable and sound, and shall be reasonably uniform in density and quality.

Crushed rock stockpiles shall be made only with approved Owner. Storage sites must be clear and level prior to stockpiling. Place crushed rock stockpiles in a manner and at locations designated by Owner, providing separate stockpiles for materials from separate sources.

Subgrade shall be clean of all foreign substances. Correct any ruts, depressions, or soft yielding spots and areas with inadequate compaction as specified. Place and compact sand and install geotextile membrane. Owner will inspect, prior to placing crushed rock surface, for adequate compaction and surface tolerances. Grade control shall be established and maintained by means of grade stakes spaces so string lines may be stretched between stakes.

Deposit and spread crushed rock material in a uniform layer and compact to the thickness indicated and as specified. Spread material uniformly on the geotextile membrane using vehicles, spreader boxes, or manual methods in a manner that does not damage the geotextile or disturb the compacted san bedding. Level the material to the required contours and grades. Remove those portions of the layer which become segregated or mixed with subgrade or surfacing will be restricted by Owner. Remove and repair subgrade damaged during application of crushed rock when directed by Owner.

There shall also be al-inch potable water line painted blue, with backflow preventer.

The lift station site shall include a landscaped area as shown on the lift station layout sheets in the design plans. The landscaping shall include the required plantings with an automatic controlled drip system irrigation system with approved backflow preventer. The irrigation system design shall be submitted to PUB for approval at least two weeks prior to installation of the landscaping or irrigation system.

- 3.07 ACCESS DRIVEWAY For ingress and egress to the lift station site, a concrete driveway shall be built as shown on PLANS. It shall consist of 6 inch thick 3,000 psi concrete reinforced with #4 bars at 12" O.C. Both Ways.
- 3.08 TOTALIZING FLOW METER. Provide McCrometer Ultra Mag, Endress & Hauser PMP-50, or engineer accepted equivalent electromagnetic flow meter suitable for measuring and recording raw sewage flow. The mag-meter shall be furnished with grounding rings (as required) and a remote mounted Flow indicating Transmitter (FIT). The FIT shall generate a 4-20 mA flow signal that shall be extended to associated NEMA-4X-NM large-case type Flow Indicating Totalizing Recorder. The 4-20 mA shall also be extended to the SCADA system RTU and connected as an analog input.

Phase 1 Olmito Park	Olmito, TX
Land Development	11/10/2023

3.09 The mag-meter body shall match the diameter of the effluent force main. The mag-meter shall be installed in a meter vault within the lift station site, on a pipe section with at least 10 pipe diameters upstream and 5 pipe diameters downstream straight pipe run (no bends, constrictions, expansions, or insertions). The Contractor shall follow all manufacture installation instructions concerning full flow conditions for accurate readings.

ATTACHMENT A

PERFORMANCE REQUIREMENTS FOR SUBMERSIBLE PUMP LIFT STATIONS

- A. Acceptable Manufactures
 - 1. FLYGT (data furnished below in based on this manufacture)
 - 2. Alternative pump meeting all performance requirements and features of this specification.

B. Pumps

1. Performance and Size:

	LIFT STATION NO.	С	D	Ι
a.	Number of Units (minimum of 2 pumps):	2	2	2
b.	Flygt Model No.:	NP 3171 181 HT	NP 3102 181 MT	NP 3127 181 MT
c.	Impeller Diameter:	195	162	188
d.	Stator:	12YSER	61D	12YSER
e.	Curve No.:	63-489-00- 2202	63-464-00- 3703	63-439-00- 2204
f.	Operating Point (one pump operating) (gpm @ft TDH):	214gpm @ 51.8'	188.9gpm @ 33.8'	411.2gpm @ 39.8'
g.	Maximum Driven Speed (rpm):	1740	1745	1740
h.	Pump Efficiency at Operating Point (%)	46.1	46.4	54.5
i.	Power Source (v, 3Phase, 60Hz):	460	460	240
j.	Maximum Motor Horsepower (HP):	7.5	5.0	7.5
k.	Pump Discharge Diameter (inches):	4	4	6
1.	Minimum Allowable Discharge Velocity (ft/s):	2	2	2
m.	Maximum Allowable Discharge Velocity (ft/s):	8	8	8
n.	Minimum Solids Handling Size (inches):	3	3	3

2. Provide identical stainless steel guide rail systems, discharge elbow, and discharge piping for all pumps. Furnish integrated control panel and level control devices. Furnish all items shown on PLANS or specified herein.

C. Spare Parts

- 1. Provide the following spare parts:
 - a. Spare gaskets and O-rings are to be provided for each pump. One spare seal in a sealed factory container for each pump.
 - b. Furnish any special tools required for routine pump maintenance of for

installation of the furnished spare parts.

- c. Furnish those parts listed in Section 3.04.B.
- 2. Provide all additional parts recommended by pump manufacturer.
- D. Lift Station Design

1.	Wet Well Diameter	See PLANS.
2.	Base Ell Diameter	See PLANS.
3.	Discharge Piping and Valves Diameter	See PLANS.

END OF SECTION

SECTION 33 39 13

FRAMES, GRATES, RINGS, AND COVERS

PART 1 GENERAL

- 1.01 SECTION INCLUDES
 - A. Iron castings for manhole frames and covers, inlet frames and grates, catch basin frames and grates, meter vault frames and covers, adjustment rings, and extensions.
 - B. Ring grates.

1.02 REFERENCES

- A. AASHTO American Association of State Highway and Transportation Officials Standard Specification for Highway Bridges.
- B. ASTM A 48 Specification for Gray Iron Castings.
- C. ASTM A 615 Standard Specification for Deformed Billet-Steel Bars for Concrete Reinforcement.
- D. AWS D 12.1 Welding Reinforcing Steel.

1.03 SUBMITTALS

- A. Submit product data in accordance with Section 01 33 00 Submittal Procedures.
- B. Submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions.
- C. Submit shop drawings for fabrication and installation of casting assemblies that are not included in Drawings. Include plans, elevations, sections and connection details. Show anchorage and accessory items. Include setting drawings for location and installation of castings and anchorage devices.

PART 2 P R O D U C T S

2.01 CASTINGS

A. Castings for frames, grates, rings and covers shall conform to ASTM A 48, Class 30. Provide locking covers if indicated on Drawings.

- B. Castings shall be capable of withstanding the application of an AASHTO H-20 loading without permanent deformation.
- C. Fabricate castings to conform to the shapes, dimensions, and with wording or logos shown on the Drawings. Standard dimensions for manhole covers are 32 inches in diameter.
- D. Castings shall be clean, free from blowholes and other surface imperfections. Cast holes in covers shall be clean and symmetrical, free of plugs.
- 2.02 BEARING SURFACES
 - A. Machine bearing surfaces between covers or grates and their respective frames so that even bearing is provided for any position in which the casting may be seated in the frame.
- 2.03 SPECIAL FRAMES AND COVERS
 - A. Where indicated on the Drawings, provide watertight manhole frames and covers with a minimum of four bolts and a gasket designed to seal cover to frame. Supply watertight manhole covers and frames, Model R-1916H (32-inch cover diameter) manufactured by Neenah Foundry Company, Model V-2420 by Vulcan Foundry, or approval equal.
 - B. Where shown on the Drawing, provide manhole frames and covers with 48-inch-diameter clear opening, with inner cover for 22-inch diameter clear opening. Provide inner cover with pattern shown on Drawings, Neenah Foundry, Model R-1741-F, Vulcan Foundry V-7, or approved equal.
- 2.04 FINISH
 - A. Unless otherwise specified, coat iron castings with the manufacturer's standard asphaltic paint.
- 2.05 FABRICATED RING GRATES
 - A. Ring grates shall be fabricated from reinforcing steel conforming to ASTM A 615.
 - B. Welds connecting the bars shall conform to AWS D 12.1.

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Install castings according to approved shop drawings, instructions given in related specifications, and applicable directions from the manufacturer's printed materials.

- B. Set castings accurately at required locations to proper alignment and elevation. Keep castings plumb, level, true, and free of rack. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in formwork until permanently set.
- C. Ring grates shall be fabricated in accordance to the Engineer, Ring Grate for Open End of 18" to 72" Stubs to Ditch, and shall be set in mortar in the mouth of the pipe bell.

END OF SECTION

SECTION 40 05 61

GATE VALVES

PART 1 GENERAL

- 1.01 SECTION INCLUDES
 - A. Gate valves.
- 1.02 MEASUREMENT AND PAYMENT
 - A. Payment will be made for gate valves at the unit price for each gate valve and valve box installed for the various sizes itemized under this Section. Unit Prices shall include all materials and labor necessary to install the gate valves.
- 1.03 REFERENCES
 - A. ASTM A 307 Carbon Steel Externally Threaded Standard Fasteners.
 - B. ASTM B 62 Composition Bronze or Ounce Metal Casting.
 - C. ASTM D 429 Test Methods for Rubber Property-Adhesion to Rigid Substrates.
 - D. ASTM B 763 Copper Alloy Sand Casting for Valve Application.
 - E. AWWA C 500 Gate Valves, 3 Through 48 in. NPS, for Water and Sewage Systems.
 - F. AWWA C 509 Resilient-seated Gate Valves, 3 through 12 NPS, for Water and Sewage Systems.
 - G. AWWA C 550 Protective Epoxy Interior Coatings for Valves and Hydrants.
- 1.04 SUBMITTALS
 - A. Submittals shall conform to requirements of Section 01 33 00 Submittal Procedures.
 - B. Submit manufacturer's product data for proposed valves for approval.
- 1.05 QUALITY CONTROL
 - A. Submit manufacturer's affidavit that gate valves are manufactured in the United States and conform to stated requirements of AWWA C 500, AWWA C 509, and this Section, and that they have been satisfactorily tested in the United States in accordance with AWWA C 500 and AWWA C 509.

PART 2 P R O D U C T S

Gate Valves

2.01 MATERIALS

- A. Gate Valves 4 Inches to 12 Inches in Diameter: Non-directional, resilient seated (AWWA C 509), 200 psig, bronze mounting, Mechanical Joint ends, and nut-operated unless otherwise specified. Provide resilient seated valves manufactured by Mueller 2360 Series, or approved equal. Comply with following requirements:
 - 1. Design: Fully encapsulated rubber wedge or rubber seat ring mechanically attached with minimum 304 stainless-steel fasteners or screws; threaded connection isolated from water by compressed rubber around opening.
 - 2. Body: Cast iron, flange bonnet and stuffing box together with 304 SS or 316 SS bolts. Manufacturer's initials, pressure rating, and year manufactured shall be cast in body.
 - 3.. Bronze: Valve components in waterway to contain not more than 15 percent zinc and not more than 2 percent aluminum.
 - 4. Stems: ASTM B 763 bronze, alloy number 995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.
 - 5. O-rings: AWWA C 509, sections 2.2.6 and 4.8.2.
 - 6. Stem Seals: Consist of three O-rings, two above and one below thrust collar with antifriction washer located above thrust collar.
 - 7. Stem Nut: Independent or integrally cast of ASTM B 62 bronze.
 - 8. Resilient Wedge: Molded, synthetic rubber, vulcanized and bonded to cast or ductile iron wedge or attached with 304 stainless steel screws tested to meet or exceed ASTM D 2000; seat against epoxy-coated surface in valve body.
 - 9. Bolts: AWWA C 509 Section 4.4; 304 or 316 stainless steel only.
 - 10. Direct bury Valves open counterclockwise.
- B. If type of valve is not indicated on Drawings, use gate valves as line valves for sizes less than 16-inches. If type of valve is indicated, no substitute is allowed.
- C. Gate Valves 1-1/2 Inches in Diameter and Smaller: 125 psig; bronze; rising-stem; single-wedge; disc type; screwed ends; such as Crane No. 428, or approved equal.
- D. Coatings for Gate Valves 2 Inches and Larger: AWWA C 550; Indurall 3300 or approved equal, non-toxic, imparts no taste to water, functions as physical, chemical, and electrical barrier between base metal and surroundings, minimum 10-mil-thick, fusion-bonded epoxy. Prior to assembly of valve, apply protective coating to interior and exterior surfaces of body.
- E. Gate Valves 2 Inches in Diameter: Cast Iron body, non-rising stem, 500-psi test, 2-inch square nut operating counter clockwise to open.

- F. Gate Valves 16 Inches and larger in Diameter: Non-directional, resilient seated (AWWA C 509), 200 psig, bronze mounting, Mechanical Joint ends, and nut-operated unless otherwise specified. Provide resilient seated valves manufactured by Mueller 2361 Series, or approved equal. Comply with following requirements:
 - 1. Design: Fully encapsulated rubber wedge or rubber seat ring mechanically attached with minimum 304 stainless-steel fasteners or screws; threaded connection isolated from water by compressed rubber around opening.
 - 2. Body: Cast iron, flange bonnet and stuffing box together with 304 SS or 316 SS bolts. Manufacturer's initials, pressure rating, and year manufactured shall be cast in body.
 - 3.. Bronze: Valve components in waterway to contain not more than 15 percent zinc and not more than 2 percent aluminum.
 - 4. Stems: ASTM B 763 bronze, alloy number 995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.
 - 5. O-rings: AWWA C 509, sections 2.2.6 and 4.8.2.
 - 6. Stem Seals: Consist of three O-rings, two above and one below thrust collar with antifriction washer located above thrust collar.
 - 7. Stem Nut: Independent or integrally cast of ASTM B 62 bronze.
 - 8. Resilient Wedge: Molded, synthetic rubber, vulcanized and bonded to cast or ductile iron wedge or attached with 304 stainless steel screws tested to meet or exceed ASTM D 2000; seat against epoxy-coated surface in valve body.
 - 11. Bolts: AWWA C 509 Section 4.4; 304 or 316 stainless steel only.
 - 12. Gate Valves for Fire Hydrants leads shall be provided with Aquagrip connection.
- G. Gate Valves Installed at Greater than 4-foot Depth: Provide non-rising, extension stem having coupling sufficient to attach securely to operating nut of valve. Upper end of extension stem shall terminate in square wrench nut no deeper than 4 feet from finished grade.
- H. Gate Valves in Factory Mutual (Fire Service) Type Meter Installations: Conform to provisions of this specification; outside screw and yoke valves; carry label of Underwriters' Laboratories, Inc.; flanged, Class 125; clockwise to close.
- I. Provide flanged joints when valve is connected to steel or PCCP.

PART 3 E X E C U T I O N

3.01 INSTALLATION

- A. Earthwork. Conform to applicable provisions of Section 31 23 33 Excavation and Backfilling for Utilities.
- B. Operation. Do not use valves for throttling without prior approval of manufacturer.
- 3.02 SETTING VALVES AND VALVE BOXES
 - A. Remove foreign matter from within valves prior to installation. Inspect valves in open and closed positions to verify that parts are in satisfactory working condition.
 - B. Install valves and valve boxes where shown on Drawings. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of 4 feet, or to undisturbed trench face if less than 4 feet. Install valves completely closed when placed in water line.
 - C. For pipe section of each valve box, use only cast iron, ductile iron, or DR18 PVC pipe cut to proper length. Size to allow future operation of valve. Assemble and brace box in vertical position as indicated on Drawings.
- 3.03 DISINFECTION AND TESTING
 - A. Solid-Wedge Gate Valves: Apply hydrostatic pressure equal to twice rated working pressure of valve with both ends bulk headed and gate open. The valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied through bulkheads alternately to each side of closed gate with opposite side open for inspection. The valve shall show no leakage through metal, flanged joints, or stem-seals. Do not exceed a leakage rate of 1 oz/hr/inch of nominal valve size.
 - B. Repair or replace valves which exceed the leakage rate.

3.04 PAINTING OF VALVES

- A. Paint valves in vaults, stations, and above ground using ACRO Paint No. 2215, or approved equal.
- B. If damage to the exterior surface of the fire hydrant occurs during the handling and/or installation of the hydrant, the contractor shall be responsible for the touch-up/repair of said exterior surface. The Contractor shall follow the hydrants manufactures recommendations for such repairs.

END OF SECTION 40 05 61

SECTION 00100

PREPARING RIGHT-OF-WAY

PART 1 GENERAL

1.01 SECTION INCLUDES

This Item shall govern for the preparation of the right-of-way for construction operations by the removal and disposal of all obstructions from the right-of-way and from designated easements, where removal of all such obstructions is not otherwise shown on the plans and specifications.

Such obstructions shall be considered to include remains of houses, foundations, floor slabs, concrete, brick, lumber, plaster, septic tank drain fields, basements, abandoned utility pipes or conduits, equipment, fences, retaining walls, outhouses and shacks, and other obstructions.

This Item shall also include the removal of trees and shrubs and other landscape features not designated for preservation, stumps, brush, roots, vegetation, logs, curb and gutter, driveways, paved parking areas, miscellaneous stone, sidewalks, drainage structures, manholes, inlets, abandoned railroad tracks, scrap iron and debris, whether above or below ground except live utility facilities.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for preparation of right-of-way under this Section. Costs associated with this item are subsidiary to other items.

PART 2 EXECUTION

2.01 PREPARATION

A. All areas, as shown on the plans, shall be cleared of all structures and obstructions as defined above. Those trees, shrubs and other landscape features specifically designated by the Engineer for preservation shall be carefully protected from abuse, marring, or damage during construction operations. Continual parking and/or servicing of equipment under the branches of trees marked for preservation will not be permitted. When trees and shrubs are designated for preservation and require pruning, they shall be trimmed as directed by the Engineer and all exposed cuts over 2 inches in diameter shall be treated with a material approved by the Engineer.

- B. Culverts, storm sewers, manholes and inlets shall be removed in proper sequence for maintenance of traffic and drainage.
- C. Underground obstructions, except those items designated for preservation, shall be removed to the following depths:
 - (a) In areas to receive embankment: 2 feet below natural ground, except when permitted by the plans, trees and stumps may be cut off as close to natural ground as practicable on areas which are to be covered by at least three feet of embankment.
 - (b) In areas to be excavated: 2 feet below the lower elevation of the excavation.
 - (c) All other areas: 1 foot below natural ground.

2.02 DISPOSAL

- A Unless otherwise shown herein, all materials and debris removed shall become the property of the Contractor and shall be removed from the right of way and disposed of in a manner satisfactory to the Engineer.
- B. No timber shall be cut or defaced outside of the right of way lines or material pit limits as indicated on the plans or by the Engineer.

2.03 BACKFILL

- A. Holes remaining after removal of all obstructions, objectionable material, trees, stumps, etc., shall be backfilled with approved material, compacted and restored to approximately its original contours by blading, bulldozing, or by other methods, as approved by the Engineer. In areas to be immediately excavated, the backfilling of holes may not be required when approved by the Engineer.
- B. Before backfilling, the remaining ends of all abandoned storm sewers, culverts, sanitary sewers, conduits, and water or gas pipes over 3 inches in diameter, shall be plugged with an adequate quantity of concrete to form a tight closure.

END OF SECTION

Section 01562

TREE AND PLANT PROTECTION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- 1. Tree and plant protection and maintenance.
 - a. Relocating and replanting existing trees.
 - b. Employ qualified Arborist acceptable to City Engineer to move and relocate trees. Arborist must be normally engaged in field and have minimum of 5 years' experience.

1.02 UNIT PRICES

1. No separate payment will be made for other tree and plant protection specified herein.

1.03 SUBMITTALS

- 1. Conform to requirements of Section 01 33 00 Submittal Procedures.
- 2. Submit name and experience of qualified Arborist to Owner.

1.04 PROJECT CONDITIONS

- 1. Preserve and protect existing trees and plants to remain from foliage, branch, trunk, or root damage that could result from construction operations.
- 2. Prevent following types of damage:
 - a. Compaction of root zone by foot, vehicular traffic, or material storage.
 - b. Trunk damage from equipment operations, material storage, or from nailing or bolting.
 - c. Trunk and branch damage caused by ropes or guy wires.
 - d. Root poisoning from spilled solvents, gasoline, paint, and other noxious materials.
 - e. Branch damage due to improper pruning or trimming.
 - f. Damage from lack of water due to:
 - a. Cutting or altering natural water migration patterns near root zones
 - b. Failure to provide adequate watering
 - g. Damage from alteration of soil pH factor caused by depositing lime, concrete, plaster, or other base materials near roots
 - h. Cutting of roots larger than 1-1/2 inches in diameter

1.05 DAMAGE ASSESSMENT

When trees other than those designated for removal are destroyed or badly damaged as result of construction operations, remove and replace with same size, species, and variety up to and including 8 inches in trunk diameter. Tree larger than 8 inches in diameter shall be replaced with 8-inch diameter tree of same species and variety and total contract amount shall be reduced by amount determined from following International Shade Tree Conference formula: $0.7854 \times D2 \times 38.00 where D is diameter in inches of tree or shrub trunk measured 12 inches above grade.

PART 2 P R O D U C T S

2.01 MATERIALS

- 1. Asphalt Paint: Emulsified asphalt or other adhesive, elastic, antiseptic coating formulated for horticultural use on cut or injured plant tissue, free from kerosene and coal creosote
- 2. Burlap: Suitable for use as tree wrapping.
- 3. Fertilizer: Liquid containing 20 percent nitrogen, 10 percent phosphorus, and 5 percent potash.
- 4. Necessary tree replacements shall be as approved by City Forrester.

PART 3 E X E C U T I O N

3.01 PROTECTION AND MAINTENANCE OF EXISTING TREES AND SHRUBS

- 1. Except for trees shown on Drawings or determined by City Forrester to be removed and relocated, trees within Project area are to remain in place, protected from damage and maintained by Contractor.
- 2. For trees or shrubs to remain, perform following:
 - a. Trim trees and shrubs to remain only under supervision of professional tree surgeon or horticulturist.
 - b. Prune trees according to International Society of Arbor culture specifications.
 - c. Trees and shrubs requiring pruning for construction should also be pruned for balance as well as to maintain proper form and branching habit.
 - d. Cut limbs at branch collar. No stubs should remain on trees. Branch cuts should not gouge outer layer of tree structure or trunk.

- e. Prior to construction, prune all trees to remain of new or recent growth to maintain basic branching from of trees. Base extent of pruning upon proximity of pavement to trunk and size of tree block outs and requirements of construction adjacent to tree.
- f. Limit pruning to young branches as much as possible. Take care to maintain older branches that provide basic form of tree. All pruning shall be done in presence of and direction of City Forrester.
- g. Paint cuts over 3/4" in diameter with tree paint, covering exposed living tissue.
- h. Use extreme care to prevent excessive damage to root systems.
- i. Roots in construction areas shall be cut smoothly with a trencher before excavation begins. Do not allow ripping of roots with a backhoe or other equipment.
- j. Temporarily cover exposed roots with wet burlap to prevent roots from drying out.
- k. Cover exposed roots with soil as soon as possible.
- 1. Prevent damage or compaction of root zone (area below drip line) by construction activities.
- m. Do not allow scarring of trunks or limbs by equipment or other means.
- n. Do not store construction materials, vehicles, or excavated material under drip line of trees.
- o. Do not pour liquid materials under drip line.
- p. Water and fertilize remaining trees and shrubs to maintain their health during construction period.
- q. Supplemental watering of landscaping during construction should be done once every 7 days in cold months and once every 4 days in hotter months.
- r. This watering shall consist of saturating soils at least 6 to 8 inches beneath surface.
- s. Water areas currently being served by private sprinkler systems while systems are temporarily taken out of service to maintain health of existing landscapes.

t. Contractor's option with City Forrester's permission, shrubs to remain may be temporarily transplanted and returned to original positions under supervision of professional horticulturist.

3.02 PROTECTION

- 1. Protection of Trees or Shrubs in Open Area:
 - a. Install steel drive-in fence posts in protective circle, approximately 8 feet on center, not closer than 4 feet to trunk of trees or stems of shrubs.
 - b. Drive steel drive-in fence posts into ground for 3 feet minimum, leaving 5 feet minimum above ground.
 - c. Mount fluorescent orange construction fence on fence posts.
 - d. For trees or shrubs in paved areas, mount concrete-filled steel pipe 2-1/2 inches in diameter minimum in rubber auto tires filled with concrete (movable posts).
- 2. Timber Wrap Protection for Trees in Close Proximity of Moving or Mechanical Equipment and Construction Work: When work is required within construction fence protecting trees, provide timber wrap protection for trees in close proximity of moving or mechanical equipment and work.
 - a. Wrap trunk with layer of burlap.
 - b. Install 2 by 4's or 2 by 5's (5-foot to 6-foot lengths) vertically, spaced 3 inches to 5 inches apart around circumference of tree trunk.
 - c. Tie in place with 12 to 9 gauge steel wire.

3.03 MAINTENANCE OF NEWLY PLANTED TREES AND REPLANTED TREES

- 1. Show proof of capacity to water during dry periods.
- 2. Guarantee trees planted for this Project shall remain alive and healthy at least until end of one-year warranty period and additional one-year period required by Surface Restoration Bond.
- 3. Within four weeks notice from City Engineer, replace dead trees or trees that in opinion of City Engineer, have become unhealthy, unsightly or have lost their natural shape as result of additional growth, improper pruning, maintenance or weather conditions.
- 4. When tree must be replaced, guarantee period begins on date of tree replacement, subject to City Engineers inspection, for no less than one year.

- 5. Straighten leaning trees and bear entire cost.
- 6. Dispose of trees rejected by City Engineer and bear entire cost. END OF SECTION

SECTION 02448

PIPE AND CASING AUGERING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Installation of casing for pipe by dry augering or slurry boring methods, together with installation of pipe in the casing.
- B. Installation of pipe by slurry boring methods. Construction casing may be used at the Contractor's option.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. Casing installed by augering methods shown on the Drawings, will be measured, and paid by the linear foot from end to end of the augered section. Casing installed in the auger pits or open cuts adjacent to augered sections shall be paid for under a separate bid item. Casing installed by open-cut methods were shown on the Drawings, will be measured and paid by the linear foot from end to end of the casing.
 - 2. Pipe augering shown on the Drawings, will be measured and paid by the linear foot from end to end of the augered section.
 - 3. Payment will include and be full compensation for labor, equipment, materials and supervision for excavation and construction of the pipe, complete in place including disposal of excess materials, shoring, dewatering, utility adjustments, grouting, backfill, clean-up, and other related work necessary for construction as indicated on the Drawings and specified this Section.
 - 4. Cost for pits and other excavations are to be included in the unit price for pipe with or without casing.
 - 5. Trench safety systems for pits are to be included in the unit price for pipe with or without casing.
- B. Stipulated Price (Lump Sum). There shall be no separate payment for work covered under this section. All costs associated with this item shall be included in the bid price for the entire project. Schedule of Values shall be based on consideration of applicable construction units or quantities determined from construction drawings.

1.03 DEFINITIONS

- A. Augering means either "dry augering" or "slurry boring".
- B. Dry augering is jacking a casing while excavating the soil at the heading and transporting the spoil back through the casing by an otherwise uncased auger.
- C. Slurry boring is installing a casing or pipe by drilling a small diameter pilot hole, followed by reaming the bore to full diameter with the assistance of slurry or drilling fluids.
- 1.03 REFERENCE STANDARDS
 - A. American Railway Engineering Association (AREA) Manual for Railway Engineering.
 - B. American Association of State Highway and Transportation Officials (AASHTO).
 - C. AWWA C 200 Steel Water Pipe, 6-Inch and Larger.

1.05 SUBMITTAL

- A. Make submittals in conformance with Section 01330 Submittal Procedures.
- B. For installation by augering, submit for review:
 - 1. Description of mechanized excavating equipment.
 - 2. Method of controlling line and grade.
 - 3. Grouting techniques to be used for filling annular void between pipe and casing, and void between pipe or casing and the ground, including equipment, pumping and injection procedures, pressure grout types, and mixes.
 - 4. Locations and dimensions of pits.
 - 5. Pit design and construction drawings.
 - 6. Identification of casings required and paid under the Contract and casings installed at the Contractor's option.
 - 7. Design of casings.
- C. Prepare auger pit and casing design submittals that are site specific. Have auger pit and casing design submittals signed and sealed by a qualified Professional Engineer registered in the State of Texas.
1.06 CRITERIA FOR DETERMINING CASING INSTALLATION LOADS

- A. Select and design casing pipe and pipe joints to carry the thrust of jacks or loads due to the pulling mechanism in combination with overburden, earth and hydrostatic loads. Select casings for dry augering to withstand the action of the auger without damage.
- B. Have a Professional Engineer determine design stresses, design deflections and factors of safety for design of casing. Present such determination as a part of the design submittal. Apply the following maximum casing pipe stresses and deflections to casings shown on the Drawings:
 - 1. Design stress in the pipe wall: 50 percent of the minimum yield point of the steel or 18,000 psi, whichever is less, when subjected to the applicable loading conditions.
 - 2. Wall thickness: Maximum allowable deflection which does not exceed 3 percent of nominal casing diameter.
- C. Use Cooper E-80 locomotive loading distributions as criteria for railroad crossings in accordance with AREA's specifications for culverts. In the design, account for additive loadings due to multiple tracks.
- D. Use H-20 vehicle loading distributions as criteria for truck loading in accordance with AASHTO.
- E. When not specifically indicated on the Drawings, select casing diameter to permit practical installation (including skids if applicable) and grouting.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide casing pipe which is straight, circular in section, uncoated, welded steel pipe, manufactured in accordance with AWWA C 200.
- B. Provide pipe in accordance with the plans.
- C. Provide restrained-joint pipe when installing pipe in slurry bored holes by a pull-back method.
- PART 3 EXECUTION

3.01 LOCATION AND SIZE OF AUGER PITS

A. Locate auger pits for slurry boring so that the distance between pits is no greater than 80 feet; and for dry augering not more than 120 feet apart.

- B. Where possible, locate auger pits and associated work areas to avoid blocking driveways and cross streets and to minimize disruption to business and commercial interests. Avoid auger pit locations near areas identified as potentially contaminated.
- C. Make size adequate for construction of any structures indicated on the Drawings. Provide adequate room to meet Contractor's operational requirements for augering.
- D. Provide a portable concrete traffic barrier around the periphery of the pit, meeting applicable safety standards. Properly maintain the barrier throughout the period the pit remains open. Angle traffic barriers in the direction of the lane flow; do not place barriers perpendicular to on-coming traffic.
- E. Provide a full cover or other security fencing for each access pit in which there is no construction activity or which is unattended by Contractor's personnel.

3.02 DRY AUGERING OF CASING

- A. Provide jacks, mounted on a frame or against a backstop, of a capacity suitable for forcing the excavating auger and casing through the soil conditions to be encountered. Operate jacks so that even pressure is applied to the casing.
- B. Provide steerable front section of casing to allow vertical grade adjustments. Provide a water level or other means to allow monitoring of the grade elevation of the auger casing.
- C. Bentonite slurry may be used to lubricate the casing during installation. The use of water to facilitate removal of spoil is permitted; however, water jetting for excavation of the soil is not allowed when jacking casing.
- D. Tolerances from lines and grades shown on the Drawings for pipe installed in casing are plus or minus 6 inches in horizontal alignment, and plus or minus 1-1/2 inches in elevation.

3.03 SLURRY BORING OF CASING OR PIPE

- A. Drill a small diameter pilot hole and check for line and grade at the receiving end. Redrill the pilot hole if the bored pipe does not meet specified tolerances.
- B. Using the pilot hole as a guide, bore a larger diameter hole of sufficient size for pipe or casing installation. Water jetting is not permitted.
- C. Bentonite slurry may be used to maintain a stable hole and furnish lubrication for pipe or casing installation.
- D. Tolerances from lines and grades shown on the Drawings for the installed pipe are plus or minus 6 inches in horizontal alignment and plus or minus 1-1/2 inches in elevation.

E. Completely fill the annular space between the pipe and the surrounding soil or casing with grout, without displacing the pipe during the grouting operation.

3.04 PIPE IN CASING

A. Grout the annular void between pipe and any casing from end to end of the casing. Block and brace the pipe to prevent movement during grout placement and to maintain specified line and grade.

3.05 SETTLEMENT MONITORING

- A. Monitor the ground surface elevation along the length of the augering operation. Locate and record settlement monitoring points with respect to construction baseline and elevations. Record elevations to an accuracy of 0.01 feet for each monitoring point location. Establish monitoring points at locations and by methods that protect them from damage by construction operations, tampering, or other external influences. As a minimum, locate survey points as follows:
 - 1. For road crossings: Centerline and each shoulder.
 - 2. Railroads: Track subbase at centerline of each track.
 - 3. Utilities and Pipelines: Directly above and 10 feet before and after the utility or pipeline intersection.
 - 4. Long bores under improved areas such as pavements: Ground surface elevations must be recorded on the centerline ahead of augering operations at locations not to exceed 50 feet apart (including points located for roads, railroads, utilities, and pipelines), or at least three locations per augering drive.
- B. Reading Frequency and Reporting. Take settlement survey readings:
 - 1. Prior to the auger excavation reaching the point.
 - 2. After the auger reaches the monitoring point in plan.
 - 3. After grouting of the ground supporting pipe or casing is complete.
- C. Immediately report to the Engineer any movement, cracking, or settlement which is detected.
- D. Following substantial completion but prior to final completion, make a final survey of all monitoring points.
- E. All damage done, by the augering operation, to roadways or other structures shall be repaired by the Contractor at no cost to the Owner.

3.06 DISPOSAL OF EXCESS MATERIAL

A. Remove and dispose of spoil from the job site.

SECTION 02513

WET CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wet connections for new water mains and service lines to existing water mains.

1.02 MEASUREMENT AND PAYMENT

- A. Payment for wet connections shown on Drawings is on the basis of each wet connection. Separate payment will be made for each size of water main.
- B. No compensation will be given for extra work or for damages occurring as a result of an incomplete shutoff.

1.03 REFERENCES

A. AWWA C 800 - Underground Service Line Valves and Fittings.

1.04 DEFINITIONS

- A. Wet connections consist of isolating sections of pipe to be connected with installed valves, draining the isolated sections, and completing the connections.
- B. Connection of 2-inch or smaller lines, which may be referred to on Drawings as "2inch standard connections" or "gooseneck connections" will be measured as 2-inch wet connections. This item is not to be used as part of a 2-inch service line.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Pipe shall conform to requirements of applicable portions of Sections 02506 Polyvinyl Chloride Pipe.
- B. Corporation cocks and saddles shall conform to requirements of Section 33 12 13 -Water Tap and Service Line Installation.
- C. Valves shall conform to requirements of Section 02521 Gate Valves.
- D. Brass fittings shall conform to requirements of AWWA C 800.

PART 3 EXECUTION

3.01 CONNECTION OPERATIONS

- A. Plan wet connections in such manner and at such hours as to least inconvenience public. Notify the Engineer and the Owner at least 48 hours in advance of making connections.
- B. Do not operate valves on mains in use by the Owner. The Owner will handle, at no cost to Contractor, operations involving opening and closing valves for wet connections.
- C. Conduct connection operations when Inspector is at job site. Connection work shall progress without interruption until complete once existing mains have been cut or plugs has been removed for making connections.

3.02 2-INCH WET CONNECTIONS

A. Tap water main. Use corporation cocks, saddles, copper tubing as required for line and grade adjustment, and brass fittings necessary to adapt to existing main. Use 2inch valves when indicated on Drawings for 2-inch copper gooseneck connections.

SECTION 02520

FIRE HYDRANTS

PART 1 GENERAL

- 1.01 SECTION INCLUDES
 - A. Fire hydrants.
 - B. Adjustment of fire hydrants and gate valves.
- 1.02 MEASUREMENT AND PAYMENT
 - A. Payment will be made for fire hydrants assembly at the unit price for each fire hydrant, various diameter mainline tee, pipe branch, gate valve, valve box, and other fittings installed for the bid item itemized under this Section. Unit Prices shall include all materials and labor necessary to install the fire hydrant assembly.
- 1.03 SUBMITTALS
 - A. Submittals shall conform to requirements of Section 01 33 00 Submittal Procedures.
 - B. Submit name of hydrant manufacturer, type of bonnet paint, and engineering control drawing number for hydrant proposed for use.

PART 2 PRODUCTS

2.01 HYDRANTS

- A. Fire Hydrants Provide fire hydrants manufactured by Mueller Super Centurion 250, or approved equal. Fire hydrants shall conform to AWWA Standard "Dry-Barrel Fire Hydrants" C502, latest revision. Hydrants shall be cast iron, fully bronze mounted and have a working pressure of 150 psi. Fire hydrants shall have a minimum valve opening of 5 1/4 inch. Hydrants shall be furnished with Aquagrip connection system or approved equal. Hydrants shall be furnished with Hydrant Defender with barrel lock.
- B. The Owner may, at any time prior to or during installation of hydrants, randomly select a furnished hydrant for disassembly and laboratory inspection, at the Owner's expense, to verify compliance with Specifications. If such hydrant is found to be non-compliant, replace, at Contractor's expense, hydrants, with hydrants that comply with Specifications.

2.02 LEADS

- A. Branches (Leads): Conform to requirements of ITEM REMOVED, Section 33 30 00 Sanitary sewer pipework, and Section 02506 Polyvinyl Chloride Pipe.
- 2.03 PAINT
 - A. Paint: Apply finish coat of Silicone Alkyd Resin Enamel, Acro Products No. 2215, or approved equal meeting SSPC Paint Specification No. 21. Total dry film thickness (DFT): 2 to 3 mils. Exception: Hydrants shall be painted RED with WHITE bonnets.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Set fire hydrant plumb and brace at locations and grades as shown on Drawings. When barrel of hydrant passes through concrete slab, place a 1-inch-thick piece of standard sidewalk expansion joint material around section of barrel passing through concrete.
- B. Locate nozzle center line minimum 18 inches above finish grade.
- C. Place 12-inch x 12-inch yellow indicators (plastic, sheet metal, plywood, or other material approved by the Owner) on pumper nozzles of new or relocated fire hydrants installed on new mains not in service. Remove indicators after new main is tested and approved by the Owner. Install Hydrant defenders upon removal of indicators.
- D. A 12-inch gravel pocket (in all directions) shall be installed around the drain ports. Do not cover drain ports when placing concrete thrust block.
- E. Obtain the Owner's approval in writing prior to installation of hydrants which require changes in bury depth due to obstructions not shown on Drawings. Unit price adjustments will not be allowed for changes in water main flow line or fire hydrant barrel length caused by such obstructions.
- F. Plug branch lines to valves and fire hydrants shown on Drawings to be removed. Deliver fire hydrants designated for salvage to the nearest Owner Maintenance Quadrant Facility.
- G. Install branches (leads) in accordance with Section 02511 Water Mains.
- H. Coating Requirements:
 - 1. Apply coatings in strict accordance with manufacturer's recommendations. No requirements of this specification shall cancel or supersede written directions and recommendations of specific manufacturer so as to jeopardize integrity of applied system.

- 2. Furnish an affidavit of compliance that coatings furnished comply with requirements of this specification and referenced standards, as applicable.
- I. If damage to the exterior surface of the fire hydrant occurs during the handling and/or installation of the hydrant, the contractor shall be responsible for the touch-up/repair of said exterior surface. The Contractor shall follow the hydrants manufactures recommendations for such repairs.

Section 02533

ACCEPTANCE TESTING FOR SANITARY SEWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Acceptance testing of sanitary sewers including:
 - 1. Visual inspection of sewer pipes
 - 2. Mandrel testing for flexible sewer pipes.
 - 3. Leakage testing of sewer pipes.
 - 4. Leakage testing of manholes.
 - 5. Smoke testing of point repairs.
- B. All tests listed in this Section are not necessarily required on this Project. Required tests are named in other Sections which refer to this Section for testing criteria and procedures.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
 - 1. No payment will be made for acceptance testing under this Section.

1.03 REFERENCES

- A. ASTM C 828 Standard Test Method for Low Pressure Air Test of Vitrified Clay Pipe Lines.
- B. ASTM C 924 Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
- C. ASTM D 3034 Standard Specification for Type PSM Polyethylene (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- D. ASTM F 794 Specification for Polyvinyl Chloride Large-Diameter Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
- E. ASTM F 1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air.

- F. 30 TAC 317.2 Design Criteria for Sewage Systems.
- G. Uni-Bell UNI-B-3 Polyvinyl Chloride (PVC) Pressure Pipe (Complying with AWWA C 900).
- 1.04 PERFORMANCE REQUIREMENTS
 - A. Gravity flow sanitary sewers are required to have a straight alignment and uniform grade between manholes.
 - B. Flexible pipe, including Asemi-rigid pipe, is required to show no more than 5 percent deflection. Test pipe no sooner than 30 days after backfilling of a line segment but prior to final acceptance using a standard mandrel to verify that installed pipe is within specified deflection tolerances.
 - C. Maximum allowable leakage for Infiltration or Exfiltration
 - 1. The total exfiltration, as determined by a hydrostatic head test, shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at a minimum test head of 2 feet above the crown of the pipe at the upstream manhole or 2 feet above the groundwater elevation, whichever is greater.
 - 2. When pipes are installed more than 2 feet below the groundwater level, an infiltration test shall be used in lieu of the exfiltration test. The total infiltration shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours. Groundwater elevation must be at least 2 feet above the crown of the pipe at the upstream manhole.
 - 3. Refer to Table 02533-1, Water Test Allowable Leakage, at the end of the Section, for measuring leakage in sewers. Perform leakage testing to verify that leakage criteria are met.
 - D. Perform air testing in accordance with requirements of this Section and the Texas Natural Resources Conservation Commission requirements. Refer to Table 02533-2, Time Allowed For Pressure Loss From 3.5 psig to 2.5 psig, Table 02533-3, Minimum Testing Times for Low Pressure Air Test, and Table 02533-4, Vacuum Test Time Table, at the end of this Section.
- 1.05 SUBMITTALS
 - A. Conform to requirements of Section 01 33 00 Submittal Procedures.
 - B. Test Plan: Before testing begins and in adequate time to obtain approval through the submittal process, prepare and submit a test plan for approval by Utility Owner. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from the Drawings and Specifications.

C. Test Reports: Submit test reports for each test on each segment of sanitary sewer.

1.06 GRAVITY SANITARY SEWER QUALITY ASSURANCE

- A. Repair, correct, and retest manholes or sections of pipe which fail to meet specified requirements when tested.
- B. Provide testing reports and videotape of television inspection as directed by the Utility Owner.
- C. Upon completion of tape reviews by the Utility Owner, Contractor will be notified regarding final acceptance of the sewer segment.
- 1.07 SEQUENCING AND SCHEDULING
 - A. Perform testing as work progresses. Schedule testing so that no more than 1000 linear feet of installed sewer remains untested at any one time.
 - B. Coordinate testing schedules with the Utility Owner. Perform testing under observation of the Utility Owner.
- PART 2 P R O D U C T S

2.01 DEFLECTION MANDREL

- A. Mandrel Sizing. The rigid mandrel shall have an outside diameter (O.D.) equal to 95 percent of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, shall be the average outside diameter minus two minimum wall thickness for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe, dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.
- B. Mandrel Design. The rigid mandrel shall be constructed of a metal or a rigid plastic material that can withstand 200 psi without being deformed. The mandrel shall have nine or more "runners" or "legs" as long as the total number of legs is an odd number. The barrel section of the mandrel shall have a length of at least 75 percent of the inside diameter of the pipe. The rigid mandrel shall not have adjustable or collapsible legs which would allow a reduction in mandrel diameter during testing. A proving ring shall be provided and used for modifying each size mandrel.
- C. Proving Ring. Furnish a "proving ring" with each mandrel. Fabricate the ring of 1/2-inch-thick, 3-inch-wide bar steel to a diameter 0.02 inches larger than approved mandrel diameter.

- D. Mandrel Dimensions (5 percent allowance). Average inside diameter and minimum mandrel diameter are specified in Table 02533-5, Pipe vs. Mandrel Diameter, at the end of this Section. Mandrels for higher strength, thicker wall pipe or other pipe not listed in the table may be used when approved by the Utilities Director.
- 2.02 EXFILTRATION TEST
 - A. Water Meter: Obtain a transient water meter from the Utility for use when water for testing will be taken from the Utility system. Conform to Utility requirements for water meter use.
 - B. Test Equipment:
 - 1. Pipe plugs.
 - 2. Pipe risers where the manhole cone is less than 2 feet above highest point in pipe or service lead.
- 2.03 INFILTRATION TEST
 - A. Test Equipment:
 - 1. Calibrated 90 degree V-notch weir.
 - 2. Pipe plugs.
- 2.04 LOW PRESSURE AIR TEST
 - A. Minimum Requirement for Equipment:
 - 1. Control panel.
 - 2. Low-pressure air supply connected to control panel.
 - 3. Pneumatic plugs: Acceptable size for diameter of pipe to be tested; capable of withstanding internal test pressure without leaking or requiring external bracing.
 - 4. Air hoses from control panel to:
 - a. Air supply.
 - b. Pneumatic plugs.
 - c. Sealed line for pressuring.
 - d. Sealed line for monitoring internal pressure.

- B. Testing Pneumatic Plugs: Place a pneumatic plug in each end of a length of pipe on the ground. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5 psig. Plugs are acceptable if they remain in place against the test pressure without external aids.
- 2.05 GROUND WATER DETERMINATION
 - A. Equipment: Pipe probe or small diameter casing for ground water elevation determination.
- 2.06 SMOKE TESTING
 - A. Equipment:
 - 1. Pneumatic plugs.
 - 2. Smoke generator as supplied by Superior Signal Company, or an approved equal.
 - 3. Blowers producing 2500 scfm minimum.

PART 3 E X E C U T I O N

3.01 PREPARATION

- A. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.
- B. The selection of test methods and pressures for gravity sanitary sewers shall be determined based on ground water elevation. Determine ground water elevation using equipment and procedures conforming to Section 31 23 19 Control of Ground Water and Surface Water.

3.02 VISUAL INSPECTION OF GRAVITY SANITARY SEWERS

A. Check pipe alignment visually by flashing a light between structures. Verify if alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and re-lay or replace pipe segment.

3.03 MANDREL TESTING FOR GRAVITY SANITARY SEWERS

- A. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D 3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of the line segment.
- B. Pull the approved mandrel by hand through sewer sections. Replace any section of sewer not passing the mandrel. Mandrel testing is not required for stubs.

C. Retest repaired or replaced sewer sections.

3.04 LEAKAGE TESTING FOR GRAVITY SANITARY SEWERS

- A. Test Options:
 - 1. Test gravity sanitary sewer pipes for leakage by either exfiltration or infiltration methods, as appropriate, or with low pressure air testing.
 - 2. Test new or rehabilitated sanitary sewer manholes with water or low pressure air. Manholes tested with low pressure air shall undergo a physical inspection prior to testing.
 - 3. Leakage testing shall be performed after backfilling of a line segment, and prior to tiein of service connections.
 - 4. If no installed piezometer is within 500 feet of the sewer segment, Contractor shall provide a temporary piezometer for this purpose.
- B. Compensating for Ground Water Pressure:
 - 1. Where ground water exists, install a pipe nipple at the same time sewer line is placed. Use a 1/2-inch capped pipe nipple approximately 10 inches long. Make the installation through manhole wall on top of the sewer line where line enters manhole.
 - 2. Immediately before performing line acceptance test, remove cap, clear pipe nipple with air pressure, and connect a clear plastic tube to nipple. Support tube vertically and allow water to rise in the tube. After water stops rising, measure height in feet of water over invert of the pipe. Divide this height by 2.3 feet/psi to determine the ground water pressure to be used in line testing.
- C. Exfiltration test:
 - 1. Determine ground water elevation.
 - 2. Plug sewer in downstream manhole.
 - 3. Plug incoming pipes in upstream manhole.
 - 4. Install riser pipe in outgoing pipe of upstream manhole if highest point in service lead (house service) is less than 2 feet below bottom of manhole cone.

- 5. Fill sewer pipe and manhole or pipe riser, if used, with water to a point 2-1/2 feet above highest point in sewer pipe, house lead, or ground water table, whichever is highest.
- 6. Allow water to stabilize for one to two hours. Take water level reading to determine drop of water surface, in inches, over a one-hour period, and calculate water loss (1 inch of water in 4 feet diameter manhole equals 8.22 gallons) or measure the quantity of water required to keep water at same level. Loss shall not exceed that calculated from allowable leakage according to Table 02533-1 at the end of this Section.
- D. Infiltration test: Ground water elevation must be not less than 2.0 feet above highest point of sewer pipe or service lead (house service).
 - 1. Determine ground water elevation.
 - 2. Plug incoming pipes in upstream manhole.
 - 3. Insert calibrated 90 degree V-notch weir in pipe on downstream manhole.
 - 4. Allow water to rise and flow over weir until it stabilizes.
 - 5. Take five readings of accumulated volume over a period of 2 hours and use average for infiltration. The average must not exceed that calculated for 2 hours from allowable leakage according to the Table 02533-1 at the end of this Section.
- E. Low Air Pressure Test: When using this test conform to ASTM C 828, ASTM C 924, or ASTM F 1417, as applicable, with holding time not less than that listed in Table 02533-2.
 - 1. Air testing for sections of pipe shall be limited to lines less than 36-inch average inside diameter.
 - 2. Lines 36-inch average inside diameter and larger shall be tested at each joint. The minimum time allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch during a joint test shall be 10 seconds, regardless of pipe size.
 - 3. For pipe sections less than 36-inch average inside diameter:
 - a. Determine ground water level.
 - b. Plug both ends of pipe. For concrete pipe, flood pipe and allow 2 hours to saturate concrete. Then drain and plug concrete pipe.

- c. After a manhole-to-manhole section of sanitary sewer main has been sliplined and prior to any service lines being connected to new liner, plug liner at each manhole with pneumatic plugs.
- d. Pressurize pipe to 4.0 psig. Increase pressure 1.0 psi for each 2.3 feet of ground water over highest point in system. Allow pressure to stabilize for 2 to 4 minutes. Adjust pressure to start at 3.5 psig (plus adjustment for ground water table). See Table 02533-2 at the end of this Section.
- e. To determine air loss, measure the time interval for pressure to drop to 2.5 psig. The time must exceed that listed in the Table 02533-2 at the end of this Section for pipe diameter and length. For sliplining, use diameter of carrier pipe.
- F. Retest: Any section of pipe which fails to meet requirements shall be repaired and retested.
- 3.05 TEST CRITERIA TABLES
 - A. Exfiltration and Infiltration Water Tests: Refer to Table 02533-1, Water Test Allowable Leakage, at the end of this Section.
 - B. Low Pressure Air Test:
 - 1. Times in Table 02533-2, Time Allowed For Pressure Loss From 3.5 psig to 2.5 psig, at the end of this Section, are based on the equation from Texas Natural Resources and Conservation Commission (TNRCC) Design Criteria 317.2(a)(4)(B).

$$T = 0.0850(D)(K)/(Q)$$

where:

- T = time for pressure to drop 1.0 pounds per square inch gauge in seconds
- K = 0.000419 DL, but not less than 1.0
- D = average inside diameter in inches
- L = length of line of same pipe size in feet
- Q =rate of loss, 0.0015 ft³/min./sq. ft. internal surface
- 2. Since a K value of less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as given in Table 02533-3, Minimum Testing Times for Low Pressure Air Test.
- Notes: 1. When two sizes of pipe are involved, the time shall be computed by the ratio of lengths involved.
 - 2. Lines with a 27-inch average inside diameter and larger may be air tested at each joint.
 - 3. Lines with an average inside diameter greater than 36 inches must be air tested for leakage at each joint.

- 4. If the joint test is used, a visual inspection of the joint shall be performed immediately after testing.
- 5. For joint test, the pipe is to be pressurized to 3.5 psi greater than the pressure exerted by groundwater above the pipe. Once the pressure has stabilized, the minimum times allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be 10 seconds.
- 3.06 LEAKAGE TESTING FOR MANHOLES
 - A. After completion of manhole construction, wall sealing, or rehabilitation, but prior to backfilling, test manholes for water tightness using hydrostatic or vacuum testing procedures.
 - B. Plug influent and effluent lines, including service lines, with suitably-sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations. Place plugs a minimum of 6 inches outside of manhole walls. Brace inverts to prevent lines from being dislodged if lines entering manhole have not been backfilled.
 - C. Vacuum testing:
 - 1. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to the recommended maximum inflation pressure; do not over-inflate.
 - 2. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for the time period specified in Table 02533-4, Vacuum Test Time Table.
 - 3. If the drop in vacuum exceeds 1 inch Hg over the specified time period tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.
 - D. Hydrostatic exfiltration testing shall be performed as follows:
 - 1. Seal wastewater lines coming into the manhole with an internal pipe plug. Then fill the manhole with water and maintain it full for at least one hour.
 - 2. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour.
 - 3. If water loss exceeds amount tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

3.07 SMOKE TEST PROCEDURE FOR POINT REPAIRS

- A. Application: Perform smoke test to:
 - 1. Locate points of line failure for point repair.
 - 2. Determine if point repairs are properly made.
 - 3. Determine if service connections have been reconnected to the rehabilitated sewer.
 - 4. Check integrity of connections to newly replaced service taps to liners and to existing private service connections.
- B. Limitations: Do not backfill service taps until completion of this test. Test only those taps in a single manhole section at any one time. Keep the number of open excavations to a minimum.
- C. Preparation: Prior to smoke testing, give written notices to area residents no fewer than 2 days, nor more than 7 days, prior to proposed testing. Also give notice to City Police and Fire Departments 24 hours prior to actual smoke testing.
- D. Isolate Section: Isolate the manhole section to be tested from adjacent manhole sections to keep smoke localized. Temporarily seal the annular space at manhole for sliplined sections.
- E. Smoke Introduction:
 - 1. Operate equipment according to manufacturer's recommendation and as approved by Utilities Director.
 - 2. Conduct test by forcing smoke from smoke generators through sanitary sewer main and service connections. Operate smoke generators for a minimum of 5 minutes.
 - 3. Introduce smoke into upstream and downstream manhole as appropriate. Monitor the tap/connection for smoke leaks. Note sources of leaks.
- F. Repair and Retest: Repair and replace any taps or connections noted as leaking and then retest. Taps and connections may be left exposed in only one manhole section at a time. If repair or replacement, testing or retesting, and backfilling of the excavation is not completed within one work day, properly barricade and cover each excavation as approved by the Utility Owner.
- G. Service Connections: On houses where smoke does not issue from plumbing vent stacks to confirm reconnection of sewer service to the newly installed liner pipe, perform a dye test to confirm reconnection. Introduce dye into the service line through a plumbing fixture inside the structure or a sewer cleanout immediately outside the structure and flush with water.

Observe flow at service reconnection or downstream manhole. Detection of dye confirms a reconnection.

	VOLUME PER I	NCH OF DEPTH	ALLOWANCE LEAKAGE*			
DIAMETER OF RISER OR STACK IN INCHES	Inch	GALLONS	PIPE SIZE IN INCHES	Gallons/Minute per 100 Ft.		
1 2 2.5 3 4 5 6 8	$\begin{array}{c} 0.7854\\ 3.1416\\ 4.9087\\ 7.0686\\ 12.5664\\ 19.6350\\ 28.2743\\ 50.2655\end{array}$.0034 .0136 .0212 .0306 .0306 .0544 .1224 .2176	6 8 13 12 15 18 21 24 27 30 36 42	0.0039 0.0053 0.0066 0.0079 0.0099 0.0118 0.0138 0.0158 0.0177 0.0197 0.0237 0.0276		
For other diameters, multiply square of diameters by value for 1" diameter.			Equivalent to 50 gallons per inch of inside diameter per mle per 24 hours.			

Table 02533-1 WATER TEST ALLOWABLE LEAKAGE

* Allowable leakage rate shall be reduced to 10 gallons per inch of inside diameter per mile per 24 hours, when sewer is identified as located within the 25-year flood plain.

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Table 02533-2ACCEPTANCE TESTING FOR SANITARY SEWERS

TIME ALLOWED FOR PRESSURE LOSS FROM 3.5 PSIG TO 2.5 PSIG														
Pipe Dia m.	Min. Time (min:sec)	Min. Lengt Time h for min:sec) Min. J	Time for Longer	Specification Time for Length (L) Shown (min:sec)										
(111)		(ft)	(sec)	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft	550 ft	600 ft
6 8 10 12 15 18 21 24 27 30 33	5:40 7:33 9:27 11:20 14:10 17:00 19:50 22:40 25:30 28:20 31:10	398 298 239 199 159 133 114 99 88 80 72	$\begin{array}{c} 0.8548\\ 1.5196\\ 2.3743\\ 3.4190\\ 5.3423\\ 7.6928\\ 10.470\\ 8\\ 13.676\\ 2\\ 17.308\\ 9\\ 21.369\\ 0\\ 25.856\\ 5\end{array}$	5:40 7:33 9:27 11:20 14:10 17:00 19:50 22:48 28:51 35:37 43:06	5:40 7:33 9:27 11:20 14:10 19:14 26:11 34:11 43:16 53:25 64:38	5:40 7:33 9:27 11:20 17:48 25:39 34:54 45:35 57:42 71:14 86:11	5:40 7:33 9:54 14:15 22:16 32:03 43:38 56:59 72:07 89:02 107:44	5:40 7:36 11:52 17:06 26:43 38:28 52:21 68:23 86:33 106:51 129:17	5:40 8:52 13:51 19:57 31:10 44:52 61:05 79:47 100:58 124:39 150:50	5:42 10:08 15:50 22:48 35:37 51:17 69:48 91;10 115:24 142:28 172:23	$\begin{array}{c} 6:25\\11:24\\17:48\\25:39\\40:04\\57:42\\78:32\\102:34\\129:49\\160:16\\193:55\end{array}$	7:07 12:40 19:47 28:30 44:31 64:06 87:15 113:58 144:14 178:05 215:28	7:50 13:56 21:46 31:20 48:58 70:31 95:59 125:22 158:40 195:53 237:01	$\begin{array}{c} 8:33\\15:12\\23:45\\34:11\\53:25\\76:56\\104:42\\136:46\\173:05\\213:41\\258:34\end{array}$

Table 02533-3MINIMUM TESTING TIMES FOR LOW PRESSURE AIR TEST

PIPE DIAMETER (INCHES)	MINIMUM TIME (seconds)	LENGTH FOR MINIMUM TIME (FEET)	TIME FOR LONGER LENGTH (seconds)
			0.855 (L)
6	340	398	1.520 (L)
8	454	298	2.374 (L)
10	567	239	3.419 (L)
12	680	199	5.342 (L)
15	850	159	7.693 (L)
18	1020	133	10.471 (L)
21	1190	114	13.676 (L)
24	1360	100	17.309 (L)
27	1530	88	21.369 (L)
30	1700	80	25.856 (L)
33	1870	72	

Table 02533-4 VACUUM TEST TIME TABLE

DEPTH IN FEET	TIME IN SECONDS BY PIPE DIAMETER					
	48"	60"	72"			
4	10	13	16			
8	20	26	32			
12	30	39	48			
16	40	52	64			
20	50	65	80			
24	60	78	96			
*	5.0	6.5	8.0			

*Add T times for each additional 2-foot depth. (The values listed above have been extrapolated from ASTM C 924-85)

Olmito, TX 11/10/2023

Table 02533-5 PIPE VS. MANDREL DIAMETER

	Nominal	Average	Minimum Mandrel
Material and	Size	I.D.	Diameter
Wall Construction	(Inches)	(Inches)	(Inches)
PVC-Solid (SDR 26)	6	5.764	5.476
	8	7.715	7.329
	10	9.646	9.162
PVC-Solid (SDR 35)	12	11.737	11.150
	15	14.374	13.655
	18	17.629	16.748
	21	20.783	19.744
	24	23.381	22.120
	27	26.351	25.033
PVC-Truss	8	7.750	7.363
	10	9.750	9.263
	12	11.790	11.201
	15	14.770	14.032
PVC-Profile (ASTM F 794)	12	11.740	11.153
	15	14.370	13.652
	18	17.650	16.768
	21	20.750	19.713
	24	23.500	22.325
	27	26.500	25.175
	30	29.500	28.025
	36	35.500	33.725
	42	41.500	39.425
	48	47.500	45.125
HDPE-Profile	18	18.000	17.100
	21	21.000	19.950
	24	24.000	22.800
	27	27.000	25.650
	30	30.000	28.500
	36	36.000	34.200
	42	42.000	39.900
	48	48.000	45.600
	54	54.000	51.300
	60	60.000	57.000
Fiberglass-Centrifugally Cast	12	12.85	11.822
(Class SN 46)	18	18.66	17.727
	20	20.68	19.646
	24	24.72	23.484
	30	30.68	29.146
	36	36.74	34.903
	42	42.70	40.565
	48	48.76	46.322
	54	54.82	52.079
	60	60.38	57.361

TABLE OF CONTENTS

STRUCTURAL SPECIFICATIONS FOR: CAMERON COUNTY PARKS OLIMITO PARK COMPLEX

PREPARED FOR: GOMEZ MENDEZ SAENZ

SEALED SET ISSUED: 11-14-2023

SECTION 011100 – TDI WINDSTORM CERTICATION DELEGATION RESPONSIBILTY SECTION 031000 – CONCRETE FORMS SECTION 032000 – CONCRETE REINFORCEMENT SECTION 032000 – CAST-IN-PLACE CONCRETE SECTION 042200 – CONCRETE MASONRY UNITS SECTION 050400 – HOT-DIP GALVANIZING SECTION 050400 – HOT-DIP GALVANIZING SECTION 051200 – STRUCTURAL STEEL FRAMING SECTION 067300 – COMPOSITE DECKING SECTION 061760 – WOOD TRUSSES SECTION 131200 – PRE-ENGINEERED METAL BUILDINGS SECTION 316219 – TIMBER PILES SECTION 316329 – DRILLED PIERS



SECTION 011100 - TEXAS DEPARTMENT OF INSURANCE

WINDSTORM CERTIFICATION OF NEW STRUCTURES

DELEGATED RESPONSIBILITY TO THE GENERAL CONTRACTOR

PART 1 - GENERAL

1.1 SUMMARY

A. The general contractor (Contractor) shall be responsible for the windstorm certification of all building envelope repairs, assembly replacements and alterations through the Texas Department of Insurance (TDI). The general contractor shall contract with a TDI Appointed Qualified Inspector (Inspector) to issue an Application for Windstorm Inspection Certificate of Compliance (WPI-1) form for each building, review exterior architectural and mechanical envelope assembly submittals, conduct periodic inspections of the installation of the exterior envelope assemblies, issue reports of finding of field inspection, conduct follow up inspections as deemed necessary by the Inspector and shall issue Inspection Verification (WPI-2) forms for each building. The Contractor shall include copies of each form and a final copy of the Windstorm Certificate of Compliance (WPI-8) form for each building with the substantial completion close-out documents.

1.1 CONTRACTOR'S DELEGATED RESPONSIBILITY – TDI WINDSTORM CERTIFICATION PROGRAM

- B. The Contractor is solely responsible for all activities, scheduling, safe access, and communication to achieve a windstorm certificate (WPI-8) from the TDI for the building's contracted envelope repairs, replacements, and alterations. The contractor shall provide all construction services as needed to satisfy the requirements of the construction drawings and specifications, the referenced building code (International Building Code, 2018) and the TDI windstorm inspection program. The contractor shall contract with an Appointed Qualified Inspector (Inspector) as defined by the TDI windstorm program to provide field inspection services throughout construction. All construction administration costs, submittal preparation costs, submittal review by the Inspector costs, inspection costs, inspection coordination, including all general conditions, overhead and profit shall be included in the contractor's bid.
- C. The Contractor's Inspector shall submit an application for Windstorm Inspection Certification of Compliance (WPI-1) form to the TDI for each individual building. The WPI-1 shall be issued within 30 days of Notice to Proceed, and shall be made available to the Owner, Architect and Authority Having Jurisdiction for construction permit applications as requested.
- D. The contractor shall make available all exterior envelope assembly submittals to their Inspector for windstorm construction compliance review and comment. Exterior envelope assembly submittals may include but are not limited to the following general items:
 - 1. Roofing assemblies
 - 2. Edge of roof details and parapet coping detail assemblies
 - 3. Soffit assemblies
 - 4. Roof mounted equipment curbs and attachment assemblies
 - 5. Wall mounted mechanical louvers and attachment assemblies
 - 6. Exterior wall cladding and finish assemblies
 - 7. Exterior doors and hardware assemblies
 - 8. Exterior overhead doors and hardware assemblies
 - 9. Exterior windows and storefront assemblies

TDI WINDSTORM INSPECTIONS & CERTIFICATION OF NEW STRUCTURES DELEGATED RESPONSIBILITY TO THE GENERAL CONTRACTOR

- E. The Contractor and Inspector shall review submittals for compliance with the tested performance requirements noted in the IBC, 2018 for all door, window, storefront, wall cladding, roofing system, soffit and mechanical louver and roof mounted equipment assemblies. The contractor shall provide within the submittal substantiating product evaluation reports or tested assembly reports that confirm the tested performance requirements of the IBC are satisfied by the submitted assemblies.
- F. The Contractor shall coordinate appropriate inspections with the Inspector required to verify compliance of windstorm construction requirements as detailed by the TDI windstorm inspection program. The contractor and Inspector shall be responsible for the timing of the inspection and safe access to the site to accommodate the needs of the Inspector throughout the entire construction.
- G. The Contractor and Inspector shall rely on the signed and sealed contract drawings as an indication that the inspected buildings were designed in compliance with the International Building Code, 2018 edition. Any delegated design responsibilities of individual assemblies or components shall be the responsibility of the contractor as indicated on the contract drawings and specifications.
- H. The Contractor and Inspector shall provide site inspection reports to the Owner and Architect indicating compliance with installation details of exterior envelope assemblies or written remedial measures required by the Contractor to get inspected works in the field into compliance with submitted assembly installation details.
- I. The Contractor and Inspector shall provide a list of expected site inspections to the Owner and Architect within 30 days of the Notice to Proceed date. The inspection list shall identify the work in the field to be inspected and indicate the sequence of work at which time the Inspector will need to be present to observe the installed work prior to it being concealed by subsequent trade activities and material installation.
- J. The Contractor and Inspector shall conduct all windstorm inspections and activities required for certification of the buildings through the TDI Windstorm Certification program independent of all Architectural and Engineering Design Team field observations. The Contractor and/or the Inspector shall not rely on contract administration services from the Design Team as substitution for any delegated windstorm inspection service required by the TDI windstorm certification program and/or delegated within the contract documents to the Contractor.
- K. The contractor shall include a copy of the WPI-1, WPI-2 and WPI-8 forms for each individual building with all other substantial completion close-out documents. The contractor shall not rely on the WPI-2 from the Inspector as a means to satisfy this delegated responsibility. The windstorm inspection services delegated responsibility shall be considered incomplete until the Contractor delivers a copy a of the WPI-8 Certificate of Compliance for each individual building under contract.
- L. Should the project, Inspector or individual building be selected by the TDI for quality control auditing of the Inspector's work, the Contractor and Inspector shall be responsible for all time, documentation and field inspections requested by the TDI windstorm program to satisfy the audit requirements.

SECTION 031000 - CONCRETE FORMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Formwork for cast-in-place concrete including shoring, bracing and anchorage.
- B. Openings for other Work.
- C. Release agents and other related form accessories.
- D. Form stripping.

1.2 RELATED SECTION

- A. Section 032000 Concrete Reinforcement
- B. Section 033000 Cast-In-Place Concrete

1.3 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 347, Recommended Practice for Concrete Formwork.

1.4 DEFINITIONS

- A. Concealed: For Work required under this Section, the term "concealed" will mean "not exposed to view in finished construction."
- B. Exposed: For Work required under this Section, the term "exposed" will mean "exposed to view in finished construction."

1.5 QUALITY ASSURANCE

- A. Grading Rules. Rules of the following associations apply to materials furnished under this Section:
 - 1. Southern Pine Inspection Bureau (SPIB).
 - 2. Western Wood Products Association (WWPA).
- B. Tolerances: Follow ACI 301 (Table 4.3.1).

1.6 DELIVERY, STORAGE AND HANDLING

A. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.7 DESIGN CRITERIA

- A. Design, engineering, fabrication, erection, maintenance and removal of formwork shall be responsibility of Contractor.
- B. Construct forms following ACI 318, ACI 347, OSHA, state and local requirements.
- C. Provide forms with sufficient strength to withstand pressures resulting from concrete placement and vibration.
- D. Responsibility for properly bracing and shoring to support subsequent construction loads rests solely with Contractor.
- E. Responsibility for removal of forms at any time before concrete has obtained certified specified design strength rests solely with Contractor.
- F. The Engineer's efforts are aimed at designing a project which will be safe after full completion. The Engineer has no expertise in, and takes no responsibility for, construction means and methods or job Site safety during construction which are exclusively Contractor's responsibility. Processing and/or approving submittals made by Contractor which may contain information related to construction methods or safety issues, or participation in meetings where such issues might be discussed must not be construed as voluntary assumption by Engineer of any responsibility for safety procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS / PRODUCTS

A. Use forms specified in the general notes of the structural drawings. Provide in largest practical sizes to minimize number of required joints.

2.2 MATERIALS

- A. Wood Form Materials:
 - 1. Reference general structural notes in sheet S1.1 for wood grade requirements.
- B. Preformed Steel Forms: Minimum 16 gauge (0.06"/1.5mm) matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- C. Form Release Agent: Colorless chemical form coating or mineral oil which will not stain concrete or absorb moisture.
- D. Form Ties: Standard coil or snap galvanized adjustable ties with 3/4" diameter plastic cones on exposed surfaces. Provide manufacturer's recessed plugs of gray plastic or concrete to seal tie holes.
- E. Nails, Spikes, Lag Bolts, Through Bolts and Anchorages: Sizes required; of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork.

B. Verify that dimensions agree with drawings.

3.2 ERECTION / INSTALLATION / APPLICATION

- A. Follow ACI 301 and 347.
- B. Provide forms as follows:
 - 1. Concealed Surfaces: Rough or board form finish left by clean, straight formed lumber.
 - 2. Exposed Surfaces (Typical): Hardboard or plywood lined concrete forms.
- C. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over-stressing by construction loads.
- D. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping.
- E. Align joints and make watertight. Keep form joints to minimum.
- F. Obtain approval before framing openings in structural members which are not shown.
- G. Provide 1" chamfer strips in exposed exterior corners of beams, girders, columns, walls or foundation forms, around tops of all foundation slabs and elsewhere shown.
- H. Provide temporary ports or openings in formwork required for cleaning out debris, adjusting reinforcing steel and to facilitate inspection.
- I. Coordinate with Work of other Sections which require attachment of components to formwork.
- J. Coat forms with non-staining form release agent. No other coating will be permitted unless specifically approved by Architect.
- K. Inserts, Embedded Parts and Openings:
 - 1. Provide formed openings required for items to be embedded in or passing through concrete Work.
 - 2. Locate and set in place items which will be cast directly into concrete.
 - 3. Coordinate with Work of other Sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, collars, thimbles, ties, sockets, nailing blocks, other inserts and components of other Work.
 - 4. Obtain required setting information before proceeding.
- L. Install accessories following manufacturer's instructions, straight, level and plumb. Ensure items are not disturbed during concrete placement.
- M. Form Removal:
 - 1. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
 - 2. Loosen forms carefully. Do not wedge pry bars, hammers or tools against exposed concrete surfaces.
 - 3. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged. Discard damaged forms.
- N. Do not construct any masonry walls on concrete floors or walls until concrete has attained its design strength and forms and shoring have been removed.
- O. Terminate embedded form ties 1-1/2" from formed face of concrete. Construct ties so that ends and fasteners can be removed without causing spalling of face of concrete.

- P. Repair form tie holes as follows:
 - 1. Below Grade Surfaces: Fill tie holes with waterproof bituminous mastic to prevent water infiltration.
 - 2. Above Grade Surfaces Concealed: Fill tie holes with compatible materials flush with adjacent concrete.
 - Above Grade Surfaces Exposed: Fill tie holes with compatible materials flush with adjacent concrete. Repairs shall blend in inconspicuously with surrounding surfaces. Follow Section 03 30 00.
- Q. Finishes. Follow ACI 301 unless specifically shown otherwise.

3.3 TOLERANCES

- A. Formwork: Follow ACI 301.
- 3.4 FIELD QUALITY CONTROL
 - A. Inspect erected formwork, shoring and bracing to ensure that Work follows formwork design and that supports, fastenings, wedges, ties and items are secure.

3.5 ADJUSTING AND CLEANING

- A. Clean forms as erection proceeds to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
- C. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

SECTION 032000 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Reinforcing steel, welded wire fabric, tie wires and other related accessories.
- B. Work includes reinforcing for interior and exterior cast-in-place concrete.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete

1.3 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 301, Structural Concrete.
 - 2. 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
 - 3. 318, Building Code Requirements for Reinforced Concrete.
- B. American Society for Testing and Materials (ASTM):
 - 1. A82, Cold Drawn Steel Wire for Concrete Reinforcement.
 - 2. A185, Welded Steel Wire Fabric for Concrete Reinforcement.
 - 3. A615, Deformed and Plain Billet Steel Bars for Concrete Reinforcement (including supplementary requirements)
- C. Concrete Reinforcing Steel Institute (CRSI):
 - 1. Manual of Practice.
 - 2. 63, Recommended Practice For Placing Reinforcing Bars.
 - 3. 65, Recommended Practice for Placing Bar Supports, Specifications and Nomenclature.

1.4 SUBMITTALS

- A. Submit:
 - 1. Shop drawings. Provide electronic (PDF) copies of each drawing.
 - a. Show reinforcing steel and wire fabric sizes, spacings, locations and quantities, bending and cutting schedules and supporting and spacing devices.
 - b. Indicate visual method of identification of bar strengths following ASTM standard for steel type used.
 - 2. Certified copies of mill test reports of reinforcement materials analysis (upon request).
- B. Provide submittals within 30 days after Contract date.

1.5 QUALITY ASSURANCE

- A. Maintain 1 copy of each referenced document at Site.
- B. Fabrication and Placement Tolerances: Follow ACI 301.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver to Site free of rust and scale, clearly marked as to bar strength.
- B. Store reinforcing materials on pallets or other materials off ground. Avoid surface contamination before placement and prevent bending or warping.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforcing Steel: ASTM A615, Grade 60 (60,000 psi yield strength) billet steel bars; unfinished. Provide in sizes shown on plans provide deformed bars typically and plain bars where dowels are shown.
- B. Stirrup Steel: #3 reinforcing bars may by ASTM A615 Grade 40.
- C. Welded Wire Fabric (WWF): ASTM A185, plain type; unfinished. Provide in sheet form not in rolls. Provide as sized if shown or as follows if not shown:
 - 1. Provide 1 layer of 6 x 6-W2.9 x W2.9 in sidewalk and toppings 4" or less in thickness.

2.2 ACCESSORIES

- A. Tie Wire: Minimum 16 gauge (0.06") annealed type.
- B. Chairs, Bolsters, Bar Supports and Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions.
- C. Special Chairs, Bolsters, Bar Supports and Spacers Adjacent to Weather Exposed Concrete Surfaces: Stainless steel type; sizes and shapes required.

2.3 FABRICATION

- A. Fabrication: Follow CRSI Manual of Practice.
- B. Locate reinforcing splices not shown at points of minimum stress.

PART 3 - EXECUTION

3.1 PREPARATION

A. Foundations and Footings:

- 1. Clean excavations of loose debris and earth. Cut sides of excavations square and remove loose material.
- 2. Pump out standing water from excavations before placing reinforcement. Remove and replace mud or frozen soil with lean concrete.
- B. Clean reinforcement completely before concrete placing. Reinforcement shall be free from loose, flaky rust, mud, oil or other coatings that would destroy or reduce bond with concrete at time concrete is placed. Reinspect reinforcement and clean off any dried cement, mortar or dirt when placement is delayed.
- C. Obtain Owner's Engineer's approval of reinforcement installations prior to placement of any concrete.

3.2 ERECTION / INSTALLATION / APPLICATION

- A. Position reinforcement following ACI 301, ACI 315 and drawn details.
- B. Provide reinforcing steel in concrete footings, foundation walls, thickened slabs, retaining walls and elsewhere shown.
- C. Provide corner reinforcing steel in footings at corners and at intersections of walls unless shown otherwise:
 - 1. Bar size and spacing shall match wall or footing reinforcing.
 - 2. Return bars minimum of 36 diameters on each end.
 - 3. WELDING OF REINFORCING IS NOT PERMITTED.
- D. Provide the following minimum concrete cover requirements for reinforcing steel unless shown otherwise:
 - 1. Concrete Cast Against and Permanently Exposed to Earth: 3".
 - 2. Concrete Exposed to Earth or Weather:
 - a. #5 Bars and Smaller: 1-1/2".
 - b. Others: 2".
- E. Provide minimum splice requirements for reinforcing steel shown or required by ACI 318. Stagger splices so that no more than 1/2 of horizontal reinforcing steel is spliced at any given cross section.
- F. Provide a bond breaker such as plastic sleeves at all dowel bars occurring at control and expansion joints.
- G. Place, support and secure reinforcement against displacement. Do not deviate from required position.
 - 1. Provide bolsters and chairs required to maintain reinforcing steel at proper elevation in slab.
- H. Lap welded wire fabric minimum 6" or 1 full mesh on sides and 1 foot or 2 full meshes on ends and extend to within 2" of slab edges. Chair support welded wire fabric so that welded wire fabric is in upper half of slab while placing slabs on grade unless specifically shown otherwise.
- I. Carry welded wire fabric and reinforcing steel through control (contraction) joints but not through construction and expansion joints unless shown otherwise.
 - 1. Grease dowels thoroughly and paper wrap to allow for horizontal movement at expansion joints.
 - 2. Cut alternate wires of welded wire fabric at control joints.
- J. Take care to avoid disturbing reinforcement and vapor retarder during placing of concrete. Remove and reinstall disturbed or improperly installed reinforcement when discovered or instructed by Owner's Engineer before continuing concrete placement.
- K. Accommodate placement of formed openings.

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior and exterior plain and reinforced site-placed concrete, vapor retarders, expansion joints, curing compounds and other related accessories.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Masonry Wall Dowels.

1.3 RELATED SECTIONS

- A. Section 032000 Concrete Reinforcement
- B. Section 042200 Concrete Masonry Units

1.4 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 301, Structural Concrete.
 - 2. 302, Guide for Concrete Floor and Slab Construction.
 - 3. 304, Measuring, Mixing, Transporting and Placing Concrete.
 - 4. 305R, Hot Weather Concreting.
 - 5. 308, Curing Concrete.
 - 6. 309, Recommended Practice for Consolidation of Concrete.
 - 7. 318, Building Code Requirements for Reinforced Concrete.
- B. American Society for Testing and Materials (ASTM):
 - 1. C31, Making and Curing Concrete Test Specimens in the Field.
 - 2. C33, Concrete Aggregates.
 - 3. C39, Compressive Strength of Cylindrical Concrete Specimens.
 - 4. C94, Ready Mixed Concrete.
 - 5. C143, Test Method for Slump of Portland Cement Concrete.
 - 6. C150, Portland Cement.
 - 7. C171, Sheet Materials for Curing Concrete.
 - 8. C172, Sampling Freshly Mixed Concrete.
 - 9. C231, Air Content of Freshly Mixed Concrete by the Pressure Method.
 - 10. C260, Air Entraining Admixtures for Concrete.
 - 11. C309, Liquid Membrane Forming Compounds for Curing Concrete.
 - 12. C494, Chemical Admixtures for Concrete.
 - 13. C618, Fly Ash and Raw or Calcinated Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

1.5 DEFINITIONS

A. Concealed: For Work required under this Section, the term "concealed" will mean "not exposed to view in finished construction."

B. Exposed: For Work required under this Section, the term "exposed" will mean "exposed to view in finished construction."

1.6 SUBMITTALS

- A. Submit: Provide electronic (PDF) copies of all required submittal information.
 - 1. Concrete mix designs. Follow ACI 301. Submit a mix design for each class of concrete required within 30 days after Contract date and prior to placing any concrete.
 - 2. Product data including installation requirements for curing/sealer compounds, mineral and chemical admixtures and joint devices.
 - 3. Concrete delivery tickets.
 - a. Submit to Owner's Engineer at Site.
 - b. Follow ASTM C94. Also include:
 - 1) Batch number.
 - 2) Mix by class of concrete and bag content with maximum aggregate size used
 - 3) Air content.
 - 4) Quantities and types of admixtures.
 - 5) Slump.
 - 6) Time of loading.
 - c. Delivery tickets not showing time of loading will be grounds for rejection of load.
 - 4. Testing laboratory reports.
 - a. Submit directly to Owner's Engineer, Contractor and ready-mix supplier.
 - 5. Certification or test results indicating compliance of material or source of material with these specifications (upon request).

1.7 QUALITY ASSURANCE

- A. Maintain 1 copy of each referenced document at Site.
- B. Acquire cement and aggregate from same source for all Work.
- C. Tolerances: Place and finish cast-in-place concrete within tolerance limits specified in ACI 301 and as follows:
 - 1. Formed Surfaces: Follow ACI 301 (Table 4.3.1.)
- D. Acceptance of Work: Presence or evidence of nonconforming Work shall be sufficient cause for Owner's Engineer to require entire section of concrete affected be torn out and rebuilt properly at Contractor's expense.
 - 1. Such unacceptable Work includes:
 - a. Horizontal or vertical misalignment.
 - b. Cracking.
 - c. Honeycombing.
 - d. Spalling.
 - e. Embedded debris.

- 2. If by tests or on-site observation, Owner's Engineer determines that any of Contract requirements have not been fully met in completion of this Work, he may require additional testing or retesting to determine composition, soundness and actual structural capacity of any concrete.
- 3. Costs for such testing shall be paid by Contractor if such tests subsequently establish that Work is unacceptable and by Owner if Work is found to be acceptable.
- 4. Remove and replace all unacceptable Work including related Work which was acceptable but which must be disturbed as a result of replacement if such tests establish that Work is unacceptable with regard to compliance with these specifications.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Concrete Delivery: Follow ACI 304 and ASTM C94.
- B. Deliver packaged materials in manufacturer's unopened, labeled containers.
- C. Store materials to provide protection from weather and damage.
- D. Deliver concrete in agitating or revolving type equipment. DO NOT USE NON-AGITATING EQUIPMENT.
- E. Discharge concrete at Site within 1-1/2 hours or 300 revolutions, whichever comes first, after water has been added to cement and aggregates or cement batches with aggregates unless a longer time is specifically authorized by Owner's Engineer.
- F. Owner's Engineer may require a reduction in this elapsed time during hot weather, when high early strength cement is being used or under other conditions contributing to quick stiffening of concrete.

1.9 PROJECT CONDITIONS

- A. Coordinate Work of other trades who will furnish and install items of Work (sleeves, piping, conduit, inserts, etc.) to be cast in concrete. Place no concrete until such items are in place.
- B. Place concrete at ambient temperatures between 50°F and 95°F.
- C. Follow instructions for special procedures at end of this Section should it be necessary to place concrete in colder or hotter weather.
- D. Protect freshly placed concrete from rainfall, water leaks, falling objects, traffic of any kind and other hazards to surfaces. Provide barricades and lights if necessary.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portland Cement:
 - 1. ASTM C150 Type II (Moderate).
 - 2. Cement shall be free of false set when tested following ASTM C451.
 - 3. Use same brand, type and source throughout.
- B. Aggregates:
 - 1. Fine Aggregate: ASTM C33; natural or manufactured sand, clean, hard and durable, uncoated grains, free from deleterious matter. Average fineness modulus shall be between 2.5 and 3.0.
 - 2. Coarse Aggregate: ACI 301 and ASTM C33.
- a. Interior and Concealed Exterior Applications: Crushed gravel or stone, durable uncoated particles free from deleterious matter.
- b. Exposed Exterior Applications: Crushed dolomite, granite or limestone.
- c. Grading: ASTM C33 No. 57. Exception: Use grade size No. 8 masonry core fill.
- C. Admixtures:
 - 1. Mineral Admixtures:
 - a. Fly Ash: ASTM C618 Class C or Class F; maximum 25% fly ash may be used as a cement substitute; maximum 6% loss on ignition.
 - b. Fly ash source must be approved by Owner's Engineer. Preapproved sources are:
 - 1) Class C: Boral Manufacturing
 - 2. Chemical Admixtures:
 - a. Air Entraining Admixtures: ASTM C260.
 - b. Water Reducing Admixtures: ASTM C494 Type A (Water Reducing).
 - Type E (Water Reducing and Accelerating) may be used during cold weather and Type D (Water Reducing and Retarding) during hot weather with Engineer's prior approval.
 - 2) Type F (Water Reducing High Range) or Type G (Water Reducing High Range and Retarding) admixtures (superplasticizers) may used be used with Engineer's prior approval.
 - c. Calcium chloride, thiocyanates, corrosive admixtures or admixtures containing more than 0.05% chloride ions (total) are not permitted.
 - 3. DO NOT USE ANY OTHER ADMIXTURES WITHOUT AEPSC'S PRIOR WRITTEN APPROVAL.
- D. Water: Potable; free from objectionable quantities of foreign materials harmful to concrete such as silt, organic matter, acids, alkali, salt and other deleterious substances.
- E. Vapor Retarders: Clear or black fungus resistant polyethylene or fabric reinforced plastic film recommended for below grade application; 10 mil thick. The vapor retarder should be installed according to ASTM E1643, "Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs."
- F. Expansion Joint Filler Strips: ASTM D1751 non-extruding and resilient type, asphalt impregnated fiberboard or felt or ASTM D1752 closed cell foam with resiliency recovery of 95% if not compressed more than 50% of original thickness; 3/8" thick for interior and 1/2" thick for exterior unless shown otherwise.
- G. Liquid Curing/Sealer Compound (Typical): ASTM C309 Type 1; approved by Asphalt and Vinyl Composition Tile Institute; 30% minimum solids content.
- H. Sheet Curing Membranes: ASTM C171; absorptive mats, waterproof paper or polyethylene film.

2.2 CONCRETE MIXES

- A. General Requirements:
 - 1. Concrete Mixing: Follow ASTM C94. BATCH MIXING OF CONCRETE ON SITE IS NOT PERMITTED EXCEPT FOR MISCELLANEOUS MIXES.
 - 2. Mixing Procedures: Follow ACI 301.
 - 3. Handling and Weighing: Follow ACI 304.

- 4. Measure water, air entraining admixtures and water reducing admixtures by weight or volume. Measure all other materials by weight.
- 5. Provide admixtures for entrainment in concrete Work subject to vehicle abrasion or freeze thaw cycles either during construction or afterwards. AIR ENTRAINED CEMENT IS NOT ACCEPTABLE.
- 6. Provide water reducing admixtures in all Classes of concrete Work.
- 7. No dry-packaged mixtures are allowed.
- 8. Provide fly ash as supplementary cementitious material in concrete Work. Fly ash content shall not exceed 25% of the cementitious material weight within a concrete batch.
- 9. Exposed concrete is to meet requirements for potentially destructive exposure.
- 10. Admixtures are to be added at batch plant.
- 11. Do not add water to mix on job unless previously approved by Owner's Engineer. Note amount of water added on delivery ticket.
- 12. Nominal maximum allowable slump of concrete (except for controlled density fill) is 4".
- 13. Follow Exhibit 03 30 00 for water/cementitious ratio of concrete.
- 14. Provide minimum 3 day compressive strength of 1800 psi for concrete used for floors.
- B. Concrete Properties and Proportions:
 - 1. Provide concrete meeting the following properties and performance specifications

F'c	3,000 psi (28-day compressive strength)
Portland Cement	ASTM C 150 Type II
Fly Ash	ASTM C 618 Class C (Maximum of 25% of cementitous material)
Water/Cementitious	0.60 Maximum
Material Ratio	
Slump	5" (+/- 1") measured from the discharge of the truck
Coarse Aggregate	1" maximum with gradation requirements prescribed in Table 2 of ASTM C33 Size No. 57
Air Entrainment	Air entrainment shall not be used for concrete with exposed steel troweled surfaces
Total Air Content	3% Maximum (by volume)
Concrete Temperature	95⁰F Maximum

a. <u>Cast-In-Place Concrete (Class 1)</u>

b. Drilled Pier Concrete (Class 2)

F'c	4,000 psi (28-day compressive strength)
Portland Cement	ASTM C 150 Type II
Fly Ash	ASTM C 618 Class C (Maximum of 25% of cementitous material)
Water/Cementitious	0.60 Maximum
Material Ratio	
Slump	7" (+/- 1") measured from the discharge of the truck
Coarse Aggregate	1" maximum with gradation requirements prescribed in Table 2 of ASTM C33 Size No. 57
Air Entrainment	Air entrainment shall not be used for concrete with exposed steel troweled surfaces
Total Air Content	3% Maximum (by volume)
Concrete Temperature	95°F Maximum

c. Masonry Grout Fill (Class 3)

F'c	3,000 psi (28-day compressive strength)
Portland Cement	ASTM C 150 Type II
Fly Ash	ASTM C 618 Class C (Maximum of 25% of cementitous material)
Slump	8" to 11" measured from the discharge of the truck
Coarse Aggregate	3/8" maximum with gradation requirements prescribed in Table 2 of ASTM C33 Size No. 8

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Site conditions and excavations for earth forms to verify that they are neatly and accurately cut and correctly located.
- B. Examine formwork to verify that it is sound and correctly located, that conditions are proper for concrete installation and that excavations are sufficient to permit placement, inspection and removal of forms.
- C. Examine reinforcement to verify requirements for concrete cover.
- D. Examine areas of Work to be cast to determine that substrates are properly installed, required reinforcement, inserts and embedded items are in place and that correct finish top of cast elevations can be obtained.
 - 1. Verify that conduit and piping is installed below slab. NO UTILITIES ARE TO BE BUILT INTO SLAB OR TOPPING.
 - 2. Verify depths of depressed conditions are correct for specified delayed finishes. Slabs to receive finishes over 1/8" in thickness shall be depressed as required to allow for alignment with adjacent finish materials.
 - 3. Verify base and sub-base slope correctly at floor drains. Slab thickness shall be maintained in sloped areas.
- E. Do not start Work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Ensure availability of sufficient labor, equipment and materials to place concrete correctly following Project requirements and scheduled casting.
- B. Notify Owner's Engineer at least 48 hours in advance of placing any concrete. Place concrete only when Owner's Engineer is present unless this requirement is specifically waived. Excavations must be inspected and approved by soils engineer.
- C. Place no concrete before embedded items are in place and before forms, reinforcing and affected Work of other trades have been examined.
 - 1. Coordinate placement of joint devices with erection of formwork and placement of form accessories.
- D. Drill holes in previously poured concrete, insert steel dowels and pack solid with non-shrink grout in locations where new concrete is dowelled to existing Work including at bases and pads.
- E. Immediately Before Placing Concrete:
 - 1. Clean debris from forms, decks, base slabs, bottoms of forms, etc. to receive concrete.
 - 2. Thoroughly wet base of slabs poured directly on earth, sand, stone, concrete or gravel.
 - 3. Verify sizes and locations of openings required.
 - 4. Secure approval of conditions from Owner's Engineer. Allow a minimum of 1 hour for Owner's Engineer's inspection after installation of reinforcing and before placing concrete.

3.3 ERECTION / INSTALLATION / APPLICATION

A. Follow ACI 301.

- B. Place concrete only when Owner's Engineer is present unless this requirement is specifically waived by Owner's Engineer upon notice of scheduled pour.
- C. Notify Owner's Engineer not less than 48 hours (excluding holidays and weekends) in advance of placing concrete.
- D. Provide concrete of following various classes unless shown otherwise.
 - 1. Class 1: Cast-In-Place Concrete
 - 2. Class 2: Drilled Pier Concrete
 - 3. Class 3: Masonry Grout Fill
- E. Provide uniform slope at rate shown on structural foundation plans. Exterior walkways shall slope as indicated on Architectural plans.
- F. Install vapor retarder under interior and exterior slabs, walks, bases and pads on grade.
 - 1. Lay film directly on slab base just before setting reinforcing and pouring concrete slabs. Provide widest widths practical and oriented to obtain least lineal footage of joint.
 - 2. Lap and seal joints. Lap film a minimum of 6" at joints with top lap placed in direction of spreading of concrete. Seal joints watertight by taping or applying sealant at overlapping edges and ends.
 - 3. Carry film up walls, columns, etc. and secure in place with cement or tape. Fold and cement corners or otherwise make vaporproof.
 - 4. Provide sealed contact with piping and other penetrating items. Cut film carefully around opening for pipes, ducts, conduit, wiring, etc. Tape film to insure maximum barrier effectiveness.
 - 5. Exercise care so that film is not punctured. Seal joints, cuts, punctures, etc. with tape, cement or hot iron.
 - 6. Trim exposed film at floor line after concrete has cured and hardened.
 - 7. Repair vapor retarder damaged during placement of concrete reinforcing.
- G. Provide sufficient workmen to allow for placement of concrete and other operations within time limits required in Article 1.07 herein.
- H. Keep delivery carts and buggies on runways. Do not allow them to bear on reinforcing or uncured concrete.
- I. Deposit concrete within 6 feet of its final location to avoid segregation due to rehandling or flowing. Do not drop concrete freely where reinforcing will cause segregation. Chuting procedure is subject to approval of Owner's Engineer. Maximum allowable drop is 5 feet. SPREADING WITH VIBRATORS IS PROHIBITED.
- J. Place concrete quickly and vibrate thoroughly with a vibratory screed or other device approved by Owner's Engineer. Maintain specified position of mesh and reinforcement. Follow ACI 309 for use and type of vibrators.
- K. Deposit concrete continuously, or when continuous placement is not possible, provide construction joints at locations approved by Owner's Engineer.
- L. Do not deposit partially set concrete, retempered concrete or any concrete failing slump or air content tests.
- M. Consolidate concrete by internal vibration to maximum practical density so that it is free from pockets of coarse aggregate and trapped air, fits tightly against subgrades, forms and embedded items and leaves smooth, dense surfaces.
- N. Operate vibrators using experienced workers and where possible use same operators throughout Project. DO NOT USE VIBRATORS AGAINST FORMS OR REINFORCEMENT.
- O. Finishes: Follow ACI 301 (Chapter 11). Perform finishing using only experienced, skilled workers.
 - 1. Flatwork:

- a. Slab finish shall be as noted on structural foundation plans. Reference structural general notes for flatness requirements pertaining to surface finish.
- b. Detectable Warning Finish: For exterior handicapped curb cuts (ramp only not on flared sides), textured or imprinted concrete using rollers or aluminum tools to produce 0.9" diameter x 0.2" high (nominal) truncated domes at 2.35" on center following requirements of Americans With Disabilities Act (ADA).
- 2. Vertical and Miscellaneous Work:
 - a. Exposed Surfaces: Smooth, Do Not Rub Cement Paste on Exposed Concrete Surfaces.
 - b. Concealed Surfaces: Rough form finish.
- P. Control (Contraction) Joints:
 - 1. General Requirements:
 - a. Provide joints in walks, pads, slabs and toppings shown or specified.
 - b. Make joints approximately 1/8" wide and minimum depth of 1/4 slab thickness.
 - c. Locate as shown or as follows if not shown. Verify final locations with Owner's Engineer before proceeding.
 - 2. Interior Locations:
 - a. Provide sawed control joints where shown or at maximum 20 feet on center in each direction in slabs and toppings if not shown.
 - b. Install sawed joints immediately after final finishing to depth of 1/4 slab thickness with Soff-Cut saw.
 - c. Saw control joints 1/8" wide unless otherwise approved. A construction joint may be located where sawed joint is required.
- Q. Curing and Protection: Follow ACI 308.
 - 1. Prevent excessive moisture loss from formed surfaces. Cure formed surfaces by moist-curing or application of curing compound for remainder of curing period if forms are removed before 7 days have elapsed.
 - 2. Provide 1 application of liquid curing/sealer compound immediately after finishing of concrete on interior and exterior concrete slabs.
 - a. Exception #1: Floors scheduled to receive ceramic tile and quarry tile shall be sheet membrane/water (moist) cured for minimum of 10 days.
 - 1) Begin water curing as soon as concrete has hardened sufficiently to prevent damage from water or cover material.
 - 2) Water curing shall consist of ponding or with sprinkling, spraying or covering with wet burlap, sand or waterproof barrier such as polyethylene or building paper.
 - 3) Maintain 100% coverage continuously over water cured slabs for minimum of 4 days for ponding and for 7 days for spraying and membrane curing.

3.4 FIELD QUALITY CONTROL

- A. Test and inspect materials and operations as Work progresses. Failure to detect defective Work shall not prevent rejection when defect is discovered nor shall it obligate Owner for final acceptance.
- B. Costs for any retesting resulting from Work found to be in non-compliance shall be paid for by Contractor.
- C. Strength: ASTM C31, C39 and C172.
 - 1. Conduct strength tests of all classes of concrete (except miscellaneous mixes).

- Secure composite samples following ASTM C172. For strength tests, a sample shall be obtained from same batch of concrete on a representative, random basis. A sample consists of six specimens.
- 3. Mold and cure each sample following ASTM C31.
- 4. Test 1 specimen at 7 days, test 2 specimens at 28 days and 1 specimen at 56 days following ASTM C39. Results shall be average of strengths of 2 specimens, except that if 1 specimen in a test manifests evidence of improper sampling, molding or testing, it shall be discarded.
- 5. Record exact location of Work represented by each sample on test reports.
- 6. Provide a sample for each amount or fraction thereof of each class of concrete placed each day as follows:
 - a. 0-100 Cubic Yards: 1 Sampling of 4 Cylinders.
- D. Air Content: ASTM C231.
- E. Slump: ASTM C143.

3.5 ADJUSTING AND CLEANING

- A. Provide materials, methods and finishes for cleaning, patching and other repairs consistent with similar concrete Work in place, approved by Owner's Engineer before beginning repair Work and performed at Contractor's expense.
- B. Repair any slabs which do not meet finish requirements performing all grinding, filling of cracks or patching and leveling procedures as required. Replace slabs which cannot be successfully repaired.
- C. Point carefully around piping, conduit and other penetrations on both interior and exterior surfaces.
- D. Obtain Owner's Engineer prior approval of any corrective measures for slabs which are dusting or showing other signs of improper curing. These may include additional applications of sealer or hardener, grinding or covering with coating or topping.
- E. Remove from interior and exterior exposed surfaces any stain-producing elements such as pyrites, nails, wire, reinforcing steel and form ties immediately prior to final acceptance.
- F. Remove stains completely. Use of weak acids or patented cleaners is acceptable but surface is to be completely neutralized after use.
- G. Blend in surfaces of exposed repairs inconspicuously with surrounding surfaces.

3.6 PROTECTION

A. Protect newly placed concrete from weather and construction traffic damage.

3.7 SPECIAL PROCEDURES

- A. It is Project intent to continue concrete Work required to keep Project on schedule throughout summer and winter.
- B. Hot Weather Concreting:
 - 1. Follow ACI 305R.
 - 2. Obtain approval to use a retarder in concrete.
 - 3. Temperature of concrete shall not exceed 95°F.
 - 4. Cool water and aggregate to lower temperature of concrete.
 - 5. Cool subgrade and forms by sprinklering with water immediately before placing.

- Schedule trucks to reduce waiting time at Site. Cure immediately after finishing. 6.
- 7.
- Replace any concrete injured or destroyed by reason of freezing, hot or cold weather at Contractor's own expense including cost of replacing any Work embedded in concrete. C.

END OF SECTION 033000

SECTION 042200 - CONCRETE MASONRY UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete masonry units, lintels, mortar and other related accessories.

1.2 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Reinforcing steel.
- B. Masonry accessories.

1.3 RELATED SECTIONS

- A. Section 032000 Concrete Reinforcement
- B. Section 033000 Cast-In-Place Concrete

1.4 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 530, Building Code Requirements for Masonry Structures.
 - 2. 530.1, Specifications for Masonry Structures.
- B. American Society for Testing and Materials (ASTM):
 - 1. C33, Concrete Aggregates.
 - 2. C90, Load-Bearing Concrete Masonry Units.
 - 3. C140, Methods of Testing Concrete Masonry Units.
 - 4. C150, Portland Cement.
 - 5. C331, Lightweight Aggregates for Concrete Masonry Units.
 - 6. C618, Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
- C. Portland Cement Association (PCA): Recommended Practices For Laying Concrete Block.

1.5 DEFINITIONS

- A. Concealed: For Work required under this Section, the term "concealed" will mean "not exposed to view in finished construction."
- B. Exposed: For Work required under this Section, the term "exposed" will mean "exposed to view in finished construction."

1.6 SUBMITTALS

A. Submit: Provide electronic (PDF) copies of all required submittal information.

- Provide independent test reports following ASTM C140 for sampling and testing of CMU. Test reports shall be dated within six months of start of project. Test reports shall include net area compressive strength, absorption and density results, average width, height and length of each unit, minimum face shell thickness, average face shell thickness, minimum web thickness, average web thickness, and all other test reporting requirements as noted in ASTM C140.
- 2. Color samples for precolored units.
- 3. Masonry unit assembly components such as horizontal wire reinforcement, control joint material and masonry veneer ties.

1.7 QUALITY ASSURANCE

- A. Follow ACI 530 and 530.1.
- B. Maintain 1 copy of each referenced document at Site.
- C. Manufacturer: Current NCMA member.
- D. Provide units from single manufacturing source to ensure uniform texture for continuous and visually related areas.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver to Site only units properly cured and following these specifications.
- B. Protect masonry units from damage and against moisture and weather, particularly against freezing and thawing. Maintain hollow concrete masonry units in their initial dry state until after they are laid up in wall.
- C. Stack masonry units in dry place, off ground on prepared plank platform and in manner to promote circulation of air through and around block. Protect stacked block by shed roof or tarpaulin arranged to allow for circulation of air around and above stacked block.
- D. Carefully handle masonry units. Do not build units into Work with chipped edges, spalls or other damage to their appearance which would show in finished wall.
- E. Do not store adjacent to materials which can cause staining or discoloration.

1.9 PROJECT CONDITIONS

- A. Do not erect masonry when, in Owner's Engineer's opinion, atmospheric conditions or limited facilities prevent proper setting, bonding and curing.
- B. Protect tops of masonry walls against weather. Use strong, non-staining waterproof membrane secured with metal masonry wall clamps or properly weighted down. Maintain this protection during construction of walls and after their completion, properly anchored, repaired and replaced until tops of walls are covered by Work of others.
- C. Leave necessary openings for passage of pipes, drains, ducts, wires and utility lines. Form chases shown, required or directed. Return and solidly close all openings at completion of Work of other trades. Remove rubbish and sweep out area before closing up any pipe chase, duct space or similar limited access or inaccessible area.
- D. Coordinate with other trades and make provisions that will permit installation of their Work in manner to avoid cutting and patching. Build in items furnished by other trades as Work progresses.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portland Cement: ASTM C150 Type 1.
- B. Lime: ASTM C207 Type S.
- C. Pozzolans: ASTM C618.
- D. Aggregates: ASTM D33 normal weight or ASTM C331 lightweight. Provide either normal, medium or light weight units unless shown otherwise.
- E. Mortar: Type S, following ASTM C270 Unit Proportion Requirements using preblended masonry cement.
- F. Integral Water Repellent: ASTM E514 Class E.
 - 1. Approved Product: Grace Construction Products' "Dry-Block" admixture.
- G. Integral Color: Integral color pigment mixed with cement and aggregates during fabrication to match local licensee's color selection(s).

2.2 CONCRETE BLOCK

A. Hollow Units: ASTM C90 Type I; 1900 psi minimum compressive strength (net).

2.3 FABRICATION:

- A. Follow ACI and NCMA.
- B. Provide the following finishes and colors:
 - 1. Exterior Concrete Block: Manufacturer's regular (smooth) molded finish and precolored during fabrication.
- C. Provide integral water repellent in all exterior concrete block and exterior split face block units.
- D. Provide concrete masonry units with modular dimension; standard units 7-5/8" high, 1'-3-5/8" long and 3/8" less nominal widths or thicknesses shown or required, with permissible variation of 1/16".
- E. Provide special units for 90° corners, bond beams, bullnosed corners, control joint fillers, etc. shown or required.
- F. Cure units minimum 14 days in presence of moist air following ASTM C426.
 - 1. Provide block properly cured to 30% of maximum absorption. Questionable block will be tested and shipment rejected if average moisture content is found to exceed specification limits.
 - 2. Do not build in block with moisture content exceeding specification requirements into Work. Dry block containing excess moisture to acceptable maximum either by further air drying or use of heat before being used.
 - 3. No extension of time for completion will be allowed due to delay cause by failure of Contractor to maintain stored block at acceptable moisture content.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive Work.
- B. Inspect materials for defects before starting installation.
- C. Reject any chipped or broken block. DO NOT BUILD DAMAGED UNITS INTO WORK.

3.2 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied to other sections.
- B. Provide temporary bracing during installation of masonry Work. Maintain in place until building structure provides permanent bracing.

3.3 ERECTION / INSTALLATION / APPLICATION

- A. Follow ACI and NCMA.
- B. See Sections under which materials to be installed are furnished for additional installation requirements.
- C. Use thoroughly dry concrete block with sharp, square, unbroken corners and edges and no cracks. DO NOT WET MASONRY UNITS.
- D. Take special care in handling and storage of units for exposed block Work. Do not install chipped or marred block where exposed.
- E. Lay block in running bond with each course lapping block below by 1/2 block unless shown otherwise.
- F. Lay solid block units with full mortar coverage on head and bed joints and hollow block units with face shell bedding on head and bed joints. Mortar hollow block unit web joints in load bearing piers or pilasters, in starting course on footings or solid foundation walls and next to cores grouted solid.
 - 1. Do not shift or tap masonry after mortar has achieved initial set. Remove mortar and replace where adjustments must be made.
 - 2. Buttering corners of joints or excessive furring of mortar joints are not permitted.
- G. Build walls and partitions true to dimension, plumb and square, laid to line in level courses, accurately spaced and coordinated with other Work. Keep individual face units "in plane" with walls rising together. Use double lines in multiple-tier walls with each tier plumb and all units "in plane."
- H. Lay out Work to avoid fractional pieces. Interlock external corners. Set partitions on structural floor slabs before finish floor is laid unless shown otherwise.
- I. Perform required cutting with power equipment which will produce true, straight, clean edges free of chipping and undamaged surfaces. CUTTING WITH HAMMER AND CHISEL WILL NOT BE PERMITTED. Use 100% solid block where webs would be exposed. Minimum length of cut units on exposed Work shall be 1/2 unit.
- J. Cut units accurately to fit around pipes, ducts, openings, structural framing, etc. and slush voids full.

- K. Take particular care to embed conduits and pipes within block without fracturing exposed shells and to fit units around switch, receptacle and other boxes set in walls. Grind and cut units before building in service where electric conduit, outlets, switch boxes and similar items occur.
- L. Fill voids and joints between block and different types of materials with mortar.
- M. Make joints approx. 3/8" wide. Line up joints vertically. Remove burrs with burlap or carpet after tooling.
- N. Neatly tool interior and exterior joints below grade and in exposed masonry firm to slightly concave profile when mortar is thumbprint hard unless shown otherwise. Cut off flush and brush off surplus as Work progresses. Tool vertically then horizontally. Furnish all masons with joint tools of same diameter. Exception: Strike flush interior concealed joints (such as in chases and plenums) or those covered with directly applied finish materials.
- O. Install vertical and horizontal masonry reinforcing where shown. Grout cores solid full length of reinforcing with masonry core grout specified in Section 03300. Maintain position of reinforcing within 1/2" of dimensioned position.
- P. Fill voids receiving anchor bolts, wedge anchors, expansion bolts, etc. solid with masonry grout specified under Section 03300.
- Q. Provide solid masonry bearing surface under lintels, beams, bearing plates, etc. as shown. Provide the following minimum solid bearing (as applicable) if not shown:
 - 1. Lintels: Solid masonry bearing for full thickness of wall by length of bearing plus 8" by 8" high.
 - 2. Beams: Solid masonry bearing for full thickness of wall by length of bearing plus 1'-4" by 2 ft high.
- R. Provide solid masonry for course directly below corbelled masonry walls. Max corbel for each course is 1".
- S. Provide closure, lintels, bond beams, jamb units, sash, corners headers and other special shapes shown or required. Provide standard manufactured sizes or cut full size block for fractional course heights and lengths. Provide sash blocks or other shapes designed to receive specified control joint filler strips.
- T. Provide bullnosed units at exterior corners unless shown otherwise. Field grind to Owner's Engineer's satisfaction all external corners not installed bullnosed.
 - 1. Exception: Provide square cornered blocks at window jambs.
- U. Step back unfinished Work for joining with new Work. Toothing will not be permitted unless specifically approved by Owner's Engineer. Remove loose masonry and mortar and clean thoroughly before new Work is started.
- V. Build in chases, openings, reinforcement, anchors, access doors, lintels, flashings and other items required. Provide centering required to properly support masonry until mortar attains design strength. Build in sleeves except where shown to be installed in other Sections.
- W. Build hollow metal door frames into wall. Plumb and brace. Thoroughly embed frame anchors. Slush frame jambs full with mortar. Allow 1/4" for caulking around frame in exterior walls and 1/8" on interior unless shown otherwise. Rake out joints for caulking.
- X. Fill masonry units solid with mortar 2 cores wide at each door jamb and 1 core wide at each window jamb for full height of opening.
- Y. Hold block down approximately 2" below roof structural members such as beams, joists and roof deck subject to deflection at non-bearing walls.
- Z. Provide control and expansion joints in all block Work. Reference Architectural Contract Drawings for masonry joint locations. Joints spacing shall not exceed 22 ft. on center nor shall a joint be located within two feet of an opening.

- AA. Build in control joint filler strips in control joints as masonry is laid up allowing for caulking on each side of wall. Reference architectural for caulking material. Exception: Do not carry horizontal joint reinforcement through control or expansion joints.
- BB. Maintain lateral support of intersecting masonry non- load bearing walls with wire mesh ties placed across joint between walls and spaced 1'-4" on center vertically.
- CC. Install concealed masonry flashing where shown. Provide clean smooth surfaces set in full mortar bed and cover with full mortar bed. Seal penetrations and joints with mastic.
- DD. Build in exposed sheet metal flashing, expansion joints and reglets occurring in masonry. Cut out mortar joint and set flashing or reglet in new mortar bed in existing construction.
- EE. Build in bond beams grouting full and carefully position reinforcing where shown. Lap rebars a minimum length of 48 bar diameters. Field modify standard units required to receive required reinforcing where bond beam units are not available in specified finish.
- FF. Any masonry Work found deficient in respect to these specifications will require entire wall to be removed and relayed at Contractor's expense.

3.4 TOLERANCES

- A. Maximum Variation From Unit to Adjacent Unit: 1/32".
- B. Maximum Variation From Plane of Wall: 1/4" in 10 feet and 1/2" in 20 feet or more.
- C. Maximum Variation From Plumb: 1/4" per story non-cumulative; 1/2" in 2 stories or more.
- D. Maximum Variation From Level Coursing: 1/8" in 3 feet, 1/4" in 10 feet and 1/2" in 30 feet.
- E. Maximum Variation From Joint Thickness: 1/8" in 3 feet.
- F. Maximum Variation From Cross Sectional Thickness of Walls: 1/4".

3.5 ADJUSTING AND CLEANING

- A. Replace any masonry units which are loose or damaged and repair defective mortar joints. Make these repairs such that evidence of repair is not apparent.
- B. Remove surplus mortar, drippings, splatter, etc. from exterior and interior masonry as Work progresses.
- C. Clean, point & dry brush all exposed Work at end of each working day. Fill holes from line pins and nails.
- D. Point joints to provide a neat uniform appearance. Cut out unrepairable defective joints. Fill solidly with mortar and tool to match adjacent Work. DO NOT CORRECT IMPERFECTIONS WITH SPACKLE.
- E. Thoroughly rub out exposed Work to remove any projections. Fill indentations flush with surface.
- F. Clean masonry surfaces upon completion from top down with water and fiber brushes to remove stains. ACID CLEANING OF MASONRY IS NOT PERMITTED.

END OF SECTION 042200

SECTION 050400 - HOT-DIP GALVANIZING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Hot-dip galvanizing of iron and steel materials

1.2 RELATED WORK

A. Steel materials, fabrications and assemblies are specified to be furnished and installed in various other sections

1.3 REFERENCES

- A. Publications
 - 1. American Galvanizers Association (AGA):
 - a. Inspection of Products Hot-dip Galvanized After Fabrication
 - b. The Design of Products to be Hot-dip Galvanized After Fabrication
 - c. Recommended Details of Galvanized Structures
 - d. Quality Assurance Manual
 - 2. Research Council on Structural Connections of the Engineering Foundation:
 - a. Specification for Structural Joints Using ASTM A 325 or A 490 bolts.
- B. Reference standards
 - 1. American Society for Testing and Materials (ASTM):
 - a. A 123 / A 123M Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
 - b. A 143 Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement
 - c. A 153 / A 153M Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - d. A 384 Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies
 - e. A 385 Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
 - f. A 767 / A 767M Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
 - g. A 780 Repair of Damaged Hot-Dip Galvanized Coatings
 - h. B 6 Specification for Zinc
 - i. D 6386 Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting
 - j. E 376 Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Test Methods
 - 2. Federal specifications
 - a. DOD-P-21035 Paint, High Zinc Dust Content, Galvanizing Repair
 - b. MIL-P-26915 Primer Coating, Zinc Dust Pigmented

1.4 QUALITY ASSURANCE

- A. Coating applicator: Company specializing in hot-dip galvanizing after fabrication and following the procedures in the Quality Assurance Manual of the American Galvanizers Association.
- B. Coordination Between Fabricator and Galvanizer: Prior to fabrication, fabricators shall submit approved fabrication shop drawings to the galvanizer. The Galvanizer shall review fabricator's shop drawings for suitability of materials for galvanizing and coatings and coordinate any required fabrication modifications.
- C. Materials: For steel to be hot-dip galvanized, provide steel chemically suitable for metal coatings complying with the following requirements: carbon below 0.25%, phosphorous below 0.04%, manganese below 1.3%, and silicon below 0.04%. Notify the galvanizer if steel does not meet these requirements so that suitability for galvanizing may be determined and whether special processing techniques are required.

1.5 DELIVERY, STORAGE & HANDLING

A. Load and store galvanized articles in accordance with accepted industry standards.

PART 2 – PRODUCTS

2.1 ACCEPTABLE COATING APPLICATORS

A. Members of the AGA or equal approved by the architect and/or engineer.

2.2 STEEL MATERIALS

- A. Material for galvanizing to be geometrically suitable for galvanizing as described in ASTM A 384 and A 385. Steel materials suitable for galvanizing include structural shapes, pipe, sheet, fabrications and assemblies.
- B. Recommended steel materials for hot-dip galvanizing include but are not limited to:
 - 1. Structural shapes and plates: ASTM A 36, A 242 type 2, A 283, A 441, A 500, A 501, A 529, A 572, A 588 and A 992.
 - 2. Steel for fasteners:

General Category	Bolt Material	Nut Material
Carbon Steel	A 307 Gr A or B	A 563 Gr A
High-strength	A 325 Type 1	A 563 Gr DH
Tower Bolts	A 394	A 563 Gr A
Quenched & Tempered (Carbon Steel Bolts)	A 499	A 563 Gr C
Quenched & Tempered (Alloy Steel Bolts)	A 354 Gr BC	A 563 Gr DH

- 3. Steel for sheet metal articles: ASTM A 569 or A 570.
- 4. Steel for pipe or tubing: ASTM A 53, A 120 or A 595, Gr A or B.

2.3 FABRICATION REQUIREMENTS

A. Fabricate structural steel in accordance with Class I, II, III guidelines as described in AGA's Recommended Details for Galvanized Structures.

- B. Fabrication practices for products to be in accordance with the applicable portions of ASTM A 143, A 384, and A 385, except as specified herein. Avoid fabrication techniques that could cause steel distortion or embrittlement.
- C. The fabricator shall consult with architect/engineer and hot-dip galvanizer regarding potential concerns, including handling issues, during the galvanizing process that may require design modification before fabrication proceeds.
- D. Remove all welding slag, splatter, anti-splatter compounds and burrs prior to delivery for galvanizing.
- E. Provide holes and/or lifting lugs to allow for handling during galvanizing.
- F. Avoid unsuitable marking paints. Consult with the galvanizer about removal of grease, oil, paint and other deleterious material prior to fabrication.
- G. Remove by blast-cleaning, or other methods, surface contaminants and coatings that are not removable by the normal chemical cleaning process in the galvanizing operation.
- H. Whenever possible, slip joints should be used to minimize field welding of material.

PART 3 – EXECUTION

3.1 SURFACE PREPARATION

A. Pre-clean steel work in accordance with accepted methods to produce an acceptable surface for quality hot-dip galvanizing.

3.2 COATING APPLICATION

- A. Galvanize steel members, fabrications and assemblies after fabrication by the hot-dip process in accordance with ASTM A 123 / 123M.
- B. Galvanize bolts, nuts, washers and iron and steel hardware components in accordance with ASTM A 153 / 153M.
- C. Safeguard products against steel embrittlement in conformance with ASTM A 143.
- D. Galvanize reinforcing steel in accordance with ASTM A 767.
- E. Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

3.3 COATING REQUIREMENTS

- A. Conform to paragraph 6.1 of ASTM A 123 / 123M, Table 1 of ASTM A 153 / 153M, or Table 2 of A 767, as appropriate.
- B. Surface Finish: Continuous, adherent, as smooth and evenly distributed as possible and free from any defect detrimental to the stated end use of the coated article.
- C. Adhesion: Withstand normal handling consistent with the nature and thickness of the coating and normal use of the article.

3.4 TESTS

- A. Inspection and testing of hot-dip galvanized coatings shall be done under the guidelines provided in the AGA publication Inspection of Products Hot-dip Galvanized After Fabrication.
- B. Include visual examination and tests in accordance with ASTM A 123 / 123M, A 153 / 153M, or A 767, as applicable, to determine the thickness of the zinc coating on the metal surface.
- C. If requested by owner or architect/engineer, the steel fabricator shall be prepared to furnish notarized Certificate of Compliance with ASTM standards and specifications herein listed. The Certificate must be signed by the galvanizer and contain a detailed description of the material processed. The Certificate shall include information as to the ASTM standard used for the coating.

3.5 REPAIR OF DAMAGED COATING

- A. The maximum area to be repaired is defined in accordance with ASTM A 123 / 123M, Section 6.2, current edition.
 - 1. The maximum area to be repaired in the field shall be determined in advance by mutual agreement between parties.
- B. Repair areas damaged by welding, flame cutting or during handling, transport or erection by one of the approved methods in accordance with ASTM A 780 whenever damage exceeds 3/16" in width. Minimum thickness requirements for the repair are those described in ASTM A 123 / 123M, Section 6.2, current edition.

END OF SECTION 050400

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Structural steel.
 - 2. Architecturally exposed structural steel.
 - 3. Grout.
- B. Related Sections include the following:
 - 1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 5 Section "Steel Deck" for field installation of shear connectors.
 - 3. Reference Architectural specifications for surface preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.
- B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Submit shop drawings of all structural steel members. Provide electronic (PDF) copies of each drawing. Shop drawings shall include fabrication piece drawings and field erection drawings. Structural construction drawings shall not be photocopied and submitted.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned bolted connections.
 - 5. For structural steel connections indicated to comply with design loads, include structural analysis data signed and sealed by a qualified professional engineer responsible for their preparations.
- C. Welding certificates.
- D. Qualification Data: For Installer and fabricator.

- E. Mill Test Reports: Submit mill test reports upon request by project engineer. Mill test reports shall be signed by manufacturers certifying that the following products comply with requirements:
 - 1. Structural steel including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - 3. Direct-tension indicators.
 - 4. Tension-control, high-strength bolt-nut-washer assemblies.
 - 5. Shear stud connectors.
 - 6. Shop primers.
 - 7. Nonshrink grout.
- F. Source quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Erector Qualifications: A qualified erector who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE. In lieu of AISC certification, erector may, at the general contractor's recommendation and request, provide an in-house quality control program indicating compliance with minimum steel erection quality control requirements noted in AISC 360 – 10 "Specification for Structural Steel Buildings", Chapter N, subsection N2.
- B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, under Building QMS Certification Program, Category BU. In lieu of AISC certification, fabricator may, at the general contractor's recommendation and request, provide an in-house quality control program indicating compliance with quality control procedures meeting minimum fabrication requirements noted in AISC 360 – 10 "Specification for Structural Steel Buildings", Chapter N, subsection N2.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- D. Comply with applicable provisions of the following specifications and documents:
 - 1. AISC 303 "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. AISC 360 "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
 - 3. AISC's "Specification for the Design of Steel Hollow Structural Sections."
 - 4. AISC's "Specification for Allowable Stress Design of Single-Angle Members.
 - 5. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- E. Mockups: Build mockups of architecturally exposed structural steel to set quality standards for fabrication and installation.
 - 1. Coordinate finish painting requirements with Division 9 painting Sections.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
 - 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.

2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M, ASTM A 572/A 572M, Grade 50 (345).
- B. Channels, Angles Shapes: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M for general use, and ASTM A 572/A 572M, Grade 50 (345) for metal building built-up plate section members.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 - 1. Weight Class: As indicated on structural drawings.
 - 2. Finish: Primed.
- F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts;
 - 1. Finish: Plain
 - 2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8,) compressiblewasher type.
 - a. Finish: Plain.
- B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head steel structural bolts with splined ends; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.
 - 1. Finish: Plain.
- C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- D. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
 - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 4. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.

- 5. Finish: Plain.
- E. Headed Anchor Rods: ASTM F 1554, Grade 36 straight.
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
 - 4. Finish: Plain.
- F. Threaded Rods: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6).
 - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy hex carbon steel.
 - 2. Washers: ASTM F 436 (ASTM F 436M) hardened and ASTM A 36/A 36M carbon steel.
 - 3. Finish: Plain.
- G. Turnbuckles: ASTM A 108, Grade 1035, cold-finished carbon steel.
- H. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.
- I. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 PRIMER

- A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.
 - 1. SSPC-Paint 25, Type I, zinc oxide, alkyd, linseed oil primer.

2.4 GROUT

- A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- B. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design.
 - 1. Camber structural-steel members where indicated.
 - 2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
 - 3. Mark and match-mark materials for field assembly.
 - 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

- 5. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
- 6. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning"
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 - 3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
 - 2. Surfaces to be field welded.

- 3. Surfaces to be high-strength bolted with slip-critical connections.
- 4. Surfaces to receive sprayed fire-resistive materials.
- 5. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.8 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
 - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - 1. Liquid Penetrant Inspection: ASTM E 165.
 - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3. Ultrasonic Inspection: ASTM E 164.
 - 4. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
 - 1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design".
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of base plate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
 - 4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel and architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

- G. Do not use thermal cutting during erection unless approved by Engineer. Finish thermally cut sections within smoothness limits in AWS D1.1.
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 - 4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances.
 - a. Grind butt welds flush.
 - b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
 - 1. In addition to visual inspection, field welds may be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.
 - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

END OF SECTION 051200

SECTION 061760 - METAL-PLATE-CONNECTED WOOD TRUSSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Wood roof trusses.
 - 2. Wood girder trusses.
 - 3. Wood truss bracing.

1.3 DEFINITIONS

- A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from heavy timber dimension lumber and cut and assembled before delivery to Project site.
- B. TPI: Truss Plate Institute, Inc.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
- D. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 1. NLGA: National Lumber Grades Authority.
 - 2. SPIB: The Southern Pine Inspection Bureau.
 - 3. WCLIB: West Coast Lumber Inspection Bureau.
 - 4. WWPA: Western Wood Products Association.

1.4 PERFORMANCE REQUIREMENTS

- A. A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
 - 1. Design Loads: As indicated on contract structural drawings.
 - 2. Maximum Deflection Under Design Loads:
 - a. Roof Trusses: Vertical deflection of 1/360 of span.

1.5 SUBMITTALS

- A. Provide electronic (PDF) copies of all required submittal information.
- B. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer. Show fabrication and installation details for trusses. Shop drawings shall be submitted as a single PDF, indexed electronic file.
 - 1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
 - 2. Indicate sizes, stress grades, and species of lumber.
 - 3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
 - 4. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
 - 5. Show splice details and bearing details.
 - 6. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.
- D. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- E. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1.6 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with qualitycontrol procedures in TPI 1 for manufacture of connector plates.
 - 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
 - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction.
- C. Source Limitations for Connector Plates: Connector plates shall be fabricated from ASTM A36 steel, all plates shall be connected to wood members using thru fastened bolts.
- D. Comply with applicable requirements and recommendations of the following publications:
 - 1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
 - 2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
 - 3. TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
- E. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."
- F. Forest Certification: Provide metal-plate-connected wood trusses produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations of TPI HIB, "Commentary and Recommendations for Handling, Installing & Bracing Metal Plate Connected Wood Trusses."
 - 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
 - 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
 - 3. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

1.8 COORDINATION

A. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying progress of other trades whose work must follow erection of trusses.

PART 2 - PRODUCTS

2.1 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.

- 2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
- 3. Provide dressed lumber, S4S.
- 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.
- B. Grade and Species: For truss chord and web members, provide dimension lumber of any species, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values according to AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."
- C. Permanent Bracing: Provide wood bracing that complies with truss design.

2.2 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.3 METAL TRUSS ACCESSORIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 2.4 MISCELLANEOUS MATERIALS
 - A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

2.5 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.
- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
 - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- D. Connect truss members by metal connector plates located along center line of wood members and thru bolted flush with all wood members at connection.

PART 3 - EXECUTION

- 3.1 INSTALLATION
 - A. Install wood trusses only after supporting construction is in place and is braced and secured.
 - B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
 - C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses 24 inches o.c. or as indicated; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in truss accessories according to manufacturer's fastening schedules and written instructions.
- H. Securely connect each truss ply required for forming built-up girder trusses.
 - 1. Anchor trusses to girder trusses as indicated.
- I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
 - 1. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.
- J. Install wood trusses within installation tolerances in TPI 1.
- K. Do not cut or remove truss members.
- L. Replace wood trusses that are damaged or do not meet requirements.
 - 1. Do not alter trusses in field.

3.2 REPAIRS AND 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, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- C. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- D. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.
 - 1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

END OF SECTION 061760

SECTION 067300 - COMPOSITE DECKING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Composite Decking

1.2 RELATED SECTIONS

A. Section 061100 - Rough Carpentry

1.3 REFERENCES

- A. ASTM D-7032-04: Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails), ASTM International.
- B. ASTM D-7031-04: Standard Guide for Evaluating Mechanical and Physical Properties of Wood-Plastic Composite Products, ASTM International
- C. ASTM E-84-01: Test Method for Surface Burning Characteristics of Building Materials, ASTM International.
- D. ASTM D 570: Water Absorption of Plastics
- E. ASTM D 1761: Mechanical Fasteners in Wood
- F. ASTM D -1413-99: Test method for Wood Preservatives by Laboratory Soil-block Cultures
- G. ASTM C177: Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

1.4 DESIGN/PERFORMANCE REQUIREMENTS

- A. Structural Performance:
 - 1. Deck: Uniform Live Load 100 pounds per square foot.
 - 2. Tread of Stairs: Concentrated Load: 100 pounds per square foot and 1/8" max deflection with a concentrated load of 300 pounds on area of 4 sq. in.
- B. Fire-Test Response Characteristics per ASTM E-84.

1.5 SUBMITTALS

- A. Product Data Indicate sizes, profiles, surface style, and performance characteristics
- B. Product data for stainless steel deck screws with self-gapping hardware for edge-of-deck concealed fastening system.
- C. Samples: For each product specified, one sample representing actual product color, size, and finish.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products on a flat and level surface. Adjust support blocks accordingly
- B. Support bundles on supplied dunnage.
- C. When stacking bundles, supports should start approximately 8" from each end and be spaced approximately 2ft on center. Supports should line up vertically/perpendicular to the decking product.
- D. Do not stack decking more than 14 bundles.
- E. Keep material covered using the provided bundle cover until time of installation.

1.7 WARRANTY

A. Provide manufactures warranty against rot, decay, splitting, checking, splintering, fungal damage, and termite damage for a period of 25 years for a residential installation and 10 years for a commercial

installation. In addition provide Fade and Stain Warranty against food staining and fading beyond 5 Delta E (CIE units) for a period of 25 years for a residential installation and 10 years for a commercial installation.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Contract Documents are based on products supplied by the Trex Company, Inc., 160 Exeter Dr., Winchester, VA 22603.

2.2 COMPOSITE DECKING

- A. Wood-Plastic Composite Lumber
 - 1. Material Description: Composite Decking consisting of recycled Linear Low Density Polyethylene (LLDPE) and recycled wood. The product is extruded into shapes and sizes as follows:
 - a. Trex Transcend Decking Boards; 2x6 nominal.
 - b. Lengths 12, 16, and 20 feet
 - c. Color To be specified by Owner from Trex' standard list of colors.
 - 2. Physical and Mechanical Properties as follows:

Test	Test Method	Value	
Flame spread	ASTM E 84	60(Transcend) / 85(Enhance)	
Thermal Expansion	ASTM D 1037	1.9 x 10-5 inch/inch/degreeF	
Moisture Absorption	ASTM D 1037	< 1%	
Screw Withdrawal	ASTM D1761	558 lbs/in	
Fungus Resistance	ASTM D1413	Rating - no decay	
Termite Resistance	AWPAE1-72	Rating = 9.6	
		Ultimate (Typical)Values *	Design Values
Compression Parallel	ASTM D198	<u>Ultimate (Typical)Values *</u> 1588 psi	<u>Design Values</u> 540 psi
Compression Parallel Compression Perpendicular	ASTM D198 ASTM D143	Ultimate (Typical)Values * 1588 psi 1437 psi	Design Values 540 psi 540 psi
Compression Parallel Compression Perpendicular Bending Strength	ASTM D198 ASTM D143 ASTM D198	<u>Ultimate (Typical)Values *</u> 1588 psi 1437 psi 3280 psi	Design Values 540 psi 540 psi 500 psi
Compression Parallel Compression Perpendicular Bending Strength Shear Strength	ASTM D198 ASTM D143 ASTM D198 ASTM D143	<u>Ultimate (Typical)Values *</u> 1588 psi 1437 psi 3280 psi 1761 psi	<u>Design Values</u> 540 psi 540 psi 500 psi 360 psi
Compression Parallel Compression Perpendicular Bending Strength Shear Strength Modulus of Elasticity	ASTM D198 ASTM D143 ASTM D198 ASTM D143 ASTM D4761	Ultimate (Typical)Values * 1588 psi 1437 psi 3280 psi 1761 psi 412,000psi	<u>Design Values</u> 540 psi 540 psi 500 psi 360 psi 200,000 psi

* Ultimate strength values are not meant for design analysis. Design values are for temperatures up to 130F (54C)

2.2 ACCESSORIES

- A. Fasteners:
 - 1. Trex Universal Hideaway Hidden Fasteners stainless steel

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install according to manufacturer's installation guidelines.
- B. Cut, drill, and rout using carbide tipped blades
- C. Do not use composite wood material for structural applications

3.2 CLEANING

A. Following cleaning recommendations as specified in manufacturer's installation guide.

END OF SECTION 067300

SECTION 131200 - PRE-ENGINEERED METAL BUILDINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Structural-steel framing
 - 2. Associated building components (metal panels, thermal insulation, trims, flashings, gutters, downspouts, accessories, etc.) as specified by Architect, to be incorporated by building manufacturer.

1.2 RELATED SECTIONS

- A. Section 033000 Cast-in-Place Concrete: Foundations and anchor bolts.
- B. Section 051200 Structural Steel

1.3 REFERENCES

- A. ASTM A 36 Standard Specification for Carbon Structural Steel.
- B. ASTM A 307 Standard Specification for Carbon Steel Bolts and Studs, 60 ksi Tensile Strength.
- C. ASTM A 325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- D. ASTM A 572 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Steel.
- E. ASTM A 653 Standard Specification for Steel Sheets, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- F. ASTM E 1592 Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
- G. AWS D1.1 Structural Welding Code; American Welding Society.
- H. UL 580 Tests for Wind Uplift Resistance of Roof Assemblies; Underwriters Laboratories Inc.
- I. UL 723 Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.

1.4 DEFINITIONS

- A. Building Width: Measured from outside to outside of exterior girts.
- B. Building Length: Measured from outside to outside of exterior girts.
- C. Building Line: Outside face of wall girts.
- D. Building Eave Height: Measured from the top of the eave member at the outside of the exterior girt line to the bottom of the sidewall column base plate.

- E. Bay Spacing: Measured from centerline to centerline of primary frame.
- F. Roof Pitch: The ratio of the vertical rise to the horizontal run.

1.5 DESIGN REQUIREMENTS

- A. Design structural systems according to professionally recognized methods and standards using the 2018 International Building Code, AISC Manual of Steel Construction, AISI Cold Formed Steel Design Manual.
- B. Design sealed by a Professional Engineer licensed in State of Texas.
- C. Structural Performance: Metal building systems shall withstand the effects of the following loads within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 - 1. Design Loads:
 - a. Dead Loads: Self-weight, including weight of all indicated permanent construction.
 - b. Roof Live Load: 20 psf (Reducible)
 - c. Roof Collateral Load: 5 psf.
 - d. Wind Load: Wind design in accordance with ASCE 7-16 design standard:
 - a) Ultimate Design Wind Speed: 138 mph (Vasd = 107 mph)
 - b) Risk Category: II
 - c) Wind Exposure Category: B
 - d) Internal Pressure Coefficient (GCpi): +/-0.00
 - e) Kzt: 1.0
 - f) Kd: 0.85
 - e. Seismic Performance: Metal building system shall withstand the effects of earthquake motions determined according to ASCE 7-16.
 - 2. Deflection and Drift Limits: No greater than the following:
 - a. Purlins and Rafters: Vertical deflection of 1/240 of the span.
 - b. Girts: Horizontal deflection of 1/240 of the span.
 - c. Design wall panel system to withstand specified loads with deflection of L/180 of span, maximum.
 - d. Lateral Drift For Rigid Frames: Maximum of 1/300 of the building height.
 - e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
- D. Structural Performance for Metal Panels:
 - 1. Provide metal panel systems and attachments capable of withstanding component & cladding design wind pressures listed on drawings, based on testing according to ASTM E 1592.
 - 2. Provide metal roof panel assemblies that comply with UL 580, Class 90.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F.
- F. Anchor Bolts: Provide anchor bolt material, quantity and diameter. Embedment length of anchor bolt shall be by project structural engineer.
- G. Manufacturer must be certified by AISC in the Metal Building category.
- H. Supplier must be a primary manufacturer of frames, secondary steel, roof and wall sheeting, and trim.

1.6 SUBMITTALS

- A. Provide electronic (PDF) copies of all required submittal information.
- B. Delegated-Design Data: For metal building systems.
 - Provide detailed design criteria, analysis data and calculations indicating compliance with performance requirements, sealed by the Professional Engineer responsible for their preparation.
 Include structural reactions at the base of frame columns.
- C. Shop Drawings: Include full building plan, elevations, sections and details. Show primary and secondary framing member sizes and locations, cross-sections and connection details, including attachments to other work. Indicate components by others.
- D. Anchor Bolt Installation Drawings: Plan layouts with minimum bolt diameters.
- E. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
 - 1. Name and location of Project.
 - 2. Order number.
 - 3. Name of manufacturer.
 - 4. Name of Contractor.
 - 5. Building dimensions including width, length, height, and roof slope.
 - 6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 - 7. Governing building code and year of edition.
 - 8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 - 9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 - 10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- F. Third party independent laboratory reports of metal panel assembly meeting ASTM E1592 for the prescribed wind loads noted on the drawings.
- G. Product Data: For each type of metal building system component. Include information on manufactured products to be incorporated into the work.
- H. Welding certificates.
- I. Material test reports.
- J. Source quality-control reports.
- K. Field quality-control reports.
- L. Maintenance data.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
 - 1. Accreditation: Manufacturer's facility accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
- 2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a Professional Engineer who is legally qualified to practice in jurisdiction where Project is located.
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."
 - 2. AWS D1.3, "Structural Welding Code Sheet Steel."

1.8 WARRANTY

A. Reference Architectural

PART 2 - PRODUCTS

2.1 METAL MATERIALS

- A. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
- B. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- C. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.
- D. Select materials and material yield strengths based on building design requirements; use the following unless required otherwise.
 - 1. Structural Steel Plate, Bar, Sheet, and Strip for Use in Bolted and Welded Constructions: ASTM A 572, A570, A 529 or A 36 Modified 50, with minimum yield strength of 50,000 psi.
 - 2. Structural Steel Material for Use in Roll Formed or Press Broken Secondary Structural Members: ASTM A 570 or A 607, with minimum yield strength of 55,000 psi (380 MPa).
 - 3. Galvanized Steel Sheet for Roll Formed or Press Broken Roof and Wall Coverings, Trim and Flashing: ASTM A 653/A 653M, with minimum yield strength of 50,000 psi (345 MPa).
 - 4. Galvalume Steel Sheet Used in Roll Formed or Press Broken Roof Covering: Aluminum-zinc alloycoated steel sheet, ASTM A 792, with minimum yield strength of 50,000 psi; nominal coating weight of 0.5 oz per sg ft (equivalent to an approximate coating thickness of 0.0018 inch) both sides.
 - 5. Hot Rolled Steel Shapes: W, M and S shapes, angles, rods, channels and other shapes; ASTM A 572 or ASTM A 36 as applicable; with minimum yield strengths required for the design.
 - 6. Structural Bolts and Nuts Used with Primary Framing: High strength, ASTM A 325.
 - 7. Bolts and Nuts Used with Secondary Framing Members: ASTM A 307.
- E. All materials noted as "HD Galv." shall be hot-dipped galvanized after fabrication.

2.2 FRAMING COMPONENTS

- A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters and rake beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 - 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated on drawings.

- 2. Rigid Frames: Provide solid web framing consisting of tapered or uniform depth rafters rigidly connected to tapered or uniform depth columns, as indicated on drawings. Provide a clear span that supports the loads at bay spacings indicated on drawings.
- B. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating.
- C. Purlins: Zee-shaped; depth as required; with minimum yield strength of 57,000 psi; simple span or continuous span as required for design.
- D. Girts: The girts' configuration and thickness shall be the Building Manufacturer's standard provided all design criteria, including deflection and girt spacing is met. Based on a simple span, the deflection of the girts (supporting the wall covering) shall be proportioned with due regard to that produced by the previously prescribed design (wind) load.
- E. Wind Bracing: Portal, torsional, diagonal bracing or diaphragm in accordance with manufacturer's standard design practices; utilizing rods, angles, and other members, with minimum yield strengths as required for design.
- F. Primary Frame Flange Bracing: Attached from purlins or girts to the primary framing, minimum yield strength as required for design.
- G. Sag Straps: Galvanized 2" wide steel strap, with minimum 50,000 psi yield strength.
- H. Base Angles: 2 inch x 3 inch x 0.059 inch steel angles, with minimum yield strength of 55,000 psi, anchored to the floor slab or grade beam with power driven fasteners or equivalent at a maximum spacing of 4 feet on center and not more than 6 inches from the end of any angle member.
- I. Anchor Bolts: Threaded anchor rods as indicated in Anchor Bolt Plan for attachment of metal building to foundation.
- J. Fabrication: Fabricate according to manufacturer's standard practice.
 - 1. Fabricate structural members made of welded plate sections by jointing the flanges and webs by continuous automatic submerged arc welding process.
 - 2. Welding operators and processes: Qualified in accordance with AWS D1.1.
 - 3. Field connections; Prepare members for bolted field connection by making punched, drilled, or reamed holes in the shop.
- K. Component Identification: Mark all fabricated parts, either individually or by lot or group, using an identification marking corresponding to the marking shown on the shop drawings, using a method that remains visible after shop painting.
- L. All materials noted as "HD Galv." shall be hot-dipped galvanized after fabrication.

2.3 METAL ROOF/WALL PANELS & THERMAL INSULATION

A. Reference Architectural

2.4 GUTTERS & DOWNSPOUTS, FLASHINGS, TRIMS & ACCESSORIES

A. Reference Architectural

2.5 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
 - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 - 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that foundations are installed correctly. Contractor shall notify Engineer of any deficiencies or discrepancies with the contract documents before proceeding.
- B. Verify that anchor bolts are installed as indicated on anchor bolt shop drawings. Contractor shall notify Engineer of any deficiencies or discrepancies with the contract documents before proceeding.

3.2 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions, approved erection drawings and other erection documents.
- B. Provide temporary bracing, shoring, blocking, bridging and securing of components as required during the erection process.
- C. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's Professional Engineer.
- D. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- E. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

- F. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- G. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
 - 1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned as required by manufacturer.
- H. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.
 - 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 - 2. Locate and space wall girts to suit openings such as doors and windows.
 - 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, ventilators, and other penetrations of roof and walls.
- I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
 - 1. Tighten rod and cable bracing to avoid sag.
 - 2. Locate interior end-bay bracing only where indicated.
- J. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.
- K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.3 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.
- B. Product will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 131200

SECTION 316219 - TIMBER PILES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes round timber piles.
- B. Related Sections:
 - 1. Division 06 Section "Rough Carpentry" for dimension lumber framing and for bracing.
 - 2. Division 06 Section "Heavy Timber Construction" for timber framing and for bracing.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For timber piles. Show fabrication and installation details for piles, including details of driving shoes, tips or boots, and pile butt protection.
- C. Qualification Data: For qualified Installer.
- D. Round timber pile treatment data as follows, including chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material:
 - 1. For each type of preservative-treated timber product include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 - 2. For waterborne-treated products include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.
- E. Pile-Driving Equipment Data: Include type, make, and rated energy range; weight of striking part of hammer; weight of drive cap; and, type, size, and properties of hammer cushion.
- F. Pile-Driving Records: Submit within three days of driving each pile.
- G. Field quality-control reports.
- H. Warranty of chemical treatment manufacturer for each type of treatment.
- I. Preconstruction Photographs: Photographs or video of existing conditions of adjacent construction. Submit before the Work begins.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
 - 1. Installer's responsibility includes engaging a qualified professional engineer to prepare pile-driving records.
- B. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- C. Preinstallation Conference: Conduct conference at Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver piles to Project site in such quantities and at such times to ensure continuity of installation. Handle and store piles at Project site to prevent breaks, cuts, abrasions, or other physical damage and as required by AWPA M4.
 - 1. Do not drill holes or drive spikes or nails into pile below cutoff elevation.

1.5 PROJECT CONDITIONS

- A. Protect structures, underground utilities, and other construction from damage caused by pile driving.
- B. Site Information: A geotechnical report has been prepared for this Project and is included in the Project Manual for information only.
- C. Preconstruction Photographs: Inventory and record the condition of adjacent structures, underground utilities, and other construction. Provide photographs and/or video of conditions that might be misconstrued as damage caused by pile driving. Comply with Division 01 Section "Photographic Documentation."

PART 2 PRODUCTS

2.1 TIMBER PILES

- A. Round Timber Piles: ASTM D 25, unused, clean peeled, one piece from butt to tip; of the following species and size basis:
 - 1. Species: Southern yellow pine
 - 2. Size Basis: Class B
- B. Pressure-treat round timber piles according to AWPA C3 and AWPA C18 as follows:
 - 1. Service Condition: Marine piles dual treatment

2.2 FABRICATION

- A. Pile Butt: Trim pile butt and cut perpendicular to longitudinal axis of pile. Chamfer and shape butt to fit tightly to driving cap of hammer.
- B. Field-Applied Wood Preservative: Treat field cuts, holes, and other penetrations according to AWPA M4.
 1. Coal-tar roofing cement for treating drilled holes or sealing cutoffs shall be free of asbestos.
- C. Pile Splices: Splices will not be permitted.
- D. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch intervals; label the distance from pile tip at 60-inch intervals. Maintain markings on piles until driven.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Conditions: Do not start pile-driving operations until earthwork fills have been completed or excavations have reached an elevation of 6 to 12 inches above bottom of footing or pile cap.

3.2 DRIVING EQUIPMENT

- Pile Hammer: Air-, steam-, hydraulic-, or diesel-powered type capable of consistently delivering Α adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material anticipated.
- Β. Hammer Cushions and Driving Caps: Between hammer and top of pile, provide hammer cushion and steel driving cap as recommended by hammer manufacturer and as required to drive pile without damage.
- C. Leads: Use fixed, semifixed, or hanging-type pile-driver leads that will hold full length of pile firmly in position and in axial alignment with hammer.

DRIVING PILES 3.3

- Α. General: Continuously drive piles to elevations or penetration resistance indicated. Establish and maintain axial alignment of leads and piles before and during driving.
- Spudding: Drive spud piles through overlying highly resistant strata or obstructions and withdraw for B reuse.
- C. Predrilling: Provide pre-excavated holes where indicated, to depths indicated. Drill holes with a diameter less than the largest cross-section dimension of pile.
 - Firmly seat pile in predrilled hole by driving with reduced energy before starting final driving. 1.
- Heaved Piles: Redrive heaved piles to tip elevation at least as deep as original tip elevation with a D driving resistance at least as great as original driving resistance.
- F. Driving Tolerances: Drive piles without exceeding the following tolerances, measured at pile heads:
 - Location: 4 inches from location indicated after initial driving, and 6 inches after pile driving is 1 completed.
 - 2. Plumb: Maintain 1 inch in 4 feet from vertical, or a maximum of 4 inches, measured when pile is aboveground in leads.
- F Abandon and cut off rejected piles as directed by Engineer. Leave rejected piles in place and install new piles in locations as directed by Engineer.
- Cutting Off: Cut off butts of driven piles square with pile axis and at elevations indicated. G.
 - 1 Cover cut-off piling surfaces with minimum three coats of preservative treatment according to AWPA M4.
- Pile-Driving Records: Maintain accurate driving records for each pile, compiled and attested to by a Η. qualified professional engineer. Include the following data:
 - Project name and number. 1.
 - Name of Contractor. 2.
 - Pile species. 3.
 - 4. Pile location in pile group and designation of pile group.
 - 5. Sequence of driving in pile group.
 - 6. Pile dimensions.
 - Ground elevation. 7.
 - Elevation of tips after driving. 8.
 - Final tip and cutoff elevations of piles after driving pile group. 9.
 - 10. Records of redriving.
 - 11. Elevation of splices.
 - Type, make, model, and rated
 Weight and stroke of hammer. Type, make, model, and rated energy of hammer.

 - 14. Type of pile-driving cap used.
 - 15. Cushion material and thickness.
 - 16. Actual stroke and blow rate of hammer.

- 17. Pile-driving start and finish times, and total driving time.
- 18. Time, pile-tip elevation, and reason for interruptions.
- 19. Number of blows for every 12 inches of penetration, and number of blows per 1 inch for the last 6 inches of driving.
- 20. Pile deviations from location and plumb.
- 21. Preboring, jetting, or special procedures used.
- 22. Unusual occurrences during pile driving.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Pile foundations.
 - 2. Pile driving operations.
- B. Testing Agency: Owner will engage a qualified independent testing agency to perform tests and inspections.
- C. Tests and Inspections:
 - 1. Dynamic Pile Testing: High-strain dynamic monitoring shall be performed and reported according to ASTM D 4945 during initial driving and during restriking on piles.
 - 2.
- 3.5 DISPOSAL
 - A. Remove withdrawn piles and cutoff sections of piles from site and legally dispose of them off Owner's property.

END OF SECTION 316219

SECTION 316329 - DRILLED PIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Dry-installed straight shaft drilled piers with casings.
- B. Related Sections include the following:
 - 1. Division 3 Section 033000 "Cast-In-Place Concrete" for general structural and building applications of concrete.

1.3 BASIS OF BIDS

A. Base bids on indicated number of drilled piers; design length from top elevation to bottom of shaft, and diameter of shaft.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings Provide Electronic PDF's: For concrete reinforcement detailing fabricating, bending, and placing.
- C. Design Mixes: For each class of concrete. Include revised mix proportions when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Laboratory Test Reports: For evaluation of concrete materials and mix design.
- D. Welding certificates.
- E. Qualification Data: For Drilled Pier Subcontractor and testing agency.
- F. Record drawings at Project closeout according to Division 1 Section "Closeout Procedures."

1.5 QUALITY ASSURANCE

- A. Drilled-Pier Standard: Comply with provisions in ACI 336.1, "Reference Specifications for the Construction of Drilled Piers," unless modified in this Section.
- B. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.
 - 1. Record and maintain information pertinent to each drilled pier and cooperate with Owner's testing and inspecting agency to provide data for required reports.
- C. Welding Standards: Qualify procedures and personnel according to the following:

- 1. AWS D1.1, "Structural Welding Code--Steel."
- 2. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
- D. Trial Drilled Pier: Construct trial drilled pier of diameter and depth and at location indicated or, if not indicated, of same diameter and depth as drilled piers located at least three diameters clear of permanent drilled piers, to demonstrate Installer's construction methods, equipment, standards of workmanship, and tolerances.
 - 1. Excavate shaft, install reinforcement, fill with concrete, and terminate trial drilled pier 30 inches below subgrade and leave in place.
 - 2. Install and remove temporary casings, as required.
 - 3. If Architect or Geotechnical Engineer determine that trial drilled pier does not comply with requirements, excavate for and cast another until it is accepted.
- E. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

- A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.
 - Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.
- B. Site Information: A geotechnical report has been prepared for this Project and is included elsewhere in the Project Manual for information only.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain. Cut bars true to length with ends square and free of burrs.

2.2 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type II.
 - 1. Fly Ash Admixture: ASTM C 618, Class C.
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, 1-inch maximum aggregate size.
- C. Water: Potable, complying with ASTM C 94/C 94M requirements.
- D. Admixtures: Certified by manufacturer to contain not more than 0.06 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494, Type A.
 - 2. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
 - 3. High-Range, Water-Reducing Admixture: ASTM C 494, Type G.

- 4. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- E. Sand-Cement Grout: Portland cement, ASTM C 150, Type II; clean, natural sand, ASTM C 404; and water to result in grout with a minimum 28-day compressive strength of 1000 psi (6.9 MPa), of consistency required for application.

2.3 STEEL CASINGS

A. Steel Pipe Casings: ASTM A 283/A 283M, Grade C; or ASTM A 36/A 36M, carbon-steel plate, with joints full-penetration welded according to AWS D1.1.

2.4 CONCRETE MIX

- A. Prepare design mixes according to ACI 211.1 and ACI 301 for each type and strength of concrete determined by either laboratory trial mix or field test data bases.
 - 1. Use a qualified testing agency for preparing and reporting proposed mix designs for laboratory trial mix basis.
- B. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 4,000 psi
 - Minimum Slump: Capable of maintaining the following slump until completion of placement:
 a. 7 inches (+/- 1 inch).
 - 3. Do not air entrain concrete for drilled piers.
- C. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 limits as if concrete were exposed to deicing chemicals.
- D. Concrete-mix design adjustments may be considered if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant. Resubmit and obtain approval of proposed changes to concrete-mix proportions.

2.5 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 - 1. Do not add water to concrete mix after mixing.
 - 2. Maintain concrete temperature to not exceed 90 deg F (32 deg C).

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

3.2 EXCAVATION

- A. Unclassified Excavation: Excavation is unclassified and includes excavation to bearing elevations regardless of character of materials or obstructions encountered.
 - 1. Obstructions: Unclassified excavation includes removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions.
 - 2. Obstructions: Removal of unanticipated boulders, concrete, masonry, or other unforeseen obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets of size, power, torque, and downthrust necessary for the Work, will be paid according to Contract provisions for changes in the Work.
- B. Classified Excavation: Excavation is classified as standard excavation, special excavation, and obstruction removal and includes excavation to bearing elevations, as follows:
 - 1. Standard excavation includes excavation accomplished with conventional augers fitted with soil or rock teeth, drilling buckets of size, power, torque, and downthrust necessary for the Work.
 - 2. Special excavation includes excavation that requires special equipment or procedures above or below indicated depth of drilled piers where drilled-pier excavation equipment used in standard excavation, operating at maximum power, torque, and downthrust, cannot advance the shaft.
 - a. Special excavation requires use of special rock augers, core barrels, air tools, blasting, or other methods of hand excavation.
 - b. Earth seams, rock fragments, and voids included in rock excavation area will be considered rock for full volume of shaft from initial contact with rock.
 - 3. Obstructions: Removal of unanticipated boulders, concrete, masonry, or other unforeseen obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets of size, power, torque, and downthrust necessary for the Work, will be paid according to Contract provisions for changes in the Work.
- C. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.
- D. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.
 - 1. Excavate bottom of drilled piers to level plane within 1:12 tolerance.
 - 2. Remove water from excavated shafts before concreting.
 - 3. Excavate rock sockets of dimensions indicated.
 - 4. Cut series of grooves about perimeter of shaft to height from bottom of shaft, vertical spacing, and dimensions indicated.
- E. Notify and allow Owner's testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect.
 - 1. Do not excavate shafts deeper than elevations indicated, unless approved by Architect.
 - 2. Additional authorized excavation will be paid according to Contract provisions for changes in the Work.
- F. Excavate shafts for closely spaced drilled piers and those occurring in fragile or sand strata, only after adjacent drilled piers are filled with concrete and allowed to set.
- G. Temporary Casings: Provide watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.
 - 1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete.
- H. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.

- 1. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit design and construction proposals to Architect for review before proceeding.
- I. Inspection: Each drilled pier must be inspected and tested by Owner's testing and inspecting agency before placing concrete.
 - 1. Provide and maintain facilities with equipment required for testing and inspecting excavations. Cooperate with testing and inspecting personnel to expedite the Work.
 - 2. Notify Architect and testing agency at least 24 hours before excavations are ready for tests and inspections.

3.3 STEEL REINFORCEMENT

- A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.
- C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.
- D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover to reinforcement.
- E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.
- F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.4 CONCRETE PLACEMENT

- A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by Owner's independent testing and inspecting agency.
 - 1. Construct a construction joint if concrete placement is delayed more than one hour. Level top surface of concrete. Before placing remainder of concrete, clean surface laitance, roughen, and slush concrete with commercial bonding agent or with sand-cement grout mixed at ratio of 1:1.
- B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
 - 1. Where concrete cannot be directed down shaft without striking reinforcing, place concrete with chutes, tremies, or pumps.
 - 2. Vibrate top 60 inches of concrete.
- C. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch head of concrete above bottom of casing.
 - 1. Vibrate top 60 inches of concrete after withdrawal of temporary casing.
- D. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.
- E. Protect concrete work, according to ACI 301, from hot and cold temperatures that could cause physical damage or reduced strength.

- 1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
- 2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.
- F. When hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no greater than 90 deg F (32 deg C).
 - 1. Place concrete immediately on delivery. Keep exposed concrete surfaces and formed shaft extensions moist by fog sprays, wet burlap, or other effective means for a minimum of seven days.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit reports during excavation and concrete placement for drilled piers.
- B. A drilled-pier report will be prepared by Owner's testing and inspecting agency for each drilled pier as follows:
 - 1. Actual top and bottom elevations.
 - 2. Top of rock elevation.
 - 3. Description of soil materials.
 - 4. Description, location, and dimensions of obstructions.
 - 5. Final top centerline location and deviations from requirements.
 - 6. Variation of shaft from plumb.
 - 7. Shaft excavating method.
 - 8. Design and tested bearing capacity of bottom.
 - 9. Depth of rock socket.
 - 10. Levelness of bottom and adequacy of cleanout.
 - 11. Ground-water conditions and water-infiltration rate, depth, and pumping.
 - 12. Description, diameter, and top and bottom elevations of temporary or permanent casings.
 - 13. Description of soil or water movement, sidewall stability, loss of ground, and means of control.
 - 14. Shaft dimensions and variations from original design.
 - 15. Date and time of starting and completing excavation.
 - 16. Inspection report.
 - 17. Position of reinforcing steel.
 - 18. Concrete placing method, including elevation of consolidation and delays.
 - 19. Elevation of concrete during removal of casings.
 - 20. Locations of construction joints.
 - 21. Remarks, unusual conditions encountered, and deviations from requirements.
 - 22. Concrete testing results.
- C. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities will be determined by Owner's testing and inspecting agency. Final evaluations and approval of data will be determined by Architect.
 - 1. Bearing Stratum Tests: Owner's testing agency will take undisturbed core samples from drilled-pier bottoms; test each sample for compression, moisture content, and density; and report results and evaluations.
- D. Concrete: Sampling and testing of concrete for quality control may include the following:
 - 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94/C 94M.

- a. Slump: ASTM C 143/C 143M; one test at point of placement for each compressive-strength test, but no fewer than one test for each concrete load.
- b. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
- c. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Mold and store cylinders for laboratory-cured test specimens, unless field-cured test specimens are required.
- d. Compressive-Strength Tests: ASTM C 39; one set for each drilled pier, but not more than one set for each truck load. One specimen will be tested at 7 days, 2 specimens will be tested at 28 days, and one specimen will be retained in reserve for later testing if required.
- 2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, testing will be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
- 3. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing in-place concrete.
- 4. Strength level of concrete will be considered satisfactory if averages of sets of 3 consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi (3.45 MPa).
- 5. Test results will be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests will contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, concrete type and class, location of concrete batch in drilled pier, design compressive strength at 28 days, concrete-mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- 6. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as sole basis for acceptance or rejection.
- 7. Additional Tests: Testing and inspecting agency will make additional tests of concrete when test results indicate concrete strengths or other requirements have not been met.
 - a. Continuous coring of drilled piers may be required, at Contractor's expense, when temporary casings have not been withdrawn within specified time limits or where observations of placement operations indicate deficient concrete quality, presence of voids, segregation, or other possible defects.

3.6 DISPOSAL OF MATERIALS

A. Remove surplus excavated material and concrete and legally dispose of it off Owner's property.

END OF SECTION 316329



TABLE OF CONTENTS

MEP SPECIFICATIONS FOR CAMERON COUNTY PARKS OLMITO PARK COMPLEX, BROWNSVILLE, TEXAS

November 10, 2023

DIVISION 22: PLUMBING

220010	Plumbing Summary of Work
220517	Sleeves and Sleeve Seals for Plumbing Piping
220518	Escutcheons for Plumbing Piping
220519	Meters and Gauges for Plumbing Piping
220523	General-Duty Valves for Plumbing Piping
220529	Hangers and Supports for Plumbing Piping and Equipment
220548.13	Vibration Controls for Plumbing Piping and Equipment
220553	Identification for Plumbing Piping and Equipment
220719	Plumbing Piping Insulation
221116	Domestic Water Piping
221119	Domestic Water Piping Specialties
221316	Sanitary Waste and Vent Piping
221319	Sanitary Waste Piping Specialties
223300	Electric, Domestic Water Heaters
224000	Plumbing Fixtures
224713	Drinking Fountains

DIVISION 23: HEATING, VENTILATION, AND AIR-CONDITIONING

- 230010 Summary of Mechanical Work230513 Common Motor Requirements for HVAC Equipment
- 230517 Sleeves and Sleeve Seals for HVAC Piping
- 230518 Escutcheons for HVAC Piping

230529	Hangers and Supports for HVAC Piping and Equipment
230548.13	Vibration Controls for HVAC
230553	Identification for HVAC Piping and Equipment
230593	Testing, Adjusting, and Balancing for HVAC
230713	Duct Insulation
230719	HVAC Piping Insulation
232300	Refrigerant Piping
233113	Metal Ducts
233300	Air Duct Accessories
233423	HVAC Power Ventilators
233713	Diffusers, Registers, and Grilles
238126	Split - System Air - Conditioners

DIVISION 26: ELECTRICAL

260010	Summary of Electrical Work
260519	Low-Voltage Electrical Power Conductors and Cables
260526	Grounding and Bonding for Electrical Systems
260529	Hangers and Supports for Electrical Systems
260533	Raceways and Boxes for Electrical Systems
260544	Sleeves and Sleeve Seals for Electrical Raceways and Cabling
260553	Identification for Electrical Systems
260800	Commissioning of Electrical Systems
260936	Lighting Controls
262416	Panelboards
262726	Wiring Devices
262813	Fuses
262816	Enclosed Switches and Circuit Breakers
265116	Interior Lighting
265219	Emergency and Exit Lighting
265613	Lighting Poles and Standards
265621	Exterior Lighting

267240 Intrusion Detection

268050 Hand Dryers

DRAWINGS:

MECHANICAL:

M2.01	MECHANICAL SYMBOLS AND GENERAL NOTES
M3.01	MECHANICAL PLANS, SCHEDULES, AND DETAILS

ELECTRICAL:

ES1.1	ELECTRICAL SITE PLAN
E2.01	ELECTRICAL SYMBOLS LEGEND AND ABBREVIATIONS
E3.01	LARGE AND SMALL COMFORT STATION LIGHTING AND ELECTRICAL PLAN
E4.01	CONSTABLE OFFICE LIGHTING AND ELECTRICAL PLAN
E5.01	PAVILION LIGHTING AND ELECTRICAL PLAN
E6.01	LUMINAIRE SCHEDULE AND IMAGES
E7.01	ELECTRICAL RISER DIAGRAM AND PANEL SCHEDULES
E8.01	ELECTRICAL DETAILS
E8.02	ELECTRICAL DETAILS

PLUMBING:

PS1.01	PLUMBING SITE PLAN

- P2.01 LARGE AND SMALL COMFORT STATION, PLUMBING, WASTE AND VENT PLANS
- P3.01 CONSTABLE OFFICE, PLUMBING, WASTE AND VENT PLANS
- P4.01 PLUMBING SCHEDULES
- P4.02 PLUMBING DETAILS
- P4.03 PLUMBING FIXTURE IMAGES



PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 22 Specification Sections, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, and is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.
- B. Contract Documents were prepared for the Project by: Ethos Engineering, 1126 South Commerce, Harlingen, Texas 78550 Phone Number: (956) 230-3435
- C. Scope of Work: Refer to drawings for a detailed Scope of Work.
 - 1. Provide all materials and labor associated with new fully-operational plumbing systems for the project "Cameron County Parks Olmito Park Complex", including but not limited to the following:
 - a. Plumbing domestic water heaters, floor drains, valves, fittings, hardware and specialties.
 - b. Potable hot and cold-water distribution piping, and service connections to site utilities.
 - c. Sanitary wastewater and vent piping and service line connections to site utilities.
 - d. <u>Painting</u>: See Division 9 specifications. Paint all exposed piping, insulation, hangers, accessories in interior exposed areas. Paint exterior pipe supports. Coordinate paint type, color and scope of work with Architect.

1.3 ALLOWANCES

A. See Division 0 Specifications.

1.4 COORDINATION

- A. All plumbing work shall be done under sub-contract to a General Contractor. Plumbing Contractor shall coordinate all work through General Contractor, who is ultimately responsible for the entire project.
- B. <u>Prior to bidding</u>, Plumbing Contractor shall coordinate all work in Division-22 for integration with civil work, mechanical work, electrical work, irrigation work and general construction. A detailed list of inclusion and exclusions shall be provided to General Contractors at least three

Ethos Engineering Cameron County Parks Olmito Park Complex

SECTION 220010 – SUMMARY OF PLUMBING WORK

days prior to the end of the period set aside to request clarifications so that coordination of any missing items may be addressed and clarified by Architect/Engineer as needed.

- 1. Coordinate water line diameter, tap size, meter size and backflow preventer size with MEP Engineer. While meter size may be smaller, water line diameter, tap, backflow preventer sizes shall match or be larger than the connection sizes shown on Plumbing drawings. If the distance from the water mains is too large, upsize line, valve sizes to minimize pressure drops. Coordinate details with Engineer.
- C. All electrical work required for operation of plumbing systems shall be coordinated through the General Contractor <u>prior to bidding</u> to ensure that all starters, disconnects, conduit and wiring are provided as part of the project. All components needed for a full operational installation of systems shall be provided.
- D. All Building Automation Systems (BAS) required for operation of plumbing systems shall be coordinated through the General Contractor <u>prior to bidding</u>, to ensure that all equipment, materials, valves, sensors, devices and labor are provided as part of the project. All components needed for a full operational installation of systems shall be provided.
- E. Plumbing Contractor shall coordinate and supervise installation of all controls systems, and coordinate with electrical contractors and equipment suppliers as needed. All components needed for a full operational installation of systems shall be provided.
- F. Contractor shall coordinate with other divisions for power and control of plumbing systems. It is not the intent of this specification to dictate who will conduct work, only to state the requirements of conducting the work.
- G. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.
- H. Coordinate with Div. 1 for work sequence and optimization of construction schedule.
- I. Coordinate with Div. 23 for Mechanical System.
- J. Coordinate with Div. 26 electrical contractor for providing power to plumbing equipment, and for Fire Alarm Systems interface with plumbing systems.
- K. Issue written notification of the following tasks and allow five (5) days for Engineer to respond and schedule an inspection as required. Failure to issue written notification may result in work having to be redone to allow for proper inspection. It is contractor's responsibility to make sure Engineer receives notification.
 - 1. Upon completion of underground piping installation and prior to testing or covering up.
 - 2. Upon completion of all water piping installation and prior to insulation and/or testing.
 - 3. Upon completion of ductwork and prior to testing and insulating.
 - 4. Above ceiling inspections prior to ceiling tile installation.
 - 5. When ready to request manufacturer's start-up of each piece of equipment.
 - 6. When ready for Substantial Completion Inspection.
 - 7. When ready for Final Inspection.
- L. General

SECTION 220010 – SUMMARY OF PLUMBING WORK

- 1. The Contractor shall execute all work hereinafter specified or indicated on accompanying Drawings. Contractor shall provide all equipment necessary and usually furnished in connection with such work and systems whether or not mentioned specifically herein or on the Drawings.
- 2. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation and thereby to provide an integrated satisfactory operating installation.
- 3. The Mechanical, Electrical, Plumbing, and associated Drawings are necessarily diagrammatic by their nature, and are not intended to show every connection in detail or every pipe or conduit in its exact location. These details are subject to the requirements of standards referenced elsewhere in these specifications, and structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be organized and laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.
- 4. When the mechanical, electrical and plumbing drawings do not give exact details as to the elevation of pipe, conduit and ducts, the Contractor shall physically arrange the systems to fit in the space available at the elevations intended with proper grades for the functioning of the system involved. Piping, exposed conduit and the duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner. The Drawings do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas.

1.5 WORK SEQUENCE

- A. Locate Utilities:
 - 1. Coordinate with power, water, sewer, telephone, communications, and other utilities as well as designated Owner's personnel to locate all utilities prior to digging in any area.
 - 2. Obtain any approvals required from utilities to relocate utilities.
 - 3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.
- B. Coordinate with Division 1 requirements to optimize construction schedule.
- C. Provide equipment and material submittals, coordination drawings and shop drawings as required by specifications.
- D. Submit detailed plumbing Schedule of Values with Submittals. Plumbing Submittals will not be accepted without a detailed Schedule of Values.
- E. Sequence construction in coordination with work by other disciplines.

SECTION 220010 - SUMMARY OF PLUMBING WORK

1.6 CONTRACTOR USE OF PREMISES

- A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
 - 1. Driveways and Entrances: Keep driveways and entrances to construction site clear and available to other Contractors, Owner, and A/E personnel at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:
 - 1. Temporary fencing around construction areas.
 - 2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
 - 3. Temporary fencing around equipment while site work is in progress.

1.7 SUBMITTALS

- A. Manufacturer's standard dimensioned drawings, performance and product data shall be edited to delete reference to equipment, features, or information which is not applicable to the equipment being supplied for this project.
- B. Provide all plumbing submittals at the same time in one or multiple bound volumes. Include originals from manufacturer. All submittals shall be in native pdf and searchable format. Faxes and copies of faxes are not acceptable.
- C. Provide sufficient copies of approved data, with the engineer's approved stamp, for inclusion in the operations and maintenance manuals.
- D. Provide detailed coordination drawings showing how plumbing system components will be installed in coordination with work by others. Engineer's drawing files will be made available to Contractor for producing coordination and as-built drawings upon request.

1.8 SCHEDULE OF VALUES -Special Requirements

- A. Plumbing Contractor shall submit a Schedule of Values reflecting the total value of Plumbing Work in the Contract, and broken down into the following items as a minimum, with a line-item for Materials/Equipment and another for Labor:
 - 1. Plumbing fixtures and equipment
 - 2. Plumbing materials
 - 3. Plumbing labor
 - 4. Allowances.
 - 5. Miscellaneous
 - 6. Administrative and project management.

SECTION 220010 - SUMMARY OF PLUMBING WORK

B. Schedule of Values shall be included with bound submittals. Submittals without a Schedule of Values shall not be reviewed.

1.9 EQUIPMENT MANUFACTURERS

- A. Plumbing design is based on equipment and materials scheduled and specified. These are used as the basis for performance characteristics, quality, and physical dimensions/weight.
- B. Equipment and materials by other APPROVED manufacturers may be provided by Contractor. In doing so, Contractor assumes responsibility for the performance, quality, and physical dimensions of the proposed units.
- C. Any costs associated with modifications to the design due to submittal of equipment and/or materials other than those used as the basis of design are the Contractor's responsibility. This includes any design time, production of drawings, and time delays.
- D. Where use of equipment and/or materials other than those used as the basis of design impact other disciplines, Contractor shall assume responsibility for all costs associated with any APPROVED modifications. This may include resizing of electrical circuits, modifying openings in the structure, relocating floor drains, etc.

1.10 OPERATIONS AND MAINTENANCE MANUALS & TRAINING

- A. Submit Operations and Maintenance Manuals two weeks prior to Substantial Completion Inspection. Engineer will not conduct a Substantial Completion Inspection without having reviewed Operations and Maintenance Manuals.
- B. Use Operations and Maintenance Manuals as a guide for conducting training of Owner's personnel.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 220010

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

- A. Manufacturers:
 - 1. Smith, Jay R. Mfg. Co.
 - 2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

Ethos Engineering Cameron County Parks Olmito Park Complex

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. Metraflex Company (The).
 - 4. Pipeline Seal and Insulator, Inc.
 - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers:
 - 1. Presealed Systems.
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Using grout, seal the space around outside of stack-sleeve fittings.

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade: Cast-iron wall sleeves
 - Exterior Concrete Walls below Grade: Cast-iron wall sleeves with sleeve-seal system.
 a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system
 - 3. Concrete Slabs-on-Grade: Cast-iron wall sleeves with sleeve-seal system.
 - a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 4. Concrete Slabs above Grade: Galvanized-steel-pipe sleeves
 - 5. Interior Partitions: Galvanized-steel-pipe sleeves

END OF SECTION 220517

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Insulated Piping: One-piece, stamped-steel type.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, castbrass type with polished, chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
 - e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with roughbrass finish.
 - f. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One-piece, floor-plate type.
 - 2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Liquid-in-glass thermometers.
 - 2. Thermowells.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Certificates: For each type of meter and gauge, from manufacturer.
- C. Operation and Maintenance Data: For meters and gauges to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - 1. Manufacturers:
 - a. Trerice, H. O. Co.
 - b. Weiss Instruments, Inc.
 - c. Winters Instruments U.S.
 - 2. Standard: ASME B40.200.
 - 3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
 - 4. Case Form: Adjustable angle unless otherwise indicated.
 - 5. Tube: Glass with magnifying lens and blue or red organic liquid.
 - 6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
 - 7. Window: Glass.
 - 8. Stem: Aluminum and of length to suit installation.
 - a. Design for Air-Duct Installation: With ventilated shroud.
 - b. Design for Thermowell Installation: Bare stem.

SECTION 220519 - METERS AND GAUGES FOR PLUMBING PIPING

- 9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
- 10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

- A. Thermowells:
 - 1. Standard: ASME B40.200.
 - 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 - 3. Material for Use with Copper Tubing: brass.
 - 4. Material for Use with Steel Piping: stainless steel.
 - 5. Type: Stepped shank unless straight or tapered shank is indicated.
 - 6. Bore: Diameter required to match thermometer bulb or stem.
 - 7. Insertion Length: Length required to match thermometer bulb or stem.
 - 8. Lagging Extension: Include on thermowells for insulated piping and tubing.
 - 9. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 TEST PLUGS

- A. Manufacturers
 - 1. Flow Design, Inc.
 - 2. Trerice, H. O. Co.
 - 3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - 4. Weiss Instruments, Inc.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS ¹/₄or NPS 1/2, ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.4 TEST-PLUG KITS

- A. Manufacturers:
 - 1. Flow Design, Inc.
 - 2. Trerice, H. O. Co.
 - 3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - 4. Weiss Instruments, Inc.

Ethos Engineering Cameron County Parks Olmito Park Complex

SECTION 220519 - METERS AND GAUGES FOR PLUMBING PIPING

- B. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gauge and adapter, and carrying case. Thermometer sensing elements, pressure gauge, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.
- D. Pressure Gauge: Small, Bourdon-tube insertion type with 2- to 3-inch-diameter dial and probe. Dial range shall be at least 0 to 200 psig.
- E. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install test plugs in piping tees.
- G. Install thermometers in the following locations:1. Inlets and outlets of each domestic water heater.

3.2 CONNECTIONS

A. Install meters and gauges adjacent to machines and equipment to allow service and maintenance of meters, gauges, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gauges to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each domestic water heater shall be the following:
 - 1. Industrial-style, liquid-in-glass type.
 - 2. Test plug with EPDM self-sealing rubber inserts.

SECTION 220519 – METERS AND GAUGES FOR PLUMBING PIPING

B. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Hot-Water Piping: 0 to 200 deg F.

END OF SECTION 22 05 19

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Bronze ball valves.
- 2. Bronze gate valves.
- 3. Bronze globe valves.
- B. Related Sections:
 - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
 - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller.

Ethos Engineering Cameron County Parks Olmito Park Complex

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

- 4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.
- E. Valves in Insulated Piping: With 2-inchstem extensions and the following features:
 - 1. Gate Valves: With rising stem.
 - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
- F. Valve-End Connections:
 - 1. Solder Joint: With sockets according to ASME B16.18.
 - 2. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

- A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:
 - 1. Manufacturers:
 - a. NIBCO INC.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Kitz Corporation
 - d. Apollo
 - 2. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 400 psig.
 - c. Body Design: One piece.
 - d. Body Material: Bronze.
 - e. Ends: Threaded.
 - f. Seats: PTFE or TFE.
 - g. Stem: Bronze.
 - h. Ball: Chrome-plated brass.
 - i. Port: Reduced.

2.3 BRONZE GATE VALVES

- A. Class 150, Bronze Gate Valves:
 - 1. Manufacturers:
 - a. NIBCO INC.
 - b. Hammond Valve.
 - c. Kitz Corporation.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - e. Apollo
- 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: Solid wedge; bronze.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.

2.4 BRONZE GLOBE VALVES

- A. Class 150, Bronze Globe Valves with Nonmetallic Disc:
 - 1. Manufacturers:
 - a. Hammond Valve.
 - b. Milwaukee Valve Company.
 - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - d. Kitz Corporation.
 - e. Apollo
 - 2. Description:
 - a. Standard: MSS SP-80, Type 2.
 - b. CWP Rating: 300 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
 - d. Ends: Threaded.
 - e. Stem: Bronze.
 - f. Disc: PTFE or TFE.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, or gate, or plug valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service: Globe or ball valves.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2and Smaller: Threaded ends except where solder-joint valveend option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5and Larger: Flanged ends.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: One piece, regular port, bronze with bronze trim.
 - 3. Bronze Gate Valves: Class 150.

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

- 4. Bronze Globe Valves: Class 150, bronze, nonmetallic disc.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 - 2. Iron Ball Valves: Class 150.
 - 3. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, stainless-steel disc.
 - 4. Iron Gate Valves: Class 250.
 - 5. Iron Globe Valves: Class 250.

END OF SECTION 220523

PART 1 - GENERAL

1.1 **RELATED DOCUMENTS**

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

1.2 **SUMMARY**

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2.
 - Trapeze pipe hangers. Thermal-hanger shield inserts. 3.
 - Fastener systems. 4.
 - 5. Pipe stands.
 - Equipment supports. 6.
- **Related Sections:** B.
 - 1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and 2. anchors.
 - Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" 3. for vibration isolation devices.

1.3 DEFINITIONS

MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc. A.

1.4 PERFORMANCE REQUIREMENTS

- Delegated Design: Design trapeze pipe hangers and equipment supports, including A. comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- Structural Performance: Hangers and supports for plumbing piping and equipment shall B. withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - Design equipment supports capable of supporting combined operating weight of 2. supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Fiberglass strut systems.
 - 4. Pipe stands.
 - 5. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of trapeze hangers.
 - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:

Ethos Engineering Cameron County Parks Olmito Park Complex

- 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
- 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 - 1. Manufacturers:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Flex-Strut Inc.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut Corporation; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 - 3. Standard: MFMA-4.
 - 4. Channels: Continuous slotted steel channel with inturned lips.
 - 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 - 7. Metallic Coating: Hot-dipped galvanized.
 - 8. Plastic Coating: PVC.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers:
 - 1. Carpenter & Paterson, Inc.
 - 2. Clement Support Services.
 - 3. ERICO International Corporation.
 - 4. National Pipe Hanger Corporation.
 - 5. PHS Industries, Inc.
 - 6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 - 7. Piping Technology & Products, Inc.
 - 8. Rilco Manufacturing Co., Inc.
 - 9. Value Engineered Products, Inc.

- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
 - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 2. Base: Plastic.
 - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainlesssteel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
 - 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - 2. Bases: One or more; plastic.
 - 3. Vertical Members: Two or more protective-coated-steel channels.

- 4. Horizontal Member: Protective-coated-steel channel.
- 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structuralsteel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbonsteel shapes.

2.9 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- G. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

- b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
- c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
- 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
- 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
- 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
- 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
- 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

- 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
- 2. Obtain fusion without undercut or overlap.
- 3. Remove welding flux immediately.
- 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

Ethos Engineering

- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 - 3. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
 - 4. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 - 5. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 - 6. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.

- 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
- 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
- 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
- 6. C-Clamps (MSS Type 23): For structural shapes.
- 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
- 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
- 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel Ibeams for heavy loads.
- 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel Ibeams for heavy loads, with link extensions.
- 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
- 13. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Elastomeric isolation pads.
 - 2. Elastomeric isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Elastomeric hangers.
 - 5. Spring hangers.
- B. Related Requirements:
 - 1. Section 210548.13 "Vibration Controls for Fire-Suppression Piping and Equipment" for devices for fire-suppression equipment and systems.
 - 2. Section 230548.13 "Vibration Controls for HVAC" for devices for HVAC equipment and systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.
- B. Shop Drawings:
 - 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment.
- C. Delegated-Design Submittal: For each vibration isolation device.
 - 1. Include design calculations for selecting vibration isolators.

SECTION 220548.13 - VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ace Mountings Co., Inc.
 - 2. Amber/Booth Company, Inc.
 - 3. California Dynamics Corporation.
 - 4. Isolation Technology, Inc.
 - 5. Kinetics Noise Control.
 - 6. Mason Industries.
 - 7. Vibration Eliminator Co., Inc.
 - 8. Vibration Isolation.
 - 9. Vibration Mountings & Controls, Inc.
- B. Elastomeric Isolation Pads:
 - 1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 - 2. Size: Factory or field cut to match requirements of supported equipment.
 - 3. Pad Material: Oil and water resistant with elastomeric properties.
 - 4. Surface Pattern: Ribbed, Waffle, non-slip pattern.
 - 5. Infused nonwoven cotton or synthetic fibers.
 - 6. Load-bearing metal plates adhered to pads.
 - 7. Sandwich-Core Material: Resilient and elastomeric.
- C. Double-Deflection, Elastomeric Isolation Mounts:
 - 1. Mounting Plates:
 - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
 - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

SECTION 220548.13 - VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

- 2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.
- D. Restrained Elastomeric Isolation Mounts:
 - 1. Description: All-directional isolator with restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - a. Housing: Cast-ductile iron or welded steel.
 - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.
- E. Freestanding, Laterally Stable, Open-Spring Isolators:
 - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 5. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
 - 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- F. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:
 - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 5. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
 - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 - b. Top housing with threaded mounting holes and internal leveling device, elastomeric pad.
- G. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
 - 1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
 - 2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.
- H. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

- 1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
- 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
- 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
- 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
- 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
- 7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
- 8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static within specified loading limits.

Ethos Engineering Cameron County Parks Olmito Park Complex

SECTION 220548.13 - VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

3.3 VIBRATION CONTROL DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete." Section 033053 "Miscellaneous Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

END OF SECTION 220548.13

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.
 - 6. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
 - 1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 4. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 5. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

Ethos Engineering Cameron County Parks Olmito Park Complex

- D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- E. Fasteners: Stainless-steel rivets or self-tapping screws.
- F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- G. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1/2 inch.

2.4 STENCILS

- A. Stencils for Piping:
 - 1. Lettering Size: Size letters according to ASME A13.1 for piping.
 - 2. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass beaded chain.

Ethos Engineering Cameron County Parks Olmito Park Complex

- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

- A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches minimum.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Safety yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting." and Section 099600 "High-Performance Coatings."

- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Cold Water: 1-1/2 inches, round.
 - b. Hot Water: 1-1/2 inches, round.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Domestic recirculating hot-water piping.
 - 4. Domestic chilled-water piping for drinking fountains.
 - 5. Storm water piping.
 - 6. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Products:
 - a. Armaflex
 - b. K-Flex
- G. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products:
 - a. Johns Manville; Micro-Lok.
 - b. Knauf Insulation; 1000(Pipe Insulation.
 - c. Owens Corning; Fiberglas Pipe Insulation.
 - 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
 - 1. Products:
 - a. Insulco, Division of MFS, Inc.; Triple I.
 - b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 1. Products:

Ethos Engineering Cameron County Parks Olmito Park Complex

- a. Foster Products Corporation, H. B. Fuller Company
- b. Aeroflex
- c. Armacell
- d. K-Flex
- 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.

- e. Mon-Eco Industries, Inc.; 55-40.
- f. Vimasco Corporation; 749.
- 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
- 3. Service Temperature Range: Minus 20 to plus 180 deg F.
- 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
- 5. Color: White.

2.5 SEALANTS

- A. Joint Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Permanently flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 4. Color: White or gray.
 - 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. FSK and Metal Jacket Flashing Sealants:
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: Aluminum.
 - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-76.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: White.
 - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

2.8 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.9 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Metal Jacket:
 - 1. Products:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
 - 2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper
 - d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

C. Underground Direct-Buried Jacket: 125-mil-thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.10 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Products:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Products:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 6.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.11 SECUREMENTS

A. Bands:

- 1. Products:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
- 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 316; 0.015 inch thick, 3/4 inch wide.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers. Retain subparagraph and list of manufacturers below. See Section 016000 "Product Requirements."

- 1. Manufacturers:
 - a. C & F Wire.
 - b. Childers Products.
 - c. PABCO Metals Corporation.
 - d. RPR Products, Inc.

2.12 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
 - 1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and coldwater supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
- B. Protective Shielding Piping Enclosures:
 - 1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and coldwater supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.

- 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
- 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and

unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

- 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 - 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 - 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 - 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 - 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install preformed pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 - 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 4. Install insulation to flanges as specified for flange insulation application.
SECTION 220719 - PLUMBING PIPING INSULATION

3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 - 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 - 2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
 - 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of

flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.
- C. Domestic hot-water storage tank insulation shall be the following, of thickness to provide an R-value of 13: Mineral-fiber pipe and tank.

3.12 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Hot and Recirculated Hot Water:
 - 1. Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick, with two coats of protective coating recommended by the insulation manufacturer.
- B. Condensate and Equipment Drain Water below 60 Deg F:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 3/4 inch thick, with two coats of protective coating recommended by the insulation manufacturer.
- C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch thick.
- D. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch thick.

Ethos Engineering Cameron County Parks Olmito Park Complex

SECTION 220719 - PLUMBING PIPING INSULATION

E. Hot Service Drains:

1.

1.

- All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.
- F. Hot Service Vents:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch thick.
- G. Rainwater conductors, and roof drain bodies:
 - All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch thick, with two coats of protective coating recommended by the insulation manufacturer.
- H. Vapor barrier on all piping, except on hot water piping.
- I. Insulation shall be painted where exposed to view. Coordinate with Architect.

3.14 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Domestic Water Piping:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Vapor barrier.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. Piping, Exposed:
 - 1. Aluminum, Smooth: 0.020 inch thick.

3.16 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 220719

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
 - 2. Encasement for piping.
- B. Related Requirements:
 - 1. Section 221113 "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of water service.
 - 2. Do not interrupt water service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- E. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.
- F. Copper Pressure-Seal-Joint Fittings:
 - 1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
 - 2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
- G. Copper Push-on-Joint Fittings:
 - 1. Description:
 - a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
 - b. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solderjoint ends.
- H. Copper-Tube, Extruded-Tee Connections:
 - 1. Description: Tee formed in copper tube according to ASTM F 2014.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

- 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
- 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for generalduty brazing unless otherwise indicated.

2.4 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105/A21.5.
- B. Form: tube.

2.5 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
 - 1. Manufacturers:
 - a. Cascade Waterworks Manufacturing.
 - b. Dresser, Inc.; Dresser Piping Specialties.
 - c. Ford Meter Box Company, Inc. (The).
 - d. JCM Industries.
 - e. Romac Industries, Inc.
 - f. Smith-Blair, Inc; a Sensus company.
 - g. Viking Johnson; c/o Mueller Co.
- D. Plastic-to-Metal Transition Unions:
 - 1. Manufacturers:
 - a. Charlotte Pipe and Foundry Company.
 - b. Harvel Plastics, Inc.
 - c. Spears Manufacturing Company.
 - 2. Description:

- a. PVC four-part union.
- b. Brass threaded end.
- c. Solvent-cement-joint plastic end.
- d. Rubber O-ring.
- e. Union nut.

2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Manufacturers:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. EPCO Sales, Inc.
 - d. Hart Industries International, Inc.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Wilkins Water Control Products.
 - 2. Standard: ASSE 1079.
 - 3. Pressure Rating: 150 psig.
 - 4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Manufacturers:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. EPCO Sales, Inc.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Standard: ASSE 1079.
 - 3. Factory-fabricated, bolted, companion-flange assembly.
 - 4. Pressure Rating: 150 psig.
 - 5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Nonconducting materials for field assembly of companion flanges.
 - 3. Pressure Rating: 150 psig.
 - 4. Gasket: Neoprene or phenolic.

- 5. Bolt Sleeves: Phenolic or polyethylene.
- 6. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
 - 1. Manufacturers:
 - a. Perfection Corporation; a subsidiary of American Meter Company.
 - b. Precision Plumbing Products, Inc.
 - c. Victaulic Company.
 - 2. Standard: IAPMO PS 66.
 - 3. Electroplated steel nipple complying with ASTM F 1545.
 - 4. Pressure Rating and Temperature: 300 psig at 225 deg F.
 - 5. End Connections: Male threaded or grooved.
 - 6. Lining: Inert and noncorrosive, propylene.

2.7 FLEXIBLE CONNECTORS

- A. Manufacturers:
 - 1. Flex-Hose Co., Inc.
 - 2. Flex Pression, Ltd.
 - 3. Flex-Weld, Inc.
 - 4. Hyspan Precision Products, Inc.
 - 5. Metraflex, Inc.
 - 6. Universal Metal Hose; a Hyspan company
- B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum 200 psig
 - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
 - 3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- H. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- M. Install piping to permit valve servicing.
- N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- O. Install piping free of sags and bends.
- P. Install fittings for changes in direction and branch connections.
- Q. Install PEX piping with loop at each change of direction of more than 90 degrees.
- R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump.
- T. Install thermostats in hot-water circulation piping.

Ethos Engineering Cameron County Parks Olmito Park Complex

- U. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- F. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

Ethos Engineering Cameron County Parks Olmito Park Complex

- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
 - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
 - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.
- E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.5 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.6 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

3.7 FLEXIBLE CONNECTOR INSTALLATION

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.
- B. Install bronze-hose flexible connectors in copper domestic water tubing.
- C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

- B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.9 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

- 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
- 4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.10 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.11 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source

and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.12 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.13 CLEANING

- A. Clean and disinfect domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

- c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
- d. Repeat procedures if biological examination shows contamination.
- e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of watersample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.14 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, up to NPS 8 and larger, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
- E. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; copper, solder-joint fittings; and brazed joints.
 - 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
- F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; copper, solder-joint fittings; and brazed joints.
 - 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
 - 3. Hard copper tube, ASTM B 88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.

- G. Aboveground, combined domestic water-service and fire-service-main piping, NPS 6 to NPS 12, shall be the following:
 - 1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

3.15 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
 - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
 - 3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
 - 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Backflow preventers.
 - 2. Outlet boxes.
 - 3. Wall hydrants.
 - 4. Water-hammer arresters.
 - 5. Trap-seal primer valves.
 - 6. Trap-seal primer systems.
 - 7. Flexible connectors.
- B. Related Requirements:
 - 1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
 - 2. Section 221116 "Domestic Water Piping" for water meters.
 - 3. Section 223200 "Domestic Water Filtration Equipment" for water filters in domestic water piping.
 - 4. Section 224300 "Medical Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
 - 5. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
 - 6. Section 224713 "Drinking Fountains" for water filters for water coolers.
 - 7. Section 224716 "Pressure Water Coolers" for water filters for water coolers.
 - 8. Section 224723 "Remote Water Coolers" for water filters for water coolers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.
 - 1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

Ethos Engineering Cameron County Parks Olmito Park Complex

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G [and NSF 14].[Mark "NSF-pw" on plastic piping components.]

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: [125 psig (860 kPa)] unless otherwise indicated.

2.3 BACKFLOW PREVENTERS

- A. Reduced-Pressure-Principle Backflow Preventers:
- B. Manufacturers:
 - 1. Zurn
 - 2. Wilkins
 - 3. Or Approved Equal.
- C. Description:
 - 1. Standard: ASSE 1013.
 - 2. Operation: Continuous-pressure applications.
 - 3. Pressure Loss: [12 psig (83 kPa)]
 - 4. Size: see drawings.
 - 5. Body: Bronze for NPS 2 (DN 50) and smalle
 - 6. End Connections: Threaded for NPS 2 (DN 50) and smaller.
 - 7. Configuration: Designed for [horizontal, straight-through] flow.
 - 8. Accessories:
 - a. Valves NPS 2 (DN 50) and Smaller: Ball type with threaded ends on inlet and outlet.
 - b. Valves NPS 2-1/2 (DN 65) and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
 - c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.4 OUTLET BOXES

A. Icemaker Outlet Boxes:

- 1. Manufacturers:
 - a. Guy Gray
 - b. Zurn
 - c. Moen
- 2. Description: See schedule.

2.5 WALL HYDRANTS

- 1. Manufacturers:
 - a. Zurn
 - b. Woodford
 - c. Or Approved Equal
- 2. Description: See schedule.

2.6 WATER-HAMMER ARRESTERS

- A. Water-Hammer Arresters:
 - 1. Manufacturers:
 - a. Zurn.
 - b. Mifab.
 - c. Wade.
 - d. Or "Approved equal".
 - 2. Standard: ASSE 1010 or PDI-WH 201.
 - 3. Type: [Stainless Steel Metal bellows].
 - 4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.7 TRAP-SEAL PRIMER DEVICE

- A. Supply-Type, Trap-Seal Primer Device:
 - 1. Manufacturers:
 - a. PPP or Approved Equal
 - 2. Standard: ASSE 1018.
 - 3. Pressure Rating: 125 psig (860 kPa) minimum.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
 - 6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
 - 7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.8 FLEXIBLE CONNECTORS

- A. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
 - 1. Working-Pressure Rating: Minimum [200 psig (1380 kPa)].
 - 2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
 - 3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 - 1. Locate backflow preventers in same room as connected equipment or system.
 - 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
 - 3. Do not install bypass piping around backflow preventers.
- B. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch (38-by-89mm) fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."
- C. Install water-hammer arresters in water piping according to PDI-WH 201.
- D. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

- A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Reduced-pressure-principle backflow preventers.
 - 2. Outlet boxes.

Ethos Engineering Cameron County Parks Olmito Park Complex

- 3. Supply-type, trap-seal primer valves.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test each [reduced-pressure-principle backflow preventer] [double-check, backflowprevention assembly] [and] [double-check, detector-assembly backflow preventer] according to authorities having jurisdiction and the device's reference standard.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 221119

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.
 - 3. Encasement for underground metal piping.
- B. Related Sections:
 - 1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For sovent drainage system. Include plans, elevations, sections, and details.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

Ethos Engineering Cameron County Parks Olmito Park Complex

1.7 **PROJECT CONDITIONS**

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
 - 2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
- C. Heavy-Duty, Hubless-Piping Couplings:
 - a. Manufacturers:
 - 1) ANACO.
 - 2) Clamp-All Corp.
 - 3) Ideal Div.; Stant Corp.
 - 4) Mission Rubber Co.
 - 5) Tyler Pipe; Soil Pipe Div.
 - 2. Standards: ASTM C 1277 and ASTM C 1540.
 - 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.

- 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Solvent Cement: ASTM D 2564.
 - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
 - 1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
 - 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - 3. Shielded, Nonpressure Transition Couplings:
 - a. Standard: ASTM C 1460.
 - b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
 - 4. Pressure Transition Couplings:
 - a. Standard: AWWA C219.
 - b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
 - c. Center-Sleeve Material: Stainless steel.
 - d. Gasket Material: Natural or synthetic rubber.
 - e. Metal Component Finish: Corrosion-resistant coating or material.
- B. Dielectric Fittings:
 - 1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
 - 2. Dielectric Unions:
 - a. Description:
 - 1) Standard: ASSE 1079.
 - 2) Pressure Rating: 150 psig.
 - 3) End Connections: Solder-joint copper alloy and threaded ferrous.

- 3. Dielectric Flanges:
 - a. Description:
 - 1) Standard: ASSE 1079.
 - 2) Factory-fabricated, bolted, companion-flange assembly.
 - 3) Pressure Rating: 150 psig.
 - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- 4. Dielectric-Flange Insulating Kits:
 - a. Description:
 - 1) Nonconducting materials for field assembly of companion flanges.
 - 2) Pressure Rating: 150 psig.
 - 3) Gasket: Neoprene or phenolic.
 - 4) Bolt Sleeves: Phenolic or polyethylene.
 - 5) Washers: Phenolic with steel backing washers.
- 5. Dielectric Nipples:
 - a. Description:
 - 1) Standard: IAPMO PS 66
 - 2) Electroplated steel nipple.
 - 3) Pressure Rating: 300 psig at 225 deg F.
 - 4) End Connections: Male threaded or grooved.
 - 5) Lining: Inert and noncorrosive, propylene.

2.5 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Standard: ASTM A 674 or AWWA C105/A 21.5.
- B. Material: high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- N. Install aboveground PVC piping according to ASTM D 2665.
- O. Install underground PVC piping according to ASTM D 2321.

- P. Install engineered soil and waste drainage and vent piping systems as follows:
 - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
 - 2. Sovent Drainage System: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions.
 - 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- Q. Plumbing Specialties:
 - 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
 - 2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- B. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in OD's.
 - 2. In Drainage Piping: Shielded, nonpressure transition couplings.
 - 3. In Aboveground Force Main Piping: Fitting-type transition couplings.
 - 4. In Underground Force Main Piping:

- a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
- b. NPS 2 and Larger: Pressure transition couplings.
- B. Dielectric Fittings:
 - 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - 2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
 - 3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.
 - 4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
 - 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
 - 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 2. NPS 3: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.

- 4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
- 5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- H. Install supports for vertical PVC piping every 48 inches.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 - 5. Comply with requirements for cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
 - 6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make connections according to the following unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- A. Underground and above ground (unless noted otherwise), soil, waste, and vent piping shall be the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.
- B. In Return Air Plenum: Soil, waste, and vent piping shall be the following:
 - 1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

END OF SECTION 221316

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Roof flashing assemblies.
 - 4. Through-penetration firestop assemblies.
 - 5. Miscellaneous sanitary drainage piping specialties.
 - 6. Flashing materials.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
 - 1. Wiring Diagrams: Power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

- 1.6 QUALITY ASSURANCE
 - A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
 - 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 NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.7 COORDINATION

A. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

- A. Metal Floor Cleanouts:
 - 1. ASME A112.36.2M, Cast-Iron Cleanouts: see detail on plans.
 - 2. Standard: ASME A112.36.2M for [cast-iron soil pipe with cast-iron ferrule] [threaded, adjustable housing] cleanout.
 - 3. Size: Same as connected branch.
 - 4. Type: [Threaded, adjustable housing].
 - 5. Body or Ferrule: [Cast iron].
 - 6. Clamping Device: [Required].
 - 7. Outlet Connection: [Threaded].
 - 8. Closure: [Cast-iron plug].
 - 9. Adjustable Housing Material: [Cast iron] with [threads].
 - 10. Frame and Cover Material and Finish: [Nickel-bronze, copper alloy]
 - 11. Frame and Cover Shape: [Round].
 - 12. Top Loading Classification: [Medium] Duty.
- B. Plastic Wall Cleanouts:
 - 1. See detail on plans.
 - 2. Size: Same as connected branch.
 - 3. Body: PVC.
 - 4. Closure Plug: Stainless Steel.
 - 5. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

2.2 FLOOR DRAINS

- A. Manufacturers:
 - 1. Zurn.
 - 2. Mifab.
 - 3. Josam.
 - 4. Wade.
 - 5. Watts.
- B. Description: See schedules.

2.3 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies:
 - Description: Manufactured assembly made of [6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch-(2.4-mm-)] thick, lead flashing collar and skirt extending at least [6 inches (150 mm)] from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
 - a. Open-Top Vent Cap: Without cap.
 - b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
 - c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

- A. Through-Penetration Firestop Assemblies:
 - 1. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
 - 2. Size: Same as connected soil, waste, or vent stack.
 - 3. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
 - 4. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
 - 5. Special Coating: Corrosion resistant on interior of fittings.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Floor-Drain, Trap-Seal Primer Fittings:
 - 1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
 - 2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

- B. Air-Gap Fittings:
 - 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
 - 2. Body: Bronze or cast iron.
 - 3. Inlet: Opening in top of body.
 - 4. Outlet: Larger than inlet.
 - 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
- C. Sleeve Flashing Device:
 - 1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend [1 inch (25 mm)] [2 inches (51 mm)] <Insert dimension> above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
 - 2. Size: As required for close fit to riser or stack piping.
- D. Stack Flashing Fittings:
 - 1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
 - 2. Size: Same as connected stack vent or vent stack.

2.6 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
 - 1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
 - 2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
 - 3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.
- B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
 - 1. General Applications: 12 oz./sq. ft. (3.7 kg/sq. m or 0.41-mm thickness).
 - 2. Vent Pipe Flashing: 8 oz./sq. ft. (2.5 kg/sq. m or 0.27-mm thickness).
- C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04inch (1.01-mm) minimum thickness, unless otherwise indicated. Include G90 (Z275) hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm) minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.
- H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 - 1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
 - 2. Locate at each change in direction of piping greater than 45 degrees.
 - 3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
 - 4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 - 1. Position floor drains for easy access and maintenance.
 - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Coordinate with Structural Drawings prior installation.
 - b. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
 - c. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
 - d. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.
 - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

- G. Install through-penetration firestop assemblies in plastic [conductors] [and] [stacks] at floor penetrations.
- H. Assemble open drain fittings and install with top of hub [1 inch (25 mm)] [2 inches (51 mm)] above floor.
- I. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- J. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- M. Install vent caps on each vent pipe passing through roof.
- N. Install wood-blocking reinforcement for wall-mounting-type specialties.
- O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.

Ethos Engineering Cameron County Parks Olmito Park Complex

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.5 **PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Commercial, electric, storage, domestic-water heaters.
 - 2. Flow-control, electric, tankless, domestic-water heaters.
 - 3. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of commercial and tankless, electric, domestic-water heater, from manufacturer.
- B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- C. Source quality-control reports.
- D. Field quality-control reports.
- E. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- C. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components Health Effects."

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including storage tank and supports.
 - b. Faulty operation of controls.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Periods: From date of Substantial Completion.
 - a. Commercial, Electric, Domestic-Water Booster Heaters:
 - 1) Controls and Other Components: Five years.
 - b. Commercial, Electric, Storage, Domestic-Water Heaters:
 - 1) Storage Tank: Ten years.
 - 2) Controls and Other Components: Five years.
 - c. Electric, Tankless, Domestic-Water Heaters: Five year(s).
 - d. Compression Tanks: Ten years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

- A. Commercial, Electric, Domestic-Water Heaters:
 - 1. Commercial, Storage, Electric Water Heaters:
 - a. Bradford White Co.
 - b. State Industries.
 - c. Rheem
 - d. A.O. Smith
 - 2. Standard: UL 1453.
 - 3. Tank Construction: ASME-code steel with 150-psig working-pressure rating..
 - a. Tappings: Factory fabricated of materials compatible with tank for piping connections, relief valve, pressure gage, thermometer, drain, anode rod, and controls as required. Attach tappings to tank before testing and labeling. ASME B1.20.1 pipe thread.
 - b. Interior Finish: Materials and thicknesses complying with NSF 61, barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.
 - c. Insulation: Comply with ASHRAE 90.1. Surround entire storage tank except connections and controls.
 - d. Jacket: Steel, with enameled finish.
 - 4. Factory-Installed Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - c. Insulation: Comply with ASHRAE/IESNA 90.1.
 - d. Jacket: Steel with enameled finish.
 - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - f. Temperature Control: Adjustable thermostat.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valve. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
 - i. Gages: Combination temperature-and-pressure type or separate thermometer and pressure gage.
 - 5. Special Requirements: NSF 5 construction.
 - 6. Capacity and Characteristics: See Drawings

2.2 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS

- A. Flow-Control, Electric, Tankless, Domestic-Water Heaters:
 - 1. Manufacturers:
 - a. Controlled Energy Corporation.
 - b. Chronomite Laboratories, Inc.
 - c. Eemax.
 - 2. Standard: UL 499 for electric, tankless, (domestic-water heater) heating appliance.
 - 3. Construction: Copper piping or tubing complying with NSF 61 Annex G barrier materials for potable water, without storage capacity.
 - a. Connections: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: 150 psig.
 - c. Heating Element: Resistance heating system.
 - d. Temperature Control: Flow-control fitting.
 - e. Safety Control: High-temperature-limit cutoff device or system.
 - f. Jacket: Aluminum or steel with enameled finish or plastic.
 - 4. Support: Bracket for wall mounting.
 - 5. Capacity and Characteristics: See drawings.

2.3 DOMESTIC-WATER HEATER ACCESSORIES

- A. Domestic-Water Compression Tanks:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. AMTROL Inc.
 - b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - c. State Industries.
 - d. Taco, Inc.
 - e. Rheem
 - 2. Description: Steel pressure-rated tank constructed with welded joints and factoryinstalled butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
 - 3. Construction:
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
 - b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
 - 4. Capacity and Characteristics: See drawings.

- B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.
- C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.
- D. Heat-Trap Fittings: ASHRAE 90.2.
- E. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and calibrated balancing valves to provide balanced flow through each domestic-water heater.
 - 1. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."
 - 2. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."
- F. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig-maximum outlet pressure unless otherwise indicated.
- G. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- H. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than domesticwater heater working-pressure rating.
- I. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- J. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.
- K. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of 18 inches above the floor.
- L. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.4 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

Ethos Engineering Cameron County Parks Olmito Park Complex

- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete." Section 033053 "Miscellaneous Cast-in-Place Concrete."
 - 1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 - 2. Maintain manufacturer's recommended clearances.
 - 3. Arrange units so controls and devices that require servicing are accessible.
 - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 8. Anchor domestic-water heaters to substrate.
- B. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters at least 18 inches above floor on wall bracket.
 - 1. Maintain manufacturer's recommended clearances.
 - 2. Arrange units so controls and devices that require servicing are accessible.
 - 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.
 - 5. Anchor domestic-water heaters to substrate.
- C. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
 - Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- G. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers.
- H. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves and thermometers.
- I. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of 25 psig. Comply with requirements for pressure-reducing valves and water hammer arresters specified in Section 221119 "Domestic Water Piping Specialties."
- J. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- K. Fill electric, domestic-water heaters with water.
- L. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.
- C. Connect hot- and cold-water piping with shutoff valves and unions.
- D. Make connections with dielectric fittings where piping is made of dissimilar metal.

- E. Electrical Connections: Power wiring and disconnect switches are specified in Division 16 Sections. Arrange wiring to allow unit service.
- F. Ground equipment.
 - 1. Tighten electrical connectors and terminals according to manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial and tankless, electric, domestic-water heaters.

END OF SECTION 223300

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following conventional plumbing fixtures and related components:
 - 1. Faucets for lavatories.
 - 2. Flushometers.
 - 3. Toilet seats.
 - 4. Protective shielding guards.
 - 5. Fixture supports.
 - 6. Water closets.
 - 7. Lavatories.
- B. Related Sections include the following:
 - 1. Division 10 Section "Toilet, Bath, and Laundry Accessories."
 - 2. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers, floor drains, and specialty fixtures not included in this Section.
 - 3. Division 22 Section "Drinking Fountains and Water Coolers."
 - 4. Division 31 Section "Facility Water Distribution Piping" for exterior plumbing fixtures and hydrants.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- F. FRP: Fiberglass-reinforced plastic.

- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.
- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

1.4 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For plumbing fixtures to include in emergency, operation, and maintenance manuals.
- D. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
 - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- 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. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- F. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- G. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

- 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
- 2. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
- 3. Stainless-Steel Commercial, Handwash Sinks: NSF 2 construction.
- 4. Vitreous-China Fixtures: ASME A112.19.2M.
- 5. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
- 6. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- H. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
 - 1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
 - 2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
 - 3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
 - 4. Faucets: ASME A112.18.1.
 - 5. Hose-Connection Vacuum Breakers: ASSE 1011.
 - 6. Hose-Coupling Threads: ASME B1.20.7.
 - 7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
 - 8. NSF Potable-Water Materials: NSF 61.
 - 9. Pipe Threads: ASME B1.20.1.
 - 10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
 - 11. Supply Fittings: ASME A112.18.1.
 - 12. Brass Waste Fittings: ASME A112.18.2.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
 - 1. Atmospheric Vacuum Breakers: ASSE 1001.
 - 2. Brass and Copper Supplies: ASME A112.18.1.
 - 3. Dishwasher Air-Gap Fittings: ASSE 1021.
 - 4. Plastic Tubular Fittings: ASTM F 409.
 - 5. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
- J. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 - 1. Flexible Water Connectors: ASME A112.18.6.
 - 2. Floor Drains: ASME A112.6.3.
 - 3. Grab Bars: ASTM F 446.
 - 4. Hose-Coupling Threads: ASME B1.20.7.
 - 5. Off-Floor Fixture Supports: ASME A112.6.1M.
 - 6. Pipe Threads: ASME B1.20.1.
 - 7. Plastic Toilet Seats: ANSI Z124.5.
 - 8. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 WARRANTY

- A. Special Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace components of whirlpools that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Structural failures of unit shell.
- b. Faulty operation of controls, blowers, pumps, heaters, and timers.
- c. Deterioration of metals, metal finishes, and other materials beyond normal use.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

- A. Lavatory Faucets:
 - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - a. Willoughby Industries.
 - b. Kohler Co.
 - c. Sloan Valve Company
 - 2. Description: See plumbing schedule.

2.2 FLUSHOMETERS

- A. Flushometers:
 - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - a. Willoughby Industries.
 - b. Sloan Valve Company
 - 2. Description: See plumbing schedule.

2.3 TOILET SEATS

- A. Toilet Seats:
 - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - a. American Standard Companies, Inc.
 - b. Bemis Manufacturing Company.
 - c. Kohler Co.
 - 2. Description: See plumbing schedule.

2.4 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. TRUEBRO, Inc.
 - 2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and coldwater supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.5 FIXTURE SUPPORTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. MIFAB Manufacturing Inc.
 - 2. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Water-Closet Supports:
 - 1. Description: See plumbing schedule.
- C. Lavatory Supports:
 - 1. Description: See plumbing schedule.
- D. Sink Supports:
 - 1. Description: See plumbing schedule.

2.6 WATER CLOSETS

- A. Water Closets:
 - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - a. Willoughby Industries.
 - b. Kohler Co.
 - 2. Description: See plumbing schedule.

2.7 LAVATORIES

A. Lavatories:

- 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
 - a. Willoughby Industries. Kohler Co.
 - b. Kohler co.
- 2. Description: See plumbing schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
 - 1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
 - 2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
 - 3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.
- G. Install counter-mounting fixtures in and attached to casework.

- H. Install fixtures level and plumb according to roughing-in drawings.
- I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
 - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with fixture. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
- J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- L. Install flushometer valves for accessible water closets with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- M. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- N. Install toilet seats on water closets.
- O. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- P. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- Q. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- R. Install traps on fixture outlets.
 - 1. Exception: Omit trap on fixtures with integral traps.
 - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- S. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Escutcheons for Plumbing Piping."
- T. Set service basins in leveling bed of cement grout. Grout is specified in Division 22 Section "Common Work Results for Plumbing."
- U. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets and flushometer valves to produce proper flow and stream.
- D. Replace washers and seals of leaking and dripping faucets and stops.
- E. Install fresh batteries in sensor-operated mechanisms.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

- 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
- 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

3.7 **PROTECTION**

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224000

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes drinking fountains and related components.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of drinking fountain.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include operating characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For drinking fountains to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" for fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- D. ARI Standard: Comply with ARI's "Directory of Certified Drinking Water Coolers" for style classifications.
- E. ARI Standard: Comply with ARI 1010, "Self-Contained, Mechanically Refrigerated Drinking-Water Coolers," for water coolers and with ARI's "Directory of Certified Drinking Water Coolers" for type and style classifications.
- F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a refrigerant, unless otherwise indicated.

SECTION 224713 - DRINKING FOUNTAINS

1.6 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. Filter Cartridges: Equal to 10 percent of amount installed for each type and size indicated, but no fewer than 3 of each.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS

- A. Drinking Fountains: See Drawings for schedules and description.
 - 1. Manufacturers:
 - a. Elkay Manufacturing Co.
 - b. Acorn Engineering Co.

2.2 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Josam Co.
 - 2. MIFAB Manufacturing, Inc.
 - 3. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.
 - 1. Type I: Hanger-type carrier with two vertical uprights.
 - 2. Type II: Bilevel, hanger-type carrier with three vertical uprights.
 - 3. Supports for Accessible Fixtures: Include rectangular, vertical, steel uprights instead of steel pipe uprights.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

Ethos Engineering Cameron County Parks Olmito Park Complex

SECTION 224713 - DRINKING FOUNTAINS

- B. Set pedestal drinking fountains on floor.
- C. Install recessed drinking fountains secured to wood blocking in wall construction.
- D. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation.
- F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Install ball or gate shutoff valve on water supply to each fixture. Comply with valve requirements.
- D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust water cooler temperature settings.

3.5 FIELD QUALITY CONTROL

- A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.
 - 1. Remove and replace malfunctioning units and retest as specified above.
 - 2. Report test results in writing.

SECTION 224713 - DRINKING FOUNTAINS

3.6 CLEANING

- A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
- C. Provide protective covering for installed fixtures.
- D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224713

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 23 Specification Sections, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, and is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.
- B. Mechanical Contract Documents were prepared for the Project by: Ethos Engineering, 1126 South Commerce Street Harlingen, Texas 78550 Phone Number: (956) 230-3435
- C. Scope of Work: Refer to drawings for a detailed Scope of Work.
 - 1. Provide all materials and labor associated with new fully-operational mechanical and controls systems for the project "Cameron County Olmito Park", including but not limited to the following:
 - a. Space conditioning split system units with indoor AHUs, direct-expansion cooling with staged compressors, electric heaters, and accessories for a complete and operational system.
 - b. Ductwork, diffusers, grilles, dynamic fire dampers, control dampers, exhaust fans, louvers, and other accessories.
 - c. Testing, Adjusting, & Balancing (TAB) shall not be provided under the mechanical contract. General contractor to provide TAB. Coordinate work.
 - d. Shop drawing submittals for all mechanical systems including but not limited to equipment, ductwork and piping.
 - e. Coordination drawings for placing of mechanical systems in relation to work by other disciplines.
 - f. Contractor is responsible for providing wind-storm certification inspections and certifications for exterior mounted equipment. Contractor must notify Inspector prior to installing equipment, and apprise inspector of work scheduling involving equipment requiring wind inspection / certification, so that inspections may be carried out at required stage(s) of construction. Cost for inspection shall be borne by the Contractor. Inspector shall be certified by the Texas Department of Insurance (see www.tdi.state.tx.us for a list of certified Inspectors).
 - g. Coordinate electrical work with Div. 26 as required.
 - h. Coordinate fire alarm related work with Fire Alarm Contractor. Provide smoke detectors, wiring and controls for units, 2000 cfm and larger, where none exist.
 - 2. <u>Painting</u>: See Division 9 specifications. Paint all exposed piping, ductwork, insulation, hangers, accessories in interior exposed areas. Paint exterior pipe supports. Coordinate paint type, color and scope of work with Architect.

1.3 ALLOWANCES

A. Allowances are included in the Division 1 specifications.

1.4 COORDINATION

- A. All mechanical work shall be done under sub-contract to a General Contractor. Mechanical Contractor shall coordinate all work through General Contractor, who is ultimately responsible for the entire project.
- B. <u>Prior to bidding</u>, Mechanical Contractor shall coordinate all work in Division-23 for integration with TAB, plumbing, electrical, controls work and general construction. A detailed list of inclusion and exclusions shall be provided to General Contractors at least three days prior to the end of the period set aside to request clarifications so that coordination of any missing items may be addressed and clarified by Architect/Engineer as needed.
- C. All electrical work required for operation of mechanical systems shall be coordinated through the General Contractor <u>prior to bidding</u> to ensure that all starters, disconnects, VFD's, conduit and wiring are provided as part of the project. All components needed for a full operational installation of systems shall be provided.
- D. All controls required for operation of mechanical systems shall be coordinated <u>prior to bidding</u>, to ensure that all equipment, materials, sensors, devices and labor are provided as part of the project. All components needed for a full operational installation of systems shall be provided. Mechanical Contractor shall coordinate and supervise installation of all controls systems.
- E. All questions, requests for information, submittals, and correspondence from the Div. 23 Contractor shall be submitted via the General Contractor, who will forward to the Architect, who will then forward to the Engineer.
- F. Div. 23 Contractor shall not make any changes to design without written authorization from the Engineer. If changes are requested by the Owner, Architect, General Contractor, Suppliers, Manufacturers, or any others, Contractor should issue a written RFI for response by the Engineer.
- G. Div. 23 Contractor shall issue seven days written notice prior to any activities that require the presence of the Engineer at the job-site. This applies to all inspections required by specifications, and particularly to those where work will be covered.
- H. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Ensure that systems are ready for controls and electrical connections when needed so as to not delay construction.
- I. Contractor shall coordinate with other divisions for power and control of mechanical systems. It is not the intent of this specification to dictate who will conduct work, only to state the requirements of conducting the work.
- J. Coordinate with Div. 1 for work sequence and optimization of construction schedule.
- K. Coordinate with Div. 21 for Fire Suppression System.

- L. Coordinate with Div. 22 for Plumbing System.
- M. Coordinate with Div. 26 electrical contractor for providing power to mechanical equipment, and for Fire Alarm Systems interface with mechanical systems.
- N. Coordinate TAB activities with TAB Contractor.
- O. Coordinate commissioning activities with Commissioning Agent.
- P. Issue written notification of the following tasks and allow five (5) days for Engineer to respond and schedule an inspection as required. Failure to issue written notification may result in work having to be redone to allow for proper inspection. It is contractor's responsibility to make sure Engineer receives notification.
 - 1. Upon completion of ductwork and prior to testing and insulating.
 - 2. Metal duct leakage testing.
 - 3. Above ceiling inspections prior to ceiling tile installation.
 - 4. When ready to request manufacturer's start-up of each piece of equipment.
 - 5. When ready for Systems Readiness Checklists (Commissioning).
 - 6. When ready for Functional Performance testing (Commissioning).
 - 7. When ready for an inspection by TAB contractor prior to developing detailed TAB Plan.
 - 8. When ready to conduct complete Automation System software demonstration.
 - 9. When ready for Substantial Completion Inspection.
 - 10. When ready for Final Inspection.
- Q. General
 - 1. The Contractor shall execute all work hereinafter specified or indicated on accompanying Drawings. Contractor shall provide all equipment necessary and usually furnished in connection with such work and systems whether or not mentioned specifically herein or on the Drawings.
 - 2. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation and thereby to provide an integrated satisfactory operating installation.
 - 3. The Mechanical, Electrical, Plumbing, and associated Drawings are necessarily diagrammatic by their nature, and are not intended to show every connection in detail or every pipe or conduit in its exact location. These details are subject to the requirements of standards referenced elsewhere in these specifications, and structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be organized and laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.
 - 4. When the mechanical, electrical and plumbing drawings do not give exact details as to the elevation of pipe, conduit and ducts, the Contractor shall physically arrange the systems to fit in the space available at the elevations intended with proper grades for the functioning of the system involved. Piping, exposed conduit and the duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner. The Drawings do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas.

1.5 WORK SEQUENCE

A. Locate Utilities:

- 1. Coordinate with power, water, sewer, telephone, communications, and other utilities as well as designated Owner's personnel to locate all utilities prior to digging in any area.
- 2. Obtain any approvals required from utilities to relocate utilities.
- 3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.
- 4. Where several new utilities must share a common area or path, coordinate with other trades so that the proper clearances are maintained and utilities may be installed in compliance with all requirements.
- 5. Refer to Civil Plans for coordination of connection points from site utilities to buildings.
- B. Coordinate with Division 1 requirements to optimize construction schedule.
- C. Provide equipment and material submittals, coordination drawings and shop drawings as required by specifications.
- D. Submit detailed mechanical Schedule of Values with Submittals. Mechanical Submittals will not be accepted without a detailed Schedule of Values.
- E. Sequence construction in coordination with work by other disciplines.

1.6 CONTRACTOR USE OF PREMISES

- A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
 - 1. Driveways and Entrances: Keep driveways and entrances to construction site clear and available to other Contractors, Owner, and A/E personnel at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:
 - 1. Temporary fencing around construction areas.
 - 2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
 - 3. Temporary fencing around equipment while site work is in progress.

1.7 SUBMITTALS

A. Manufacturer's standard dimensioned drawings, performance and product data shall be edited to delete reference to equipment, features, or information which is not applicable to the equipment being supplied for this project.

- B. Provide all mechanical submittals at the same time in one or multiple bound volumes. Include originals from manufacturer. All submittals shall be in native pdf and searchable format. Faxes and copies of faxes are not acceptable.
- C. Provide sufficient copies of approved data, with the engineer's approved stamp, for inclusion in the operations and maintenance manuals.
- D. Provide detailed coordination drawings showing how mechanical system components will be installed in coordination with work by others. Engineer's drawing files will be made available to Contractor for producing coordination and as-built drawings upon request.

1.8 SCHEDULE OF VALUES -Special Requirements

A. Mechanical Contractor shall submit a Schedule of Values reflecting the total value of Mechanical Work in the Contract, and broken down into the following items as a minimum, with a line-item for Materials/Equipment and another for Labor:

MECHANICAL

- 1. HVAC equipment
- 2. HVAC materials (ductwork, piping, dampers)
- 3. HVAC labor
- 4. TAB
- 5. Allowances.
- 6. Miscellaneous
- 7. Administrative and project management.
- B. Schedule of Values shall be included with bound submittals. Submittals without a Schedule of Values shall not be reviewed.

1.9 EQUIPMENT MANUFACTURERS

- A. Mechanical design is based on equipment and materials scheduled and specified. These are used as the basis for performance characteristics, quality, and physical dimensions/weight.
- B. Equipment and materials by other APPROVED manufacturers may be provided by Contractor. In doing so, Contractor assumes responsibility for the performance, quality, and physical dimensions of the proposed units.
- C. Any costs associated with modifications to the design due to submittal of equipment and/or materials other than those used as the basis of design are the Contractor's responsibility. This includes any design time, production of drawings, and time delays.
- D. Where use of equipment and/or materials other than those used as the basis of design impact other disciplines, Contractor shall assume responsibility for all costs associated with any APPROVED modifications. This may include resizing of electrical circuits, modifying openings in the structure, relocating floor drains, etc.

- 1.10 OPERATIONS AND MAINTENANCE MANUALS & TRAINING
 - A. Submit Operations and Maintenance Manuals two weeks prior to Substantial Completion Inspection. Engineer will not conduct a Substantial Completion Inspection without having reviewed Operations and Maintenance Manuals.
 - B. Use Operations and Maintenance Manuals as a guide for conducting training of Owner's personnel.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 230010

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet 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.

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque. Unless otherwise noted, windings shall be:
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: 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.

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 HP shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. 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.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

- A. Manufacturers:
 - 1. Smith, Jay R. Mfg. Co.
 - 2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

Ethos Engineering Cameron County Parks Olmito Park Complex

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. Metraflex Company (The).
 - 4. Pipeline Seal and Insulator, Inc.
 - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers:
 - 1. Presealed Systems.
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Using grout, seal the space around outside of stack-sleeve fittings.

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade: Cast-iron wall sleeves.
 - 2. Exterior Concrete Walls below Grade: Cast-iron wall sleeves with sleeve-seal system. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs-on-Grade: Cast-iron wall sleeves with sleeve-seal system. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 4. Concrete Slabs above Grade: Galvanized-steel-pipe sleeves.
 - 5. Interior Partitions: Galvanized-steel-pipe sleeves.

END OF SECTION 230517
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Escutcheons.
 - 2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Insulated Piping: One-piece, stamped-steel type.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, castbrass type with polished, chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
 - e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with roughbrass finish.
 - f. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
 - 2. Escutcheons for Existing Piping:
 - a. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
 - f. Bare Piping in Unfinished Service Spaces: Split-casting brass type with roughbrass finish.
 - g. Bare Piping in Equipment Rooms: Split-casting brass type with rough-brass finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One-piece, floor-plate type.
 - 2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230518

Ethos Engineering Cameron County Parks Olmito Park Complex

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe stands.
 - 7. Equipment supports.
- B. Related Sections:
 - 1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Section 230516 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
 - 3. Section 230548.13 "Vibration Controls for HVAC" for vibration isolation devices.
 - 4. Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Pipe stands.
 - 4. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of trapeze hangers.
 - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 - 1. Manufacturers:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Flex-Strut Inc.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut Corporation; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 - 3. Standard: MFMA-4.
 - 4. Channels: Continuous slotted steel channel with inturned lips.
 - 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 - 7. Metallic Coating: Hot-dipped galvanized.
 - 8. Paint Coating: Epoxy.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers:
 - 1. Carpenter & Paterson, Inc.
 - 2. ERICO/Michigan Hanger Co.
 - 3. PHS Industries, Inc.
 - 4. Pipe Shields, Inc.
 - 5. Rilco Manufacturing Company, Inc.
 - 6. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
 - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 2. Base: Plastic.
 - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainlesssteel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
 - 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - 2. Bases: One or more; plastic.
 - 3. Vertical Members: Two or more protective-coated-steel channels.
 - 4. Horizontal Member: Protective-coated-steel channel.
 - 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structuralsteel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbonsteel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

Ethos Engineering Cameron County Parks Olmito Park Complex

- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weightdistribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
 - 5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
 - 6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steelpipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 3. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 - 4. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
 - 5. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 - 6. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 - 7. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

- 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
- 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 - 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 - 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 - 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 - 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 - 6. C-Clamps (MSS Type 23): For structural shapes.
 - 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 - 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 - 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel Ibeams for heavy loads.
 - 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel Ibeams for heavy loads, with link extensions.
 - 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 - 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 - 13. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

- 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
- 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Elastomeric isolation pads.
 - 2. Elastomeric isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Housed-restrained-spring isolators.
 - 5. Elastomeric hangers.
 - 6. Spring hangers.
 - 7. Vibration isolation equipment bases.
- B. Related Requirements:
 - 1. Section 210548.13 "Vibration Controls for Fire Suppression" for devices for firesuppression equipment and systems.
 - 2. Section 220548.13 "Vibration Controls for Plumbing" for devices for plumbing equipment and systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.
- B. Shop Drawings:
 - 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal: For each vibration isolation device.

- 1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.
- D. Wind-Restraint Details:
 - 1. Basic Wind Speed: Refer to Arch.
 - 2. Building Classification Category: Refer to Arch.
 - 3. Code recommended wind pressure multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.
 - 4. Design Analysis: To support selection and arrangement of **wind** restraints. Include calculations of combined tensile and shear loads.
 - 5.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For testing agency.
- C. Welding certificates.
- 1.5 CLOSEOUT SUBMITTALS
 - A. Operation and Maintenance Data: Provide operation and maintenance manuals.
- 1.6 QUALITY ASSURANCE
 - A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ace Mountings Co., Inc.
 - 2. Amber/Booth Company, Inc.
 - 3. California Dynamics Corporation.
 - 4. Isolation Technology, Inc.
 - 5. Kinetics Noise Control.
 - 6. Mason Industries.
 - 7. Vibration Eliminator Co., Inc.

- 8. Vibration Isolation.
- 9. Vibration Mountings & Controls, Inc.
- B. Elastomeric Isolation Pads:
 - 1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 - 2. Size: Factory or field cut to match requirements of supported equipment.
 - 3. Pad Material: Oil and water resistant with elastomeric properties.
 - 4. Surface Pattern: Ribbed or Waffle pattern.
 - 5. Infused nonwoven cotton or synthetic fibers.
 - 6. Load-bearing metal plates adhered to pads.
 - 7. Sandwich-Core Material: Resilient and elastomeric.
 - a. Surface Pattern: Ribbed or Waffle pattern.
 - b. Infused nonwoven cotton or synthetic fibers.
- C. Double-Deflection, Elastomeric Isolation Mounts:
 - 1. Mounting Plates:
 - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded.
 - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
 - 2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.
- D. Restrained Elastomeric Isolation Mounts
 - 1. Description: All-directional isolator with restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - a. Housing: Cast-ductile iron or welded steel.
 - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.
- E. Freestanding, Laterally Stable, Open-Spring Isolators:
 - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 5. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
 - 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- F. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:
 - 1. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

- a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
- b. Top plate with threaded mounting holes elastomeric pad.
- c. Internal leveling bolt that acts as blocking during installation.
- 2. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
- 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
- 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
- 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
- 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- G. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
 - 1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
 - 2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.
- H. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
 - 1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - 7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 - 8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- I. Steel Rails: Factory-fabricated, welded, structural-steel rails.
 - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.
 - a. Include supports for suction and discharge elbows for pumps.
 - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Rails shall have shape to accommodate supported equipment.
 - 3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

- J. Steel Bases: Factory-fabricated, welded, structural-steel bases and rails.
 - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - a. Include supports for suction and discharge elbows for pumps.
 - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - 3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

2.2 VIBRATION ISOLATION EQUIPMENT BASES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amber/Booth Company, Inc.
 - 2. California Dynamics Corporation.
 - 3. Isolation Technology, Inc.
 - 4. Kinetics Noise Control.
 - 5. Mason Industries.
 - 6. Vibration Eliminator Co., Inc.
 - 7. Vibration Isolation.
 - 8. Vibration Mountings & Controls, Inc.
- B. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
 - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - a. Include supports for suction and discharge elbows for pumps.
 - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - 3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
 - 4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

3.3 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 03 Sections.

3.4 VIBRATION-CONTROL AND WIND-RESTRAINT DEVICE INSTALLATION

- A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- B. Install cables so they do not bend across edges of adjacent equipment or building structure.
- C. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- F. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

- 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
- 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
- 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
- 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust active height of spring isolators.

END OF SECTION 230548.13

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Duct labels.
 - 5. Stencils.
 - 6. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

Ethos Engineering Cameron County Parks Olmito Park Complex

- 2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- 3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- 4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- 5. Fasteners: Stainless-steel rivets or self-tapping screws.
- 6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- E. Fasteners: Stainless-steel rivets or self-tapping screws.
- F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- G. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

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- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.4 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- E. Fasteners: Stainless-steel rivets or self-tapping screws.
- F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- G. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.5 WARNING TAGS

- A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches minimum.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Safety-yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

- A. Piping Color Coding: Painting of piping is specified in Division 09 Sections.
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

- 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- E. Pipe Label Color Schedule: Coordinate with Owner.

3.5 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes: Coordinate with Owner.
- B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.7 PAINTING

- A. Clarification: In exposed areas (with no acoustic ceiling tiles), piping and piping insulation shall be painted. Although Division 9 may not specifically call for painting of MEP items, it states paint type and requirements for different materials. To extent possible coordinate painting with Division 9 and with Architect. Where adequate specifications are not available, use the following general guidelines:
 - 1. Ferrous Metal: Semi-Gloss, Alkyd-Enamel Finish: 2 finish coats over an enamel undercoat and primer.
 - a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils. S-W: Kem Kromik Universal Metal Primer B50NZ6/B50WZ1.
 - b. Undercoat: Alkyd, interior enamel undercoat or semi-gloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils. S-W: Pro-mar 200 Interior Alkyd Enamel B34W200 Series.
 - c. Finish Coat: Same as undercoat. Semi-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
 - 2. ASJ Jacket: Semi-Gloss, Acylic-Enamel Finish: 2 finish coats.
 - a. Undercoat: Semi-gloss acrylic latex enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 mils. S-W: Pro-Mar Interior Latex Egg-Shell Enamel B20W200.

- b. Finish Coat: Same as undercoat. Semi-gloss, acrylic latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils
- B. Final colors shall be coordinated with Owner and Architect during construction.

END OF SECTION 230553

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. TAB work shall not be contracted under Division 23 Contractor. Third party TAB Contractor shall be contracted by the Prime Contractor. Coordinate activities and assist TAB Contractor as needed.
- B. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - 2. Testing, Adjusting, and Balancing Equipment:
 - a. Motors.
 - b. Condensing units.
 - c. Heat-transfer coils.
 - 3. Testing, adjusting, and balancing existing systems and equipment.
 - 4. Duct leakage tests.
 - 5. Control system verification.
 - 6. Other tests as specified.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

1.4 PREINSTALLATION MEETING

A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

- 1. Minimum Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Needs for coordination and cooperation of trades and subcontractors.
 - d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Certified TAB reports.
- C. Sample report forms.
- D. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.6 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC.
 - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
 - 2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 "Air Balancing."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 "System Balancing."

1.7 PROJECT CONDITIONS

A. The Owner will occupy portions of existing buildings Owner will occupy the site and existing building during entire TAB period. Reference SECTION 011000 - SUMMARY for more precise dates and stipulations.

B. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

- K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.
- L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine operating safety interlocks and controls on HVAC equipment.
- O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. At least 15 calendar days prior to any on-site TAB measurements taking place, prepare and submit to Engineer a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume, smoke, and fire dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Variable-frequency controllers' startup is complete and safeties are verified.
 - g. Automatic temperature-control systems are operational.
 - h. Ceilings are installed.
 - i. Windows and doors are installed.
 - j. Suitable access to balancing devices and equipment is provided.

3.3 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 Total System Balance" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

- 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
- 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
- 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 SENSOR ACCURACY TESTING

A. Measure accuracy of all sensors (temperature, humidity, dewpoint, pressure, carbon dioxide (CO2), etc.) associated with air conditioning systems and the Building Automation System (BAS).

- B. Provide a written report, separate from and prior to the final TAB report, to include the following:
 - 1. List of each different type of sensor, manufacturer and model, and its accuracy as stated by manufacturer.
 - 2. List of every sensor in the project, identified by room number and associated HVAC unit name.
 - 3. Reading of sensor as measured by TAB, and as simultaneously reported by the BAS and/or other HVAC system, and difference between. (Example format for temperature sensor below.)

Temperature Sensors

	BAS read-	TAB read-	
	ing	ing	
ID	deg F	deg F	Difference
Room 100 / VAV-100	72.4	72.5	-0.1
Room 124 / VAV-124	72.1	71.7	0.4
Room 124 / VAV-124	73.5	71.6	1.9

- 4. List observations regarding sensors installation which may impact satisfactory operation of HVAC systems, such as improper location of sensors.
- C. At direction of Engineer, BAS and/or HVAC systems providers will be required to replace or calibrate sensors based upon this TAB sensors accuracy report. Subsequent to such replacement and calibration, re-measure accuracy of those sensors which were calibrated or replaced and submit report per directions above.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.

- 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
- 4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
- 5. 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 occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
 - 1. Measure airflow of submain and branch ducts.
 - 2. Adjust submain and branch duct volume dampers for specified airflow.
 - 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
 - 1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 - 2. Measure inlets and outlets airflow.
 - 3. Adjust each inlet and outlet for specified airflow.
 - 4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
 - 1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
 - 2. Re-measure and confirm that total airflow is within design.
 - 3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
 - 4. Mark all final settings.
 - 5. Test system in economizer mode. Verify proper operation and adjust if necessary.
 - 6. Measure and record all operating data.
 - 7. Record final fan-performance data.

3.7 PROCEDURES FOR MOTORS

- A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 1. Manufacturer's name, model number, and serial number.
 - 2. Motor horsepower rating.
 - 3. Motor rpm.
 - 4. Phase and hertz.
 - 5. Nameplate and measured voltage, each phase.
 - 6. Nameplate and measured amperage, each phase.
 - 7. Starter size and thermal-protection-element rating.
 - 8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.8 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record fan and motor operating data.

3.9 PROCEDURES FOR REFRIGERANT HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each refrigerant coil:
 - 1. Dry-bulb temperature of entering and leaving air.
 - 2. Wet-bulb temperature of entering and leaving air.
 - 3. Airflow.
 - 4. Air pressure drop.
 - a. Units 6 tons and less: Overall readings (upstream of filters, fan suction, fan discharge) are to be taken for all units. A full test of air pressure drops <u>across</u> <u>every single component of the system</u> (i.e. filters, coils) need be taken <u>only for a representative sample of units</u> as follows:

Qty of units	Full
Installed	Testing
1-10	1
10-20	2
20-30	3
31+	4

- b. Units larger than 6 tons: Readings across **all system components** are to be taken for all units larger than 6 tons.
- B. Where a unit has multiple coils (e.g. main cooling coil and a reheat coil), take and record data for each coil under conditions as close as possible to intended design operation (e.g., with cooling coil producing control-system sub-cooling setpoint, reheat coil producing control-system supply temperature setpoint).

3.10 TEMPERATURE TESTING

- A. During testing, adjusting, and balancing, report 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 2 successive 8hour 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.

D. Data may be trended using Building Automation System. However, calibration of DDC sensors must be verified prior to trending data.

3.11 PROCEDURES FOR INDOOR-AIR QUALITY MEASUREMENTS

- A. After air balancing is complete and with HVAC systems operating at indicated conditions, perform indoor-air quality testing.
- B. Observe and record the following conditions for each HVAC system:
 - 1. The distance between the outside-air intake and the closest exhaust fan discharge, flue termination, or vent termination.
 - 2. Specified filters are installed. Check for leakage around filters.
 - 3. Cooling coil drain pans have a positive slope to drain.
 - 4. Cooling coil condensate drain trap maintains an air seal.
 - 5. Evidence of water damage.
 - 6. Insulation in contact with the supply, return, and outside air is dry and clean.

3.12 DUCT LEAKAGE TESTS

- A. Duct leakage testing will be performed by mechanical installation contractor.
- B. Witness the duct pressure testing and provide written report on results immediately thereafter.
 - 1. Verify that proper test methods are used and that leakage rates are within specified tolerances.
 - 2. Report results of all testing and any deficiencies observed. Provide floor plans in report indicating sections of duct tested, and test criterion.

3.13 CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
 - 1. Verify temperature control system is operating within the design limitations.
 - 2. Verify the operation of lockout or interlock systems.
 - 3. Verify the operation of valve and damper actuators.
 - 4. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
 - 5. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
 - 6. Verify damper leakage is in accordance with submitted performance and not so excessive that it prevents system operation in accordance with design intent.
 - 7. Confirm that the sequences of operation are in compliance with Contract Documents.

3.14 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

- 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
- 2. Air Outlets and Inlets: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.15 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.16 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Report shall be in pdf format where all data in the entire report is searchable. Reports containing PDF scans of paper copies are not acceptable and will be rejected without review.
- B. Report Format:
 - 1. Title page.
 - a. Project name and location.
 - b. Name and address of:
 - 1) TAB specialist.
 - 2) General Contractor.
 - 3) Architect's name and address.
 - 4) Engineer's name and address.
 - 5) General Contractor's name and address.
 - c. Date of report submission.
 - 2. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 - 3. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer, certifying validity and accuracy of field data. Include signature of TAB supervisor who certifies the report.

- 4. Include a page summarizing equipment, devices, and systems which cannot be balanced to specified conditions, reasons why they cannot be so balanced, and recommendations for resolving these issues.
- 5. Provide a summary list of every air handler and fan, with a column for its design and actual CFM, and % deviation from design CFM.
- 6. Include a list of instruments used for procedures, along with proof of calibration.
- 7. Certified field-report data.
- 8. List of abbreviations used in report.
- 9. Nomenclature and data sheets for each item of equipment, including manufacturer's name, type, size. Include, at minimum:
 - a. Fan curves.
 - b. Pump curves.
 - c. Manufacturers' test data.
 - d. Field test reports prepared by system and equipment installers.
 - e. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. Final Report Contents: In addition to items listed above, include:
 - 1. Original test report of sensor accuracy testing.
 - 2. Duct leakage test report.
 - 3. Summary of observations on proper drainage of condensate drain pans for every item of equipment having a condensate drainage system.
 - a. Proper pan slope and pan condensate evacuation.
 - b. Adequate condensate trap depth versus static requirement.
 - c. Adequate slope and lack of 'bellies' in condensate pipe drainage system.
 - d. Proper pumped condensate operation.
 - 4. Field observations list of conditions of filters (verify construction filters are removed and final filters are clean) and filter racks.
 - 5. Field measurements and observations regarding leakage of outdoor air and control air dampers.
 - 6. Certified field-report data for each balanced system, including specified versus final performance, notable characteristics of systems, description of system operation sequence if it varies from the Contract Documents
 - 7. Layouts of air distribution systems from construction as-built drawings.
 - a. Number all air devices and systems referenced in report body.
 - b. Scans of paper drawings are not acceptable. Hand-written notes for numbering devices, duct runs, etc., are permissible, but the basic floor plans and duct / piping layouts, equipment and devices locations, etc., must be from original pdf files.
 - c. Indicate duct, outlet, and inlet sizes, pipe and valve sizes and locations, locations of major equipment items such as air handlers, fans, air terminal units, pumps, etc., balancing stations.
 - 8. Summary Of Critical Measurements and Setpoints:
 - a. Provide a table which summarizes critical measurements and settings for all HVAC equipment 1HP and larger. Sample tables provided below for pumps and air-side systems showing minimum required information:
| Unit | Design | Measured | Design | Measured | Tap or VFD | Req'd |
|---------|--------|----------|--------|----------|---------------|-------------|
| Name | CFM | CFM | ESP | ESP | Speed Setting | Static Stpt |
| AHU-123 | 1,000 | 990 | 1.50" | 1.10" | 55% | NA |

- * Individual system/unit.
- a. Nameplate, design, and measured performance as described in this specification.
 - 1) The intent of TAB measurements is to prove unit performs in accordance with manufacturer's specified and submitted data. Change setpoints as required to achieve this result. (For example in a dedicated outside air unit with hot gas reheat, set the cooling coil leaving air temperature setpoint and the unit leaving air temperature setpoint to achieve cooling coil design.) Clearly indicate in report the setpoints in effect when measurements were taken.
- b. Include fan and pump curves for units 1.5HP and larger.
- c. For units with VFD speed control: Indicate required VFD speed and whether VFD was speed-limited in its controller settings.
- 10. Floor plans (as-built) showing HVAC unit locations, duct layouts, air terminal devices numbered to match measured data points.
 - a. Show location of air-side pressure sensors, differential or straight pressure, where such sensors are used in control
- 12. List of Abbreviations.
- 13. Checklist of DX HVAC unit inspections: **Sample checklists below.** Include comments as required to explain anomalies or deficiencies. (Engineer will provide sample file in Excel format upon request.)

Unit Inspection Checklist

DX Units	RTU-1	RTU-2	RTU-2
Condensate drain pan is clean			
Condensate pan fully draining, no ponding in pan			
No excessive damper air leakage			
No air leakage @ cabinet, doors, duct connections			
Final air filters installed and clean			
Final filters of type/MERV rating specified			
Coil fins undamaged and/or combed straight			
Fan free of vibration, rotating in correct direction			
Unit interior cleaned and vacuumed			
Access doors open fully & freely			

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

- D. RTU/Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
 - 1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 - 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Cooling-coil static-pressure differential in inches wg.
 - g. Heating-coil static-pressure differential in inches wg.
 - h. Outdoor airflow in cfm.
 - i. Return airflow in cfm.
 - j. Outdoor-air damper position.
 - k. Return-air damper position.
 - 1. Settings for outdoor-, return-, and exhaust-air dampers.
 - 1) Air handling units / RTU's <u>may</u> be designed to operate with fan varying from high to low speed depending upon compressor operation.
 - 2) For such units, TAB must measure required outside air damper (& return, where applicable) position for intake of design ventilation air not only at full fan speed, but at low fan speed as well. Report results in final TAB report.
 - 3) Convey required damper positions to BAS contractor as soon as they are known, prior to submission of final TAB report.
- E. Fan Test Reports: For supply, return, and exhaust fans, include the following:
 - 1. Fan Data:

- a. System identification.
- b. Location.
- c. Make and type.
- d. Model number and size.
- e. Manufacturer's serial number.
- f. Arrangement and class.
- g. Sheave make, size in inches, and bore.
- h. Center-to-center dimensions of sheave and amount of adjustments in inches.
- 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
- 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- F. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated airflow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual airflow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- G. Indoor-Air Quality Measurement Reports for Each HVAC System:
 - 1. HVAC system designation.
 - 2. Date and time of test.
 - 3. Outdoor temperature, relative humidity, wind speed, and wind direction at start of test.
 - 4. Room number or similar description for each location.
 - 5. Measurements at each location.
 - 6. Observed deficiencies.

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

- H. Instrument Calibration Reports:
 - 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.17 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer conditions, perform additional TAB during near-peak summer conditions.

3.18 SUMMARY OF SYSTEMS SCOPE WORK FOR TESTING AND BALANCING

- A. The following systems are to be included in scope of TAB work for this project:
 - 1. Air distribution systems (ducts, dampers, outlets, etc.)
 - 2. Exhaust fans.
 - 3. Split System DX units.

END OF SECTION 230593

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, concealed return located in unconditioned space.
- B. Related Sections:
 - 1. Section 230719 "HVAC Piping Insulation."
 - 2. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

- 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
- 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, and are limited to, the following:
 - 1. Mineral-Fiber Insulation:
 - a. CertainTeed
 - b. Manson.
 - c. Knauf FiberGlass GmbH.
 - d. Owens-Corning Fiberglas Corp.
 - e. Schuller International, Inc.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fireresistant lagging cloths over duct insulation.
 - 3. Service Temperature Range: 0 to plus 180 deg F.
 - 4. Color: White.

2.6 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: Aluminum.
 - 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

2.9 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Width: 4 inches.
 - 2. Thickness: 6.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.

6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.10 SECUREMENTS

- A. Bands:
 - 1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide.
- B. Insulation Pins and Hangers:
 - 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
 - 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 - 1. Comply with requirements in Section 078413 "Penetration Firestopping" and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
 - 1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitordischarge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vaporbarrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 - 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 - 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 - 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 - 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 - 2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
 - 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9.
 - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

- B. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, exposed return located in unconditioned space.
 - 5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 - 6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
 - 7. Outdoor, concealed supply and return.
 - 8. Outdoor, exposed supply and return.
- B. Items Not Insulated:
 - 1. Fibrous-glass ducts.
 - 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 3. Factory-insulated flexible ducts.
 - 4. Factory-insulated plenums and casings.
 - 5. Flexible connectors.
 - 6. Vibration-control devices.
 - 7. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Service: Round & rectangular, supply-air ducts concealed.
 - 1. Material: Mineral-fiber blanket.
 - 2. Thickness: 3 inches (R-8 min).
 - 3. Number of Layers: One.
 - 4. Field-Applied Jacket: Foil and paper.
 - 5. Vapor Retarder Required: Yes.
- B. Service: Round & rectangular, return, outside-air and fume hood exhaust ducts concealed.
 - 1. Material: Mineral-fiber blanket.
 - 2. Thickness: 2 inches (R-6 min).
 - 3. Number of Layers: One.
 - 4. Field-Applied Jacket: Foil and paper.
 - 5. Vapor Retarder Required: Yes.
- C. Service: Round supply, make-up, and outside-air ducts, exposed in conditioned space.

- 1. Double wall, with 2" insulation thickness, and painted.
- D. Service: Return air duct, exposed in conditioned space: No insulation. Paint duct.
- E. Service: Ten feet of supply and return air ducts closest to AHU or FCU.
 - 1. Material: In addition to exterior wrap, provide internal liner for sound attenuation purposes.
 - 2. Thickness: 1 inches.
- F. Service: Ten feet of exhaust air duct closest to where duct penetrates the exterior envelope.
 - 1. Material: Exterior wrap.
 - 2. Thickness: 2 inches.
- G. Where ductwork is not completely concealed, paint all ductwork and insulation. Coordinate color and finish with Architect.

END OF SECTION 230713

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
 - 1. Condensate drain piping, indoors.
 - 2. Refrigerant piping, indoors and outdoors.
- B. Related Sections:
 - 1. Section 230713 "Duct Insulation."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.
 - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 5. Detail removable insulation at piping specialties.
 - 6. Detail application of field-applied jackets.
 - 7. Detail application at linkages of control devices.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

Packaging: Insulation material containers shall be marked by manufacturer with appropriate A. ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- Coordinate sizes and locations of supports, hangers, and insulation shields specified in A. Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- Schedule insulation application after pressure testing systems and, where required, after A. installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- Complete installation and concealment of plastic materials as rapidly as possible in each area of B. construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- Manufacturers: Subject to compliance with requirements, manufacturers offering products that A. may be incorporated into the Work include, but are not limited to, the following: 1.
 - Flexible Elastomeric Thermal Insulation:
 - Aeroflex USA Inc.: Aerocel. a
 - Armacell LLC; AP Armaflex. b.
 - RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180. c.

2.2 INSULATION MATERIALS

- Mineral-fiber insulation will NOT be allowed for use on any cold piping systems. A.
- Mineral-fiber wrap is NOT approved for use on piping insulation. B.
- C. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

- D. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- E. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- F. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- G. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- H. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products:
 - a. Aeroflex USA Inc.; Aeroseal.
 - b. Armacell LCC; 520 Adhesive.
 - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - d. RBX Corporation; Rubatex Contact Adhesive.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fireresistant lagging cloths over pipe insulation.
 - 3. Service Temperature Range: 0 to plus 180 deg F.
 - 4. Color: White.

2.6 SEALANTS

- A. Joint Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Permanently flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 4. Color: White or gray.
 - 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. FSK and Metal Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: Aluminum.
 - 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Flashing Sealants, Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: White.
 - 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.10 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. Metal Jacket:
 - 1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 - d. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil-thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.11 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 11.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 6.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Width: 2 inches.
 - 2. Thickness: 3.7 mils.
 - 3. Adhesion: 100 ounces force/inch in width.
 - 4. Elongation: 5 percent.
 - 5. Tensile Strength: 34 lbf/inch in width.

2.12 SECUREMENTS

- A. Bands:
 - 1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

- 1. Verify that systems to be insulated have been tested and are free of defects.
- 2. Verify that surfaces to be insulated are clean and dry.
- 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range. <u>NO EXCEPTION:</u> <u>PIPES SHALL BE PAINTED.</u>
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.

- 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
- 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.

- 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
- 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
- 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt

each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

- 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
- 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
- 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
- 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
- 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 - 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 - 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with the wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe

insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 - 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 3. Install insulation to flanges as specified for flange insulation application.
 - 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 - 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 - 2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
 - 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
 - 1. Draw jacket material smooth and tight.
 - 2. Install lap or joint strips with same material as jacket.
 - 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 - 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 - 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

- A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 Sections.
 - Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of fittings, two locations of strainers, three locations of valves, for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.

1.

3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
 - All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 3/4 inch thick.
 - b. Vapor Retarder Required: Yes.
 - c. Finish: Painted (Coordinate with Architect).
- B. Refrigerant Suction and Hot-Gas Piping:
 - 1. All Pipe Sizes: Insulation shall be:
 - a. Flexible Elastomeric: **1 inch** thick minimum, with two coats of protective coating recommended by the insulation manufacturer.
 - b. Vapor Retarder Required: Yes.
 - c. Finish: Painted (Coordinate with Architect).

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

3.14 OUTDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping:
 - 1. All Pipe Sizes: Insulation shall be:
 - a. Flexible Elastomeric: **1 inch** thick minimum, with two coats of protective coating recommended by the insulation manufacturer.
 - b. Vapor Retarder Required: Yes.
 - c. Field-Applied Jacket: Aluminum jacket.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

1. Aluminum, Smooth with Z-Shaped Locking Seam: 0.020 inch thick.

3.16 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 230719

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Refrigerant pipes and fittings.
 - 2. Refrigerant piping valves and specialties.
 - 3. Refrigerants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of valve and refrigerant piping specialty.
 - 1. Include pressure drop, based on manufacturer's test data, for the following:
 - a. Thermostatic expansion valves.
 - b. Solenoid valves.
 - c. Hot-gas bypass valves.
 - d. Filter dryers.
 - e. Strainers.
 - f. Pressure-regulating valves.
- B. Shop Drawings:
 - 1. Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes; flow capacities; valve arrangements and locations; slopes of horizontal runs; oil traps; double risers; wall and floor penetrations; and equipment connection details.
 - 2. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
 - 3. Show interface and spatial relationships between piping and equipment.
 - 4. Shop Drawing Scale: 1/4 inch equals 1 foot.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to 2010 ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-134a:
 - 1. Suction Lines for Air-Conditioning Applications: 115 psig.
 - 2. Suction Lines for Heat-Pump Applications: 225 psig.
 - 3. Hot-Gas and Liquid Lines: 225 psig.
- B. Line Test Pressure for Refrigerant R-407C:
 - 1. Suction Lines for Air-Conditioning Applications: 230 psig.
 - 2. Suction Lines for Heat-Pump Applications: 380 psig.
 - 3. Hot-Gas and Liquid Lines: 380 psig.
- C. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Suction Lines for Heat-Pump Applications: 535 psig.
 - 3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type L, Type ACR.
- B. Wrought-Copper Fittings: ASME B16.22.

- C. Wrought-Copper Unions: ASME B16.22.
- D. Brazing Filler Metals: AWS A5.8/A5.8M.
- E. Flexible Connectors:
 - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
 - 2. End Connections: Socket ends.
 - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inchlong assembly.
 - 4. Working Pressure Rating: Factory test at minimum 500 psig.
 - 5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
 - 1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
 - 2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
 - 3. Operator: Rising stem and hand wheel.
 - 4. Seat: Nylon.
 - 5. End Connections: Socket, union, or flanged.
 - 6. Working Pressure Rating: 500 psig.
 - 7. Maximum Operating Temperature: 275 deg F.
- B. Packed-Angle Valves:
 - 1. Body and Bonnet: Forged brass or cast bronze.
 - 2. Packing: Molded stem, back seating, and replaceable under pressure.
 - 3. Operator: Rising stem.
 - 4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
 - 5. Seal Cap: Forged-brass or valox hex cap.
 - 6. End Connections: Socket, union, threaded, or flanged.
 - 7. Working Pressure Rating: 500 psig.
 - 8. Maximum Operating Temperature: 275 deg F.
- C. Check Valves:
 - 1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
 - 2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
 - 3. Piston: Removable polytetrafluoroethylene seat.
 - 4. Closing Spring: Stainless steel.
 - 5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
 - 6. End Connections: Socket, union, threaded, or flanged.
 - 7. Maximum Opening Pressure: 0.50 psig.
 - 8. Working Pressure Rating: 500 psig.
 - 9. Maximum Operating Temperature: 275 deg F.
- D. Service Valves:
 - 1. Body: Forged brass with brass cap including key end to remove core.
 - 2. Core: Removable ball-type check valve with stainless-steel spring.

- 3. Seat: Polytetrafluoroethylene.
- 4. End Connections: Copper spring.
- 5. Working Pressure Rating: 500 psig.
- E. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).
 - 1. Body and Bonnet: Plated steel.
 - 2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Threaded.
 - 5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
 - 6. Working Pressure Rating: 400 psig.
 - 7. Maximum Operating Temperature: 240 deg F.
- F. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
 - 1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
 - 2. Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Seat: Polytetrafluoroethylene.
 - 4. End Connections: Threaded.
 - 5. Working Pressure Rating: 400 psig.
 - 6. Maximum Operating Temperature: 240 deg F.
- G. Thermostatic Expansion Valves: Comply with AHRI 750.
 - 1. Body, Bonnet, and Seal Cap: Forged brass or steel.
 - 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Packing and Gaskets: Non-asbestos.
 - 4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
 - 5. Suction Temperature: 40 deg F.
 - 6. Reverse-flow option (for heat-pump applications).
 - 7. End Connections: Socket, flare, or threaded union.
- H. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
 - 1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
 - 2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
 - 3. Packing and Gaskets: Non-asbestos.
 - 4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
 - 5. Seat: Polytetrafluoroethylene.
 - 6. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter and 24-V ac coil.
 - 7. End Connections: Socket.
 - 8. Throttling Range: Maximum 5 psig.
 - 9. Working Pressure Rating: 500 psig.
 - 10. Maximum Operating Temperature: 240 deg F.
- I. Straight-Type Strainers:
 - 1. Body: Welded steel with corrosion-resistant coating.
 - 2. Screen: 100-mesh stainless steel.
 - 3. End Connections: Socket or flare.
 - 4. Working Pressure Rating: 500 psig.

- 5. Maximum Operating Temperature: 275 deg F.
- J. Moisture/Liquid Indicators:
 - 1. Body: Forged brass.
 - 2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
 - 3. Indicator: Color coded to show moisture content in parts per million (ppm).
 - 4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
 - 5. End Connections: Socket or flare.
 - 6. Working Pressure Rating: 500 psig.
 - 7. Maximum Operating Temperature: 240 deg F.
- K. Permanent Filter Dryers: Comply with AHRI 730.
 - 1. Body and Cover: Painted-steel shell.
 - 2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
 - 3. Desiccant Media: Activated alumina, charcoal.
 - 4. Designed for reverse flow (for heat-pump applications).
 - 5. End Connections: Socket.
 - 6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
 - 7. Working Pressure Rating: 500 psig.
 - 8. Maximum Operating Temperature: 240 deg F.
- L. Receivers: Comply with AHRI 495.
 - 1. Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
 - 2. Comply with UL 207; listed and labeled by an NRTL.
 - 3. Body: Welded steel with corrosion-resistant coating.
 - 4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
 - 5. End Connections: Socket or threaded.
 - 6. Working Pressure Rating: 500 psig.
 - 7. Maximum Operating Temperature: 275 deg F.
- M. Liquid Accumulators: Comply with AHRI 495.
 - 1. Body: Welded steel with corrosion-resistant coating.
 - 2. End Connections: Socket or threaded.
 - 3. Working Pressure Rating: 500 psig.
 - 4. Maximum Operating Temperature: 275 deg F.

2.4 REFRIGERANTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Arkema Inc.
 - 2. DuPont Fluorochemicals Div.
 - 3. Genetron Refrigerants; Honeywell International Inc.
 - 4. Mexichem Fluor Inc.
- B. ASHRAE 34, R-134a: Tetrafluoroethane.

- C. ASHRAE 34, R-407C: Difluoromethane/Pentafluoroethane/1,1,1,2-Tetrafluoroethane.
- D. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

2.5 REFRIGERANT PIPING SUPPORT EXTERIOR TO BUILDING

A. Exterior: Pre-manufactured strut supports; 3/8" stainless steel threaded rods holding 7" long aluminum cross-strut, stainless steel bolts, 3" to 6" adjustable height, molded 33% fiberglass reinforced nylon support base; UV stabilized. MAPA Products, type MS-2 or MS-3.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
- B. Suction Lines NPS 2 to NPS 4 for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed joints.
- C. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
- D. Safety-Relief-Valve Discharge Piping: Schedule 40, black-steel and wrought-steel fittings with welded joints.
- E. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.
- F. Safety-Relief-Valve Discharge Piping: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install diaphragm packless valves in suction and discharge lines of compressor.
- B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.
- E. Install a full-size, three-valve bypass around filter dryers.

- F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.
- G. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 - 1. Install valve so diaphragm case is warmer than bulb.
 - 2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 - 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- H. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.
- I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- J. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:
 - 1. Solenoid valves.
 - 2. Thermostatic expansion valves.
 - 3. Hot-gas bypass valves.
 - 4. Compressor.
- K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.
- L. Install receivers sized to accommodate pump-down charge.
- M. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
SECTION 232300 - REFRIGERANT PIPING

- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in protective conduit where installed belowground.
- N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- O. Slope refrigerant piping as follows:
 - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
 - 2. Install horizontal suction lines with a uniform slope downward to compressor.
 - 3. Install traps and double risers to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- Q. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:
 - 1. Shot blast the interior of piping.
 - 2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
 - 3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
 - 4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
 - 5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
 - 6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.

- R. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- S. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."
- T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.4 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.
- F. Threaded Joints: Thread steel pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and to restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12M/D10.12.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

SECTION 232300 - REFRIGERANT PIPING

3.5 HANGERS AND SUPPORTS

- A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.
 - 2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.
 - 3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.
 - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod, 3/8 inch.
 - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod, 3/8 inch.
 - 6. NPS 2: Maximum span, 96 inches; minimum rod, 3/8 inch.
 - 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod, 3/8 inch.
 - 8. NPS 3: Maximum span, 10 feet; minimum rod, 3/8 inch.
 - 9. NPS 4: Maximum span, 12 feet; minimum rod, 1/2 inch.
- D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.
- B. Prepare test and inspection reports.

SECTION 232300 - REFRIGERANT PIPING

3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
 - 1. Install core in filter dryers after leak test but before evacuation.
 - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
 - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
 - 4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - 1. Open shutoff valves in condenser water circuit.
 - 2. Verify that compressor oil level is correct.
 - 3. Open compressor suction and discharge valves.
 - 4. Open refrigerant valves except bypass valves that are used for other purposes.
 - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Single-wall rectangular ducts and fittings.
 - 2. Single-wall, spiral-seam, round ducts and fittings.
 - 3. Double-wall, round and flat-oval spiral-seam ducts and formed fittings.
 - 4. Sheet metal materials.
 - 5. Duct liner.
 - 6. Sealants and gaskets.
 - 7. Hangers and supports.
- B. Related Sections:
 - 1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
 - 2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, ductmounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards Metal and Flexible"
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Liners and adhesives.
 - 2. Sealants and gaskets.
 - 3. Fire-Stopping Materials.
- B. Shop Drawings:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Factory- and shop-fabricated ducts and fittings.
 - 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - 4. Elevation of top of ducts.
 - 5. Dimensions of main duct runs from building grid lines.
 - 6. Fittings.
 - 7. Reinforcement and spacing.
 - 8. Seam and joint construction.
 - 9. Penetrations through fire-rated and other partitions.
 - 10. Equipment installation based on equipment being used on Project.
 - 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
 - 12. Hangers and supports, including methods for duct and building attachment and vibration isolation.
- C. Delegated-Design Submittal:
 - 1. Sheet metal thicknesses.
 - 2. Joint and seam construction and sealing.
 - 3. Reinforcement details and spacing.
 - 4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which duct will be attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Penetrations of smoke barriers and fire-rated construction.
 - 6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.
- B. Welding certificates.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel," for hangers and supports.
 - 2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and System Start-up."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, ductsupport intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards -Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. Round, Spiral Lock-Seam Ducts.

- B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
 - 1. Manufacturers:
 - a. Lindab Inc.
 - b. McGill AirFlow LLC.
 - c. SEMCO Incorporated.
 - d. Sheet Metal Connectors, Inc.
 - e. Spiral Manufacturing Co., Inc.
- C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- D. Duct Joints:
 - 1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
 - 2. Ducts 21 to 72 Inchesin Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
 - 3. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
 - a. Manufacturers:
 - 1) Ductmate Industries, Inc.
 - 2) Lindab Inc.
- E. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.
- F. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- G. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Unless elbow construction type is indicated, fabricate elbows as follows:
 - 1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
 - 2. Round Mitered Elbows with Aerofoil Vanes: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
 - a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
 - b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
 - 3. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for materialhandling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
 - 4. Round Elbows 8 Inchesand Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
 - 5. Round Elbows 9 through 14 Inchesin Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate

nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.

- 6. Round Elbows Larger than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
- 7. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
- 8. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
- 9. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg: 0.022 inch.

2.3 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. Lindab Inc.
 - 2. <u>McGill AirFlow LLC</u>.
 - 3. <u>SEMCO Incorporated</u>.
- B. Ducts: Prefabricated double-wall (insulated) ducts with an outer shell and an inner duct. Dimensions indicated are for inner ducts.
- C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.
- D. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
 - 1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
 - a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
 - 2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
 - 3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Inner Duct: Minimum 0.028-inch solid sheet steel.
- F. Fittings: Fabricate double-wall (insulated) fittings with an outer shell and an inner duct.1. Solid Inner Ducts: Use the following sheet metal thicknesses:

- a. Ducts 3 to 34 Inches in Diameter: 0.028 inch.
- b. Ducts 35 to 58 Inches in Diameter: 0.034 inch.
- c. Ducts 60 to 88 Inches in Diameter: 0.040 inch.
- G. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: 0.26 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - 3. Terminate insulation where double-wall duct connects to single-wall externally insulated duct, and reduce outer shell diameter to inner duct diameter.
 - 4. Coat insulation with antimicrobial coating.
 - 5. Cover insulation with polyester film complying with UL 181, Class 1.
 - 6. Supply and Make-Up Air Ducts: **2 inches** thick.
 - 7. **Painted for indoor application.** Coordinate final finish with architect.

2.4 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.5 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Manufacturers:
 - a. Owens Corning's Aeroflex Plus Duct Liner or Equal.

- 2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.
 - a. Maximum Thermal Conductivity:
 - b. Thickness: 1 inch for sound attenuation, and R8 for thermal insulation.
 - c. Thermal Conductivity (k-Value): 0.26 at 75 deg Fmean temperature.
 - d. Fire-Hazard Classification: Maximum flame-spread index of 25 and smokedeveloped index of 50 when tested according to ASTM E84.
 - e. Water-Based Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - f. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
 - 1) Tensile Strength: Indefinitely sustain a 50-lb-tensile, dead-load test perpendicular to duct wall.
 - 2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
 - 3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.
- 3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

2.6 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 - 2. Tape Width: 4 inches.
 - 3. Sealant: Modified styrene acrylic.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 7. Service: Indoor and outdoor.
 - 8. Service Temperature: Minus 40 to plus 200 deg F.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 - 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- 11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Water-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Solids Content: Minimum 65 percent.
 - 3. Shore A Hardness: Minimum 20.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. VOC: Maximum 75 g/L (less water).
 - 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 8. Service: Indoor or outdoor.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.
 - 3. Grade: NS.
 - 4. Class: 25.
 - 5. Use: O.
 - 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
 - 1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
 - 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 - 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.8 FIRE-STOPPING

- A. Fire-Resistant Sealant: Provide two-part, foamed-in-place, fire-stopping silicone sealant, onepart elastomeric sealant, formulated for use in a through-penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Products: Subject to compliance with requirements, products that may be incorporated in the Work are limited to, the following:
 - 1. "Dow Corning Fire Stop Foam"; Dow Corning Corp.
 - 2. "Dow Corning Fire Stop Sealant"; Dow Corning Corp.
 - 3. "3M Fire Barrier Caulk CP-25"; Electrical Products Div./3M.
- C. Seams and laps arranged on top of duct.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible" unless otherwise indicated.
- C. Install round and flat-oval ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 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.
- F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
- G. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
- H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - 1. Fan discharges.
 - 2. Intervals of lined duct preceding unlined duct.
 - 3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm or where indicated.
- I. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

3.4 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible", and as defined below.
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
 - 2. All Ducts U.N.O: Seal Class A.
 - 3. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 4. Conditioned Space, Return-Air Ducts: Seal Class C.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 Sections.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. <u>Comply with requirements for Leakage Class A for sealing all ducts.</u> Refer to SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:
 - a. Supply, Return, Exhaust, Outdoor Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - b. Engineer will randomly designate two supply duct systems for testing in accordance with Section 4 of SMACNA HVAC Air Duct Leakage Test Manual, current edition. If leakage test results exceed SMACNA allowable leakage rates, then additional two systems shall be tested. Supply duct test section shall include main trunk line from the mechanical room to the farthest VAV box. For systems without VAV boxes, main trunk shall be determined on site

- 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
- 4. Test for leaks before applying external insulation.
- 5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
- 6. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
 - 1. Visually inspect duct system to ensure that no visible contaminants are present.
 - 2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.9 DUCT CLEANING

- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - 4. Coils and related components.
 - 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.

- 6. Supply-air ducts, dampers, actuators, and turning vanes.
- 7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
 - 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 - 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
 - 5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
 - 6. Provide drainage and cleanup for wash-down procedures.
 - 7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

A. Supply Ducts:

- 1. Ducts Connected to Fan Coil Units, and Terminal Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A
- 2. Ducts Connected to Constant-Volume Air-Handling Units
 - a. Pressure Class: Positive 3-inch wg
 - b. Minimum SMACNA Seal Class: A
- 3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
 - a. Pressure Class: Positive 4-inch wg.
 - b. Minimum SMACNA Seal Class: A
- B. Return Ducts:
 - 1. Ducts Connected to Fan Coil Units, and Terminal Units
 - a. Pressure Class: Positive or negative 2-inch wg
 - b. Minimum SMACNA Seal Class: B.
 - 2. Ducts Connected to Air-Handling Units
 - a. Pressure Class: Positive or negative 3-inch wg
 - b. Minimum SMACNA Seal Class: B

C. Exhaust Ducts:

1.

- 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg
 - b. Minimum SMACNA Seal Class: A
- D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 - Ducts Connected to AHUs, Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units
 - a. Pressure Class: Positive or negative 2-inch wg
 - b. Minimum SMACNA Seal Class: A
- E. Double-Wall Duct Interstitial Insulation:
 - 1. Supply Air Ducts: 2 inches thick, unless noted otherwise on drawings.
- F. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Double Skin vaned elbows. See drawings.
 - 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-3, "Round Duct Elbows."
 - Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Radius-to Diameter Ratio: 1.5.
 - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.
- G. Branch Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry.
 - b. Rectangular Main to Round Branch: Spin in.
 - 2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - a. Velocity 1000 fpm or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Backdraft and pressure relief dampers.
 - 2. Barometric relief dampers.
 - 3. Manual volume dampers.
 - 4. Control dampers.
 - 5. Fire dampers.
 - 6. Flange connectors.
 - 7. Turning vanes.
 - 8. Remote damper operators.
 - 9. Duct-mounted access doors.
 - 10. Flexible connectors.
 - 11. Flexible ducts.
 - 12. Duct accessory hardware.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control-damper installations.
 - d. Fire-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

1.7 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with 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.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304.
- C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Greenheck Fan Corporation</u>.
 - 2. <u>Nailor Industries Inc</u>.
 - 3. <u>Pottorff</u>.
 - 4. <u>Ruskin Company</u>.
- B. Description: Gravity balanced. Blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner, steel ball bearings, and axles.
- C. Frame: Hat-shaped, 0.05-inch-thick, galvanized sheet steel, with welded corners and mounting flange.
- D. Blades: Multiple single-piece blades, 0.050-inch-thick aluminum sheet with sealed edges.
- E. Blade Action: Parallel.
- F. Blade Seals: Neoprene, mechanically locked.
- G. Blade Axles:1. Material: Galvanized steel.
- H. Tie Bars and Brackets: Galvanized steel.
- I. Return Spring: Adjustable tension.
- J. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Electric actuators, where noted.
 - 4. Chain pulls.
 - 5. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20 gage minimum.
 - b. Sleeve Length: 6 inches minimum.
 - 6. Screen Mounting: Rear mounted.
 - 7. Screen Material: Stainless steel.
 - 8. Screen Type: Bird.
 - 9. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - a. <u>Flexmaster U.S.A., Inc</u>.
 - b. <u>McGill AirFlow LLC</u>.
 - c. <u>Nailor Industries Inc</u>.
 - d. <u>Pottorff</u>.
 - e. <u>Ruskin Company</u>.
 - 2. Standard leakage rating, with linkage outside airstream.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
 - 6. Blade Axles: Galvanized steel.
 - 7. Tie Bars and Brackets: Galvanized steel.
- B. Standard, Aluminum, Manual Volume Dampers:
 - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - a. <u>McGill AirFlow LLC</u>.
 - b. <u>Nailor Industries Inc</u>.
 - c. <u>Pottorff</u>.
 - d. <u>Ruskin Company</u>.
 - 2. Standard leakage rating, with linkage outside airstream.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.

- e. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.
- 6. Blade Axles: Galvanized steel.
- 7. Tie Bars and Brackets: Aluminum.
- C. Low-Leakage, Steel, Manual Volume Dampers:
 - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - a. <u>Pottorff</u>.
 - b. <u>Ruskin Company</u>.
 - 2. Comply with AMCA 500-D testing for damper rating.
 - 3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
 - 4. Suitable for horizontal or vertical applications.
 - 5. Frames:
 - a. Hat shaped.
 - b. 0.094-inch-thick, galvanized sheet steel.
 - c. Mitered and welded corners.
 - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 6. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized, roll-formed steel, 0.064 inch thick.
 - 7. Blade Axles: Galvanized steel.
 - 8. Blade Seals: Neoprene.
 - 9. Tie Bars and Brackets: Galvanized steel.
 - 10. Accessories:
 - a. Include locking device to hold single-blade dampers in a fixed position without vibration.
- D. Low-Leakage, Aluminum, Manual Volume Dampers:
 - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - a. <u>Pottorff</u>.
 - b. <u>Ruskin Company</u>.
 - 2. Comply with AMCA 500-D testing for damper rating.
 - 3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
 - 4. Suitable for horizontal or vertical applications.

- 5. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
- 6. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
 - d. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.
- 7. Blade Axles: Galvanized steel.
- 8. Blade Seals: Neoprene.
- 9. Tie Bars and Brackets: Aluminum.
- 10. Accessories:
 - a. Include locking device to hold single-blade dampers in a fixed position without vibration.
- E. Jackshaft:
 - 1. Size: 1-inch diameter.
 - 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- F. Damper Hardware:
 - 1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
 - 2. Include center hole to suit damper operating-rod size.
 - 3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Greenheck Fan Corporation</u>.
 - 2. <u>Pottorff</u>.
 - 3. <u>Ruskin Company</u>.
 - 4. <u>Young Regulator Company</u>.
- B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:

- 1. Hat shaped.
- 2. 0.094-inch-thick, galvanized sheet steel.
- 3. Mitered and welded corners.

D. Blades:

1. Multiple blade with maximum blade width of 6 inches.

- 2. Opposed-blade design.
- 3. Galvanized-steel.
- 4. 0.064 inch thick single skin.
- 5. Blade Edging: Closed-cell neoprene.
- 6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- E. Blade Axles: 1/2-inch-diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
 - 1. Operating Temperature Range: From minus 40 to plus 200 deg F.
- F. Bearings:
 - 1. Molded synthetic.
 - 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Greenheck Fan Corporation</u>.
 - 2. <u>Pottorff</u>.
 - 3. <u>Ruskin Company</u>.
- B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- D. Fire Rating: 1-1/2 hours.
- E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - 1. Minimum Thickness: 0.138 inch thick, as indicated, and of length to suit application.
 - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.7 FLANGE CONNECTORS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Ductmate Industries, Inc</u>.
 - 2. <u>Nexus PDQ</u>.
 - 3. <u>Ward Industries, Inc</u>.
- B. Description: Factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Ductmate Industries, Inc</u>.
 - 2. <u>METALAIRE, Inc</u>.
 - 3. <u>SEMCO Incorporated</u>.
 - 4. <u>Ward Industries, Inc</u>.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- D. Vane Construction: Double wall.

2.9 REMOTE DAMPER OPERATORS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. Pottorff.
 - 2. <u>Young Regulator Company</u>.
- B. Description: Cable system designed for remote manual damper adjustment.
- C. Tubing: Brass.
- D. Cable: Stainless steel.

Ethos Engineering Cameron County Parks Olmito Park Complex

E. Wall-Box Cover-Plate Material: Stainless steel.

2.10 DUCT-MOUNTED ACCESS DOORS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Flexmaster U.S.A., Inc</u>.
 - 2. <u>Greenheck Fan Corporation</u>.
 - 3. <u>Pottorff</u>.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors Round Duct."
 - 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

2.11 FLEXIBLE CONNECTORS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Ductmate Industries, Inc</u>.
 - 2. <u>Duro Dyne Inc</u>.
 - 3. <u>Ward Industries, Inc</u>.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd..
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd..

Ethos Engineering Cameron County Parks Olmito Park Complex

- 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
- 3. Service Temperature: Minus 50 to plus 250 deg F.
- G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
 - 1. Minimum Weight: 16 oz./sq. yd..
 - 2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
 - 3. Service Temperature: Minus 67 to plus 500 deg F.
- H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
 - 1. Minimum Weight: 14 oz./sq. yd..
 - 2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
 - 3. Service Temperature: Minus 67 to plus 500 deg F.

2.12 FLEXIBLE DUCTS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
 - 1. <u>Flexmaster U.S.A., Inc</u>.
 - 2. Thermaflex
- A. Where acoustical flexible duct is shown on drawings, provide Flexmaster Type 8M (or Thermaflex M-KE) UL 181 Class I Air Duct or equal.
- B. The duct shall be constructed of a CPE fabric supported by helical wound galvanized steel. The fabric shall be mechanically locked to the steel helix without the use of adhesives or chemicals.
- C. The internal working pressure rating shall be at least 6" w.g. positive and 4" w.g. negative through 16" diameter, and 1" w.g. negative for 18" and 20" diameters, with a bursting pressure of at least 2 ¹/₂ time the working pressure.
- D. The duct shall be rated for a velocity of at lease 4000 feet per minute.
- E. The duct must be suitable for continuous operation at a temperature range of -20° F to $+250^{\circ}$ F.
- F. Factory insulate the flexible duct with fiberglass insulation. The R-value shall be at least 8 at a mean temperature of 75° F.
- G. Cover the insulation with a fire retardant metalized vapor barrier jacket reinforced with crosshatched scrim having a permeance of not greater than 0.05 perms when tested in accordance with ASTM E96, Procedure.
- H. Sound attenuation Properties: Acoustical performance, when tested by an independent laboratory in accordance with the Air Diffusion Council's <u>Flexible Air Duct Test Code FD 72-</u>R1, Section 3.0, Sound Properties, shall be as follows:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	7	31	40	38	40	27
8" diameter	13	29	36	35	38	22
12" diameter	21	28	29	33	26	12

- I. Flexible Duct Connectors:
 - 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

2.13 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers (control dampers for fans 2,000CFM and larger) at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.

- 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
- 7. At each change in direction and at maximum 50-foot spacing.
- 8. Upstream from turning vanes.
- 9. Upstream or downstream from duct silencers.
- 10. Control devices requiring inspection.
- 11. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
 - 4. Head and Shoulders Access: 21 by 14 inches.
 - 5. Body Access: 25 by 14 inches.
 - 6. Body plus Ladder Access: 25 by 17 inches.
- K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- N. Connect terminal units to supply ducts directly, and for fan powered boxes with maximum 12inch lengths of flexible duct. Do not use flexible ducts to change directions.
- O. Connect flexible ducts to metal ducts with stainless steel draw bands.
- P. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 - 4. Inspect turning vanes for proper and secure installation.
 - 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:1. Ceiling-mounted ventilators.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also 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 thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Fan speed controllers.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For unit hangars and supports 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. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - 2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
 - 3. Wind Restraints and Certification.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Framing and support members relative to duct penetrations.
 - 2. Ceiling suspension assembly members.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Belts: One set for each belt-driven unit.

1.8 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.9 COORDINATION

A. Coordinate size and location of structural-steel support members.

1.10 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

- B. Special Warranty: A written warranty, executed by Contractor and signed by manufacturer, agreeing to replace components that fail in materials and workmanship within the specified warranty period, provided manufacturer's written instructions for installation, operation, and maintenance have been followed.
 - 1. Warranty Period: One (1) year parts and labor for fan and motor, including all components, from date of Substantial Completion.

1.11 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. Belts: One set for each belt-driven unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. HVAC Power Ventilators: Subject to compliance with requirements, provide products by one of the following:
 - 1. Loren Cook Company.
 - 2. Greenheck Fan Corp.
 - 3. New York Blower Company (The).
 - 4. Penn Ventilation.

2.2 CEILING-MOUNTED VENTILATORS

- A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
- B. Housing: Steel, lined with acoustical insulation.
- C. Fan Wheel: Centrifugal forward curved type, injection molded of polypropylene resin for smaller fans, galvanized steel for larger fans.
- D. Grille: Manufacturer's standard **Aluminum**, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- F. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
 - 3. Factory mounted disconnect
 - 4. Stainless steel insect screen
 - 5. Isolation: Rubber-in-shear vibration isolators.
 - 6. Aluminum backdraft damper

Ethos Engineering Cameron County Parks Olmito Park Complex

- 7. Vibration isolator kit
- 8. Time-Delay Switch: See schedules for switch coordination.
- 9. See schedules for other options.

2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to 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. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- C. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Section 230548.13 "Vibration Controls for HVAC."
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 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. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 10. Shut unit down and reconnect automatic temperature-control operators.
 - 11. Remove and replace malfunctioning units and retest as specified above.
- 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.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

Ethos Engineering Cameron County Parks Olmito Park Complex
SECTION 233423 - HVAC POWER VENTILATORS

- B. Adjust belt tension.
- C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
 - 2. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
 - 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes grilles, registers, diffusers, and other air devices
- B. Related Sections:
 - 1. Section 089116 "Operable Wall Louvers" and Section 089119 "Fixed Louvers" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
 - 2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 5. Duct access panels.
- B. Source quality-control reports.

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the manufacturers specified:
 - 1. Price Industries.
 - 2. Titus.

2.2 AIR DEVICES

- A. Rectangular and Square Ceiling Grilles, Registers, Diffusers: See schedules for material, finish, size, pattern, damper type, and accessories.
- B. Fire rated air devices: Plans indicate a "fire damper" designation on diffusers that need a fire rated air device. Coordinate with plans.

2.3 INSULATION

- A. All cold surfaces that are susceptible to condensation shall be insulated.
- B. Insulation may be provided by manufacturer or by installing Contractor. Coordinate with installing Contractor.

2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes split-system air-conditioning units consisting of separate evaporator-fan and compressor-condenser components, and factory installed APR valve where noted.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design ACCU wind restraints.
- B. Wind-Restraint Performance rated for basic Wind Speed: Rated for the location.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.
- C. Wind Restraints: Submit description of equipment anchorage devices and their installation requirements.
- D. Field quality-control reports.
- E. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.
- F. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 - ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 4 -"Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-Up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004.
- D. International Building Code and TDI Compliance:
 - 1. Equipment curb/attachment for exterior equipment such as ACCUs.
 - 2. Attachment of equipment to curb/pad.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchorbolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period. Warranty period to commence from the date of equipment start-up.
 - 1. Warranty Period:
 - a. For Compressor: **Five** year(s) from date of Substantial Completion.
 - b. For Parts and Labor: **One** year(s) from date of Substantial Completion.

1.8 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. Filters: **One** set for each air-handling unit.
 - 2. Fan Belts: **One** set for each air-handling unit fan.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Trane.
 - 2. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems.
 - 3. Lennox International Inc.
 - 4. YORK; a Johnson Controls company.

2.2 INDOOR UNITS 5 TONS OR LESS

- A. Vertical, Evaporator-Fan Components: An assembly including cabinet, filter, chassis, coil, drain pan, fan, and motor in blow-through configuration with direct-expansion cooling coil, and electric heating coil, where scheduled.
- B. Cabinet: Covers and access panels shall be manufactured of 20 gauge pre- painted, galvanized sheet metal. Cabinet walls shall have insulated panels, fabricated to allow removal for access to internal parts and components. Units shall be designed and equipped for installation indoors.
- C. Chassis: Unit structural members shall be manufactured of 16 gauge pre-painted, galvanized sheet metal. Removable panels for servicing, and insulation on back of panel.
 1. Insulation: Standard insulation or minimum 1", whichever is greater.
- D. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.
- E. Reheat Coil: If scheduled, unit shall include a hot gas reheat coil with a modulating reheat control valve and an electronic controller. The valve position shall be controlled to provide a specific supply air temperature setpoint that is set on the control board or sent to the control board by a remote 0-10 Vdc signal.
- F. Electric Coil: If scheduled, helical, nickel-chrome, resistance-wire heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for over-current protection.
- G. Fan Motors: Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 1. Special Motor Features: Multi-tapped, multi-speed with internal thermal protection and permanent lubrication.
 - 2. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 3. Enclosure Type: Totally enclosed, fan cooled.
 - 4. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
 - 5. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
 - 6. Mount unit-mounted disconnect switches on unit.
- H. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.
- I. Condensate Drain Pans:
 - 1. Fabricated with slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1-2004.
 - b. Depth: A minimum of 1 inch deep.
 - c. Stainless-steel sheet or non-corrosive plastic, insulated.

- d. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
- 2. Air Filtration Section:
 - a. General Requirements for Air Filtration Section:
 - 1) Comply with NFPA 90A.
 - 2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
 - 3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
 - b. Filters:
 - 1) Factory-fabricated, viscous-coated, flat-panel type.
 - 2) Thickness: **2 inches**.
 - 3) Merv according to ASHRAE 52.2: 8.
 - 4) Media: Interlaced glass fibers sprayed with nonflammable adhesive and antimicrobial agent.
 - 5) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

- A. Air-Cooled, Compressor-Condenser Components:
 - 1. Casing: Corrosion free pre-painted steel cabinet, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
 - 2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type: Scroll, mounted on rubber mounts for vibration isolation.
 - b. Two-stage (where scheduled) compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - c. Refrigerant Charge: **R-407C** or **R-410A**.
 - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 210/240.
 - e. Internal excessive current and temperature protection.
 - 3. Fan: Aluminum-propeller type, directly connected to motor.
 - 4. Motor: Permanently lubricated, with integral thermal-overload protection.

2.4 ACCESSORIES

- A. Web-Accessible Programmable Thermidistat with the following features:
 - 1. Compressor time delay.
 - 2. 24-hour time control of system stop and start.
 - 3. Liquid-crystal display indicating temperature and RH, set-point temperature and RH, time setting, operating mode, and fan speed.
- B. Provide motorized OA and RA dampers, CO2 sensors, demand-controlled ventilation, and interlocks as follows.

- 1. Motorized OA damper interlocked with compressor, such that when compressor cycles off, OA damper closes.
- 2. Motorized OA and RA dampers shall modulate to maintain CO2 setpoints.

C. Other:

- 1. Direct driven ECM fan motor, and with built in APR valve and dehumidification sequence option for indoor units, where noted.
- 2. Low Ambient Controller: Cycles condenser fan to permit operation down to 35 deg F with time-delay relay to bypass low-pressure switch.
- 3. Package with refrigerant circuit suction and discharge gauges, and service valves.
- 4. Automatic-reset timer to prevent rapid cycling of compressor.
- 5. Site glass, filter-dryer.
- 6. High-Pressure Switch: Automatic-reset switch cycles compressor off on high refrigerant pressure.
- 7. Low-Pressure Switch: Automatic-reset switch cycles compressor off on low refrigerant pressure.
- 8. Thermostatic expansion valve to match with existing Evaporator Coil, if existing is incompatible.
- 9. Time-Delay Relay: Continues operation of evaporator fan after compressor shuts off.
- 10. Evaporator defrost controller.
- 11. Liquid line solenoid valves, electric unloaders, factory/field installed accumulators to accomplish stages of unloading.
- 12. See drawing schedules.
- D. Unit Casing: Galvanized steel, finished with paint finish capable of withstanding at least 1000 hours when tested in salt spray atmosphere (ASTM B 117- 95 test procedure); with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gage ports on exterior of casing.
 - 1. Condenser coil louvered hail guard to protect coil from physical damage.
 - 2. Condenser coil coating: epoxy coat or Energy Guard
 - 3. Wind Restraints: Bolts or metal brackets compatible with the curb and casing, painted to match unit, used to anchor unit to the pad or curb, and designed for loads at Project site.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install ground-mounted, compressor-condenser components on 4-inch- thick, reinforced concrete base that is 4 inches larger, on each side, than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.
- D. Install and connect refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

E. Provide auxiliary drain pans with float switches to disable fans. Provide drain piping with stop valves from pans to floor drains.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.
- C. Duct Connections: Duct installation requirements are specified in Division 15 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 15 Section "Duct Accessories."
- D. Ground equipment according to Division 16 Section "Grounding and Bonding."
- E. Electrical Connections: Comply with requirements in Division 16 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Verify that air-conditioning units are installed and connected according to manufacturer's written instructions and the Contract Documents.
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.

- 3. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
- 4. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
- 5. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
- 6. Comb coil fins for parallel orientation.
- 7. Verify that proper thermal-overload protection is installed for electric coils.
- 8. Install new, clean filters.
- 9. Verify that manual and automatic volume control and fire and smoke dampers in connected
- 10. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.
- 11. Measure and record motor electrical values for voltage and amperage.
- C. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Sections.
- D. Complete installation and startup checks according to manufacturer's written instructions.
- E. After startup service and performance test, change filters.
- F. Manually operate dampers from fully closed to fully open position and record fan performance.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and other Division 26 Specification Sections, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, as is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.
- B. Scope of Work:
 - 1. <u>General:</u> The "Cameron County Parks Olmito Park Complex" consists of a new single-story administration building 740 s.f., large comfort station 575 s.f., small comfort station 145 s.f., and pavilion 800 s.f. These buildings will generally be operated from 6:00am to 10:00pm. (Monday through Sunday).
 - 2. Electrical: Provide all materials and labor associated with complete operational electrical distribution system. Major items of work include, but are not limited to:
 - (a) Electrical service:
 - (i) Extend existing overhead electrical service lines and provide new underground electrical services; it shall consist of underground electrical raceways and concrete pads for Utility furnished pad mounted transformers and sectionalizers.
 - (ii) Provide a new overhead electrical service for irrigation pump; it shall consist of pole mounted electrical raceway and pole mounted transformer and meter.
 - (iii) Utility company shall provide medium voltage conductors and transformers.
 - (iv) Provide outdoor rated meter bases, enclosed switches, panelboards, and enclosed circuit breaker See electrical schedule.
 - (b) Interior and Exterior Lighting systems: shall consist of LED type. See light fixture schedule and specifications.
 - (c) Area lighting for trails, parking lots, and playground: Provide PV/battery powered LED type, see light fixture schedule and specifications.
 - (d) Lighting controls (switches, occupancy sensors, etc.): Provide as noted on plans specifications. In some cases, they will be ceiling mounted and others wall mounted. It's the intent for them to be wired to automatically control the luminaires in their respective areas.
 - (e) Power systems: Provide miscellaneous duplex receptacles, and power for H.V.A.C. and plumbing equipment.
 - (f) Intrusion Detection System: Provide a control panel, keypads, glass break sensors, motion detectors and magnetic contacts as noted on drawings.

SECTION 260010 - SUMMARY OF ELECTRICAL WORK

- (g) Commissioning: Provide for the lighting, lighting controls and electrical equipment as required per IECC 2018.
- (h) Voice and Data Communication Cabling Equipment: Provide rough-ins only. Cabling, connectors, racks, etc. provided by Owner.

1.3 ALLOWANCES

A. Electrical: See Division 1 for electrical allowances.

1.4 COORDINATION

- A. All electrical work shall be done under sub-contract to a General Contractor, who ultimately responsible for the entire project. Electrical Contractor shall coordinate all work through General Contractor, even in areas where only electrical work is to take place.
- B. All questions, requests for information, submittals, and correspondence from the Electrical Contractor shall be submitted via the General Contractor, who will forward to the Architect, who will then forward to the Engineer.
- C. Electrical Contractor shall not make any changes to design without written authorization from the Engineer. If changes are requested by the Owner, Architect, General Contractor, Suppliers, Manufacturers, or any others, Contractor should issue a written RFI for response by the Engineer.
- D. Electrical Contractor shall issue seven (7) days written notice prior to any activities that require the presence of the Engineer at the job-site. This applies to all inspections required by specifications, and particularly to those where work will be covered (underground raceways, electrical raceways above ceiling).
- E. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.
- F. Fully coordinate with Contractor for providing power to HVAC systems and plumbing equipment.
- G. Issue written notification of the following tasks and allow five (5) days for Engineer to respond and schedule an inspection as required:
 - 1. Upon completion of underground raceways installation and prior to covering up.
 - 2. Upon completion of installing all raceways, labeling all j-boxes and prior to suspended ceiling installation.
 - 3. Upon completion of pulling all wiring, making all terminations, labeling and color-coding wires at the panelboards/switchboards and prior to installing their covers.
 - 4. When ready to request manufacturer's start-up of each piece of equipment.
 - 5. When ready to conduct complete Intrusion Detection demonstration.
 - 6. When ready for Substantial Completion Inspection.
 - 7. When ready for Final Inspection.
- H. Failure to issue written notification may result in work having to be redone to allow for proper inspection. It is this contractor's responsibility to make sure Engineer receives notification.

1.5 UTILITIES

SECTION 260010 - SUMMARY OF ELECTRICAL WORK

- 1. Coordinate with power, water, telephone, cable and gas utilities to locate all utilities prior to digging in any area.
- 2. Obtain any approvals required from utilities to relocate utilities.
- 3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.
- 4. Coordinate with utility for electrical service. Base bid shall include all costs associated with service connection, including permit fees.

1.6 CONTRACTOR USE OF PREMISES

- A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
 - 1. Owner Occupancy: Allow for Owner occupancy and use by the public.
 - 2. Driveways and Entrances: Keep driveways and entrances serving the premises, clear and available to the Owner, the Owner's employees, and emergency vehicles at all time. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:
 - 1. Temporary fencing around construction areas.
 - 2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
 - 3. Temporary fencing around equipment while site work is in progress.
- C. Work shall take place with minimal disruption to Owner's operations in areas surrounding the job site.

1.7 SUBMITTALS - Special Requirements

- A. All submittals need to comply with submittal requirements as outlined on this Pre-Construction Meeting Agenda & specifications.
- B. Electrical Submittals shall be submitted electronically. Please organize the files as noted below (Native PDF format & searchable format). Files would need to be properly identified (cover letter, stamped, etc.) from the general contractor.
- C. All submittals to be separated by sections and identified by section #s, in native and searchable pdf format. All selections/markings or highlighting made on the submittal shall be specific for project requirements and exactly for what the Contractor is intending to provide on the project. If submittal does not specify as to which model/options will be used by highlighting or marking the submittal, then submittal will be returned as rejected.
- D. Manufacturer's standard dimensioned drawings, performance and product data shall be edited to delete reference to equipment, features, or information which is not applicable to the equipment being supplied for this project. Including Bill or List of Materials.

- E. Individual submittals shall not be reviewed until a complete package is received.
- F. Allow two weeks for initial review by Engineer, from the day it is received.
- G. After being released by GC, Subcontractor shall have one week to respond to our submittal/resubmittal review comments.
- H. Allow one week for review of resubmittals by Engineer, from the day it is received.
- I. All submittal review comments shall be forwarded by Engineer to Architect, who will then distribute as per Division 1.
- J. Provide detailed coordination drawings showing how mechanical, electrical & plumbing system components will be installed in coordination with work by others. Engineer's drawing files will be made available to Contractor for producing coordination and as-built drawings upon request.

1. Miscellaneous Electrical – Submittal #1

- a. 260519 Low-Voltage Electrical Power Conductors and Cables
- b. 260526 Grounding and Bonding for Electrical Systems
- c. 260529 Hangers and Supports for Electrical Systems
- d. 260533 Raceways and Boxes for Electrical Systems
- e. 260553 Identification for Electrical Systems
- f. 260544 Sleeves and Sleeve Seals for Electrical Raceways and Cabling
- g. 262726 Wiring Devices
- h. 268050 Hand Dryer

2. Electrical Gear Submittal #2

- a. 262416 Panelboards
- b. 262813 Fuses
- c. 262816 Enclosed Switches and Circuit Breakers

3. Light Fixtures Submittal #3

- a. 260936 Lighting Controls
- b. 265116 Interior Lighting
- c. 265219 Emergency and Exit Lighting
- d. 265613 Lighting Poles and Standards
- e. 265621 Exterior Lighting

4. Special Systems: Submittal #4

a. 267240 Intrusion Detection

5. Electrical Commissioning Submittal #5

a. 260800 Commissioning for Electrical Systems

1.8 SCHEDULE OF VALUES -Special Requirements

A. Electrical Contractor shall submit a Schedule of Values reflecting the total value of Electrical Work in the Contract and broken down into the following items as a minimum, with a line item for <u>Materials/Equipment and another for Labor</u>.

SECTION 260010 - SUMMARY OF ELECTRICAL WORK

ELECTRICAL

- 1. Electrical Gear.
- 2. Raceways Including Wiring.
- 3. Interior Light fixtures
- 4. Exterior Light fixtures
- 5. Wiring Devices.
- 6. Intrusion Detection System
- 7. Commissioning
- 8. Allowances.
- 9. Miscellaneous.
- 10. Administrative and project management.

1.9 CODE COMPLIANCE:

The design for this project is based on:

- 1. Occupational Safety and Health Act (OSHA)
- 2. National Electric Code (NEC)
- 3. National Fire Code
- 4. International Building Code
- 5. UL 916
- 6. Local ordinances

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member Company of NETA or an NRTL.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturer:
 - 1. Senator Wire & Cable Company.
 - 2. Southwire Company.
 - 3. Encore Wire
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, Type XHHW-2 and Type SO.

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

D. Multiconductor Cable: Comply with UL 1569 and NEMA WC 70/ICEA S-95-658 for metalclad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc.
 - 2. AMP Incorporated/Tyco International.
 - 3. Hubbell/Anderson.
 - 4. O-Z/Gedney; EGS Electrical Group LLC.
 - 5. 3M Company; Electrical Products Division.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS
 - A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
 - B. Feeders Concealed in Ceilings, Walls and Partitions: Type THHN/THWN-2, single conductors in raceway.
 - C. Feeders Concealed in Concrete, below Slabs-on-Grade, and underground: Type THHN/THWN-2, single conductors in raceway.
 - D. Exposed Branch Circuits: Type THHN/THWN-2, single conductors in raceway.
 - E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and underground: Type THHN/THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, which will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torquetightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- B. Test and Inspection Reports: Prepare a written report to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Ground rods.
- B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section "Operation and Maintenance Data," include the following:
 - a. Instructions for periodic testing and inspection of grounding features at ground rings and grounding connections for separately derived systems based on and NFPA 70B.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless **exothermic**-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad; 3/4 inch by 10 feet.

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 24 inches below grade.
- C. Grounding Bus: Install as indicated.
 - 1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
 - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

- 1. Feeders and branch circuits.
- 2. Lighting circuits.
- 3. Receptacle circuits.
- 4. Single-phase motor and appliance branch circuits.
- 5. Three-phase motor and appliance branch circuits.
- 6. Flexible raceway runs.
- 7. Metal-clad cable runs.
- 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the distribution panel to equipment grounding bar terminal on busway.
- C. Water Heater: Install a separate insulated equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.
- D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.5 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect

grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

- 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
- 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

3.6 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 - 4. Prepare dimensioned Drawings locating each, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- B. Grounding system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.
- D. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and less: 10 ohms.
 - 2. Panelboards Serving Electronic Equipment: 3 ohm(s).
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Hangers.
 - b. Steel slotted support systems.
 - c. Trapeze hangers.
 - d. Clamps.
 - e. Turnbuckles.
 - f. Sockets.
 - g. Eye nuts.
 - h. Saddles.
 - i. Brackets.
 - 2. Include rated capacities and furnished specialties and accessories.
- B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.
 - 1. Trapeze hangers. Include product data for components.
 - 2. Steel slotted-channel systems.
 - 3. Nonmetallic slotted-channel systems.
 - 4. Equipment supports.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

- 1. Suspended ceiling components.
- 2. Structural members to which hangers and supports will be attached.
- 3. Size and location of initial access modules for acoustical tile.
- 4. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Sprinklers.
 - d. Access panels.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M.
 - 2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame Rating: Class 1.
 - 2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - 2. Material: Plain steel.
 - 3. Channel Width: 1-1/4 inches.
 - 4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

- 5. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
- 6. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
- 7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- 8. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
 - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 - a. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 - b. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - c. Toggle Bolts: All-steel springhead type.
 - d. Hanger Rods: Threaded steel.

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

- e. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
- f. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
- g. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
- h. Toggle Bolts: All-steel springhead type.
- i. Hanger Rods: Threaded steel

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs and RMCs as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in] NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, and RMCs may be supported by openings through structure members, according to NFPA 70.

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 6. To Steel: Spring-tension clamps.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Architectural Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Sections "Cast-in-Place Concrete" or "Miscellaneous Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:

- 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
- 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Sections "Exterior Painting", "Interior Painting" and "High-Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Boxes, enclosures, and cabinets.
 - 4. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.
- B. EMT: Electrical metallic tubing.
- C. FMC: Flexible metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For raceways, wireways and fittings, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Source quality-control reports.

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Alflex Inc.
 - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
 - 5. Electri-Flex Co.
 - 6. Manhattan/CDT/Cole-Flex.
 - 7. Maverick Tube Corporation.
 - 8. O-Z Gedney; a unit of General Signal.
 - 9. Wheatland Tube Company.
 - 10. Hylsa
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. FMC: Comply with UL 1; zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel (Zinc is not acceptable).
 - b. Type: set-screw.
 - 3. Expansion Fittings: Match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- H. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

- 1. AFC Cable Systems, Inc.
- 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
- 3. Arnco Corporation.
- 4. CANTEX Inc.
- 5. CertainTeed Corp.; Pipe & Plastics Group.
- 6. Condux International, Inc.
- 7. ElecSYS, Inc.
- 8. Electri-Flex Co.
- 9. Lamson & Sessions; Carlon Electrical Products.
- 10. Manhattan/CDT/Cole-Flex.
- 11. RACO; a Hubbell Company.
- 12. Thomas & Betts Corporation.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RNC: Type EPC-40-PVCcomplying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. Fittings for and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- 2.3 BOXES, ENCLOSURES, AND CABINETS
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
 - 2. EGS/Appleton Electric.
 - 3. Erickson Electrical Equipment Company.
 - 4. Hoffman.
 - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
 - 6. O-Z/Gedney; a unit of General Signal.
 - 7. RACO; a Hubbell Company.
 - 8. Robroy Industries, Inc.; Enclosure Division.
 - 9. Spring City Electrical Manufacturing Company.
 - 10. Thomas & Betts Corporation.
 - 11. Walker Systems, Inc.; Wiremold Company (The).
 - B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
 - C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
 - D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
 - E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep.
- J. Gangable boxes are allowed as along is permitted by the NEC.
- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 for indoor applications and Type 4X SS outdoor with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- L. Cabinets:
 - 1. NEMA 250, Type 1, Type 4X SS box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.
 - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
 - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation.

- d. NewBasis.
- 3. Standard: Comply with SCTE 77.
- 4. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
- 5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
- 6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- 7. Cover Legend: Molded lettering, "ELECTRIC".
- 8. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
- 9. Handholes 18 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.5 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 - 1. Tests of materials shall be performed by an independent testing agency.
 - 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: GRC.
 - 2. Concealed Conduit, Aboveground: GRC.
 - 3. Underground Conduit: RNC, Type EPC-40-PVC.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X SS as noted on plans.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Concealed in Ceilings and Interior Walls and Partitions: EMT
 - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 - 4. Damp or Wet Locations: GRC.
 - 5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 1/2-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 - 2. EMT: Use setscrew steel fittings. Comply with NEMA FB 2.10.
 - 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.

- 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- 5. Change from RNC, Type EPC-40-PVC TO EMT or GRC before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.

- U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- V. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 - d. Attics: 135 deg F.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- AA. Locate boxes so that cover or plate will not span different building finishes.
- BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
 - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 3 for pipe less than 6 inches in nominal diameter.
 - 2. Install backfill as specified in Division 3."
 - 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 3."
 - 4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
 - 5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
 - 6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.
 - 7. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes with bottom below frost line, below grade.

- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 **PROTECTION**

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
- 2. Grout.
- 3. Silicone sealants.
- B. Related Requirements:
 - 1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fireresistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
 - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-firerated walls or floors.

Ethos Engineering Cameron County Parks Olmito Park Complex

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.3 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
 - 2. Sealant shall have VOC content of 150 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

- 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- C. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- D. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- F. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels.
 - 8. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.

C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Colors for Cables Carrying Circuits at 600 V and Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- C. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.
- E. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- C. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical- resistant, self-laminating, protective shield over the legend. Labels sized to fit the cable diameter such that the clear shield overlaps the entire printed legend.
- D. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.
- E. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.
- F. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical- resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.
- C. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around conductor it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.
- D. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.5 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 7 by 10 inches.
- D. Metal-Backed, Butyrate Warning Signs:
 - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396inch galvanized-steel backing; and with colors, legend, and size required for application.
 - 2. 1/4-inch grommets in corners for mounting.
 - 3. Nominal size, 10 by 14 inches.
- E. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Workspace Clearance Warning: "WARNING OSHA REGULATION AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.6 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.7 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.
- B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.

Ethos Engineering Cameron County Parks Olmito Park Complex

- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Underground-Line Detectable Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Install labels at 30-foot maximum intervals.
- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Power.
 - 2. Intrusion Detection System
 - 3. Mechanical and Electrical Supervisory System
 - 4. Telecommunication System.
 - 5. Control Wiring.
- C. Power-Circuit Conductor Identification: For secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use col-

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

ors listed below for ungrounded service feeder and branch-circuit conductors.

- a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
- b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
- c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- E. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations provide heat-shrink preprinted tubes with the conductor designation.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- I. Locations of Underground Lines: Identify with underground-line detectable warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- J. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self- adhesive warning labels.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

- 3. Apply to exterior of door, cover, or other access.
- 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- L. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- M. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer and load shedding.
- N. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label Stenciled legend 4 inches high.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 - 2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Access doors and panels for concealed electrical items.
 - c. Disconnect switches.
 - d. Enclosed circuit breakers.
 - e. Voice and data cable terminal equipment.
 - f. Fire-alarm control panel and annunciators.
 - g. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
 - h. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

3.3 INSTALLATION

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

Verify identity of each item before installing identification products.

END OF SECTION 260553

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes commissioning process requirements for the following MEP systems, assemblies, and equipment:
 - 1. Lighting and Lighting Controls.
 - 2. Electrical and Electrically Powered Equipment.
- B. Related Requirements:
 - 1. Section 019113 "General Commissioning Requirements" for general commissioning process requirements and Commissioning Coordinator responsibilities.

1.3 DEFINITIONS

A. Refer to Section 019113 "General Commissioning Requirements" for additional definitions and assignment of responsibilities.

1.4 CONTRACTOR'S RESPONSIBILITIES

- A. Refer to Section 019113 "General Commissioning Requirements".
- B. Perform commissioning tests at the direction of the CxA.
- C. Attend construction phase controls coordination meeting.
- D. Participate in electrical systems, assemblies, equipment, and component maintenance orientation and inspection.
- E. Provide information requested by the CxA for final commissioning documentation.
- F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for complete range of testing for the required test period.
- G. Provide Project-specific construction checklists and commissioning process test procedures for actual electrical systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

- H. Direct and coordinate commissioning testing among subcontractors, suppliers, and vendors.
- I. Verify testing and adjusting of Work are complete.
- J. Provide test data, inspection reports, and certificates in Systems Manual.

1.5 COMMISSIONING DOCUMENTATION

- A. Provide the following information to the CxA for inclusion in the commissioning plan:
 - 1. Plan for delivery and review of systems manuals, and other documents and reports.
 - 2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
 - 3. Process and schedule for completing construction checklists and manufacturer's pre-start and startup checklists for electrical systems, assemblies, equipment, and components to be verified and tested.
 - 4. Certificate of completion certifying that installation, pre-start checks, and startup procedures have been completed.
 - 5. Certificate of readiness certifying that electrical systems, subsystems, equipment, and associated controls are ready for testing.
 - 6. Test and inspection reports and certificates.
 - 7. Corrective action documents.

1.6 INFORMATIONAL SUBMITTALS

- A. Construction Checklists: See related Sections for technical requirements, and generate construction checklists for the following:
 - 1. Revise list of construction checklists below to suit Project. Coordinate list with appropriate related Sections' content. Below are examples of common construction checklists.
 - 2. Electrical lighting and lighting control systems.
- B. Certificates of readiness.
- C. Certificates of completion of installation, pre-start, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Refer to Section 019113 "General Commissioning Requirements".

Ethos Engineering Cameron County Parks Olmito Park Complex

3.2 SYSTEMS READINESS CHECKLISTS

- A. Construction Checklists: Assist CxA in the preparation of detailed Systems Readiness checklists for systems, subsystems, equipment, and components.
 - 1. Contributors to the development of checklists shall include, but are not limited to:
 - a. Systems and equipment installers.
 - b. Electrical and lighting technicians.
 - c. Lighting controls installers.
- B. Contractor shall conduct Systems Readiness Testing to document compliance with installation and Systems Readiness checklists prepared by Commissioning Authority for Division-26 items.
- C. Refer to Section 019113 "General Commissioning Requirements" for issues relating to Systems Readiness checklists and testing, description of process, details on non-conformance issues relating to pre-functional checklists and test.
- D. Contractor shall participate in Pre-Functional testing activities to document electrical work associated with mechanical and plumbing systems.

3.3 SYSTEM START-UP

A. Contractor is solely responsible for system start-up. CxA may, at his discretion, witness start up procedures, but will not perform any Functional Testing of systems until Contractor has completed start-up and resolved all operating deficiencies.

3.4 TESTING PREPARATION

- A. Certify that electrical systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify that electrical instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents and approved Shop Drawings and submittals, and that pretest set points have been recorded.
- C. Set systems, subsystems, and equipment into operating mode to be tested according to approved test procedures.
- D. Inspect and verify the position of each device and interlocks identified on checklists.
- E. Testing Instrumentation: Install measuring instruments and logging devices to record test data as required.

3.5 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Tests will be performed using design conditions whenever possible.

Ethos Engineering Cameron County Parks Olmito Park Complex

- C. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the Contracting Officer and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- D. The CxA may direct that set points be altered when simulating conditions is not practical.
- E. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- F. If tests cannot be completed because of a deficiency outside the scope of the electrical system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
- G. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.6 FUNCTIONAL TEST PROCEDURES FOR SYSTEMS TO BE COMMISSIONED

- A. General
 - 1. The following paragraphs outline the functional test procedures for the various Div. 26 items to be commissioned. Functional testing will take place only after System Readiness checklists have been completed, equipment has been started-up, and Contractor has certified that systems are ready for functional testing.

3.7 COMMISSIONING TESTS

- A. Lighting Systems:
 - 1. Light Fixtures: Verify all lamps work without flicker.
 - 2. Light Switches: Verify switches control lights per design.
 - 3. Lighting Controls: Verify Schedule and/or photocell controls.
- B. All Electrical and Electrically Powered Equipment:
 - 1. Inspect electrical wiring and grounding for proper connection, color coding, and quality of installation.
 - 2. Verify panel is properly identified.
 - 3. Verify supply voltage, all hot legs.
 - 4. Verify amperage is within allowable limits.
 - 5. Inspect for physical damage proper installation, anchorage.
 - 6. Verify equipment runs smoothly and quietly.
 - 7. Verify operation of safeties.
 - 8. Verify all required means of disconnect are in place.
 - 9. Verify maintenance and NEC clearances are maintained.

C. Customized system readiness checklists and function testing requirements will be released after the submittal review phase.

3.8 TRAINING AND O&M MANUALS

A. Refer to Div. 26 specifications.

END OF SECTION 260800

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Standalone lighting control systems and associated components:
 - 1. LED drivers.
 - 2. Control stations.
 - 3. Wired sensors.
 - 4. Accessories.

2.1 RELATED REQUIREMENTS

- A. Section 26 2726 Wiring Devices:
 - 1. Finish requirements for wall controls specified in this section.
 - 2. Accessory receptacles and wall plates, to match lighting controls specified in this section.

3.1 REFERENCE STANDARDS

- A. 47 CFR 15 Radio Frequency Devices; current edition.
- B. ANSI C82.11 American National Standard for Lamp Ballasts High Frequency Fluorescent Lamp Ballasts Supplements; 2011.
- C. ANSI/ESD S20.20 Protection of Electrical and Electronic Parts, Assemblies and Equipment (Excluding Electrically Initiated Explosive Devices); 2014.
- D. ASTM D4674 Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments; 2002a (Reapproved 2010).
- E. CAL TITLE 24 P6 California Code of Regulations, Title 24, Part 6 (California Energy Code); 2013.
- F. CSA C22.2 No. 223 Power Supplies with Extra-low-voltage Class 2 Outputs; 2015.
- G. IEC 60929 AC and/or DC-Supplied Electronic Control Gear for Tubular Fluorescent Lamps Performance Requirements; 2015.
- H. IEC 61000-4-2 Electromagnetic Compatibility (EMC) Part 4-2: Testing and Measurement Techniques Electrostatic Discharge Immunity Test; 2008.
- I. IEC 61000-4-5 Electromagnetic Compatibility (EMC) Part 4-5: Testing and Measurement Techniques Surge Immunity Test; 2014.
- J. IEC 61347-2-3 Lamp Control Gear Part 2-3: Particular Requirements for A.C. and/or D.C. Supplied Electronic Control Gear for Fluorescent Lamps; 2011, with Amendments, 2016.
- K. IEEE 1789 Recommended Practice for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers; 2015.

- L. IEEE C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).
- M. ISO 9001 Quality Management Systems-Requirements; 2008.
- N. NECA 1 Standard for Good Workmanship in Electrical Construction; 2015.
- O. NECA 130 Standard for Installing and Maintaining Wiring Devices; National Electrical Contractors Association; 2010.
- P. NEMA 410 Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; National Electrical Manufacturers Association; 2015.
- Q. NEMA WD 1 General Color Requirements for Wiring Devices; National Electrical Manufacturers Association; 1999 (R 2015).
- R. NFPA 70 National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- S. UL 94 Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.
- T. UL 508 Industrial Control Equipment; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.
- U. UL 924 Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- V. UL 1310 Class 2 Power Units; Current Edition, Including All Revisions.
- W. UL 1472 Solid-State Dimming Controls; Current Edition, Including All Revisions.
- X. UL 1598C Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.
- Y. UL 2043 Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.
- Z. UL 8750 Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

4.1 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of sensors and wall controls with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate the placement of wall controls with actual installed door swings.

- 3. Coordinate the work to provide luminaires and lamps compatible with the lighting controls to be installed.
- 4. Notify Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.
- B. Pre-installation Meeting: Conduct on-site meeting with lighting control system manufacturer prior to commencing work as part of manufacturer's standard startup services. Manufacturer to review with installer:
 - 1. Low voltage wiring requirements.
 - 2. Separation of power and low voltage/data wiring.
 - 3. Wire labeling.
 - 4. Control locations.
 - 5. Load circuit wiring.
 - 6. Connections to other equipment.
 - 7. Installer responsibilities.

5.1 SUBMITTALS

- A. See Section 01 3000 Administrative Requirements for submittal procedures.
- B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
 - 1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.
- C. Shop Drawings:
 - 1. Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.
- D. Samples:
 - 1. Wall Controls:
 - a. Show available color and finish selections.
 - b. Provide one sample(s) for each product.
- E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Project Record Documents: Record actual installed locations and settings for lighting control system components.
- G. Operation and Maintenance Data: Include detailed information on lighting control system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

H. Warranty: Submit sample of manufacturer's Warranty or Enhanced Warranty as specified in Part 1 under "WARRANTY". Submit documentation of final execution completed in Owner's name and registered with manufacturer.

6.1 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications:
 - 1. Company with not less than ten years of experience manufacturing lighting control systems of similar complexity to specified system.
 - 2. Registered to ISO 9001, including in-house engineering for product design activities.
 - 3. Qualified to supply specified products and to honor claims against product presented in accordance with warranty.
- D. Maintenance Contractor Qualifications: Manufacturer's authorized service representative.

7.1 DELIVERY, STORAGE, AND HANDLING

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

8.1 FIELD CONDITIONS

- A. Maintain field conditions within manufacturers required service conditions during and after installation.
 - 1. System Requirements Lutron, Unless Otherwise Indicated:
 - a. Ambient Temperature:
 - 1) Lighting Control System Components, Except Those Listed Below: Between 32- and 104-degrees F (0 and 40 degrees C).
 - b. Relative Humidity: Less than 90 percent, non-condensing.

9.1 WARRANTY

- A. See Section 01 7800 Closeout Submittals, for additional warranty requirements. Use the following paragraph if there will be no manufacturer start-up or use the standard warranty paragraph below if Lutron Startup services will be specified in Part 3 under "FIELD QUALITY CONTROL". Keep in mind however that without Lutron Startup services, warranty coverage is significantly reduced. Visit www.lutron.com for warranty information.
- B. Manufacturer's Standard Warranty; Lutron Standard 2-Year Warranty; Lutron LSC-B2:

- 1. Manufacturer Lighting Control System Components, Except Ballasts/Drivers and Ballast Modules:
 - a. First Two Years:
 - 1) 100 percent replacement parts coverage, 100 percent manufacturer labor coverage to troubleshoot and diagnose a lighting issue.
 - 2) First-available on-site or remote response time.
 - b. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding manufacturer holidays.
- 2. Ballasts/Drivers and Ballast Modules: Five years 100 percent parts coverage, no manufacturer labor coverage.

10.1 MANUFACTURERS

- A. Basis of Design Manufacturer: Lutron Electronics Company, Inc; <u>www.lutron.com</u>.
 - 1. Products by listed manufacturers are subject to compliance with specified requirements and prior approval of Architect;
- B. Substitutions:
 - 1. Crestron, it shall meet or exceed basis of design.
 - 2. Sensorworx, it shall meet or exceed basis of design.
 - 3. All other substitutions (clearly delineated as such) must be submitted in writing for approval by Engineer a minimum of 10 working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
 - 4. Any proposed substitutions to be reviewed by Engineer at Contractor's expense By using pre-approved substitutions, Contractor accepts responsibility and associated costs for all required modifications to related equipment and wiring. Provide complete engineered shop drawings (including power wiring) with deviations from the original design highlighted in an alternate color for review and approval by Architect prior to rough-in.
- C. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

11.1 LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS

- A. Sensor Layout and Tuning: No Lighting Control Manufacturer Sensor Layout and Tuning service to be provided; Lutron LSC-NO-SENS-LT.
 - 1. Contractor to utilize Lighting Control Manufacturer Installation Instructions to place/install sensors.
 - 2. At Pre-wire and Startup, Lighting Control Manufacturer to provide a rough sensor calibration only. Sensor fine-tuning to be the responsibility of Contractor.
- B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) as suitable for the purpose indicated.

- C. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.
- D. Design lighting control equipment for 10-year operational life while operating continually at any temperature in an ambient temperature range of 32 degrees F (0 degrees C) to 104 degrees F (40 degrees C) and 90 percent non-condensing relative humidity.
- E. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.
- F. Device Finishes:
 - 1. Wall Controls: Match finishes specified for wiring devices in Section 26 2726
 - 2. Standard Colors: Comply with NEMA WD1 where applicable.
 - 3. Color Variation in Same Product Family: Maximum delta E of 1, CIE L*a*b color units.
 - 4. Visible Parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

12.1 CONTROL STATIONS

- A. Provide control stations with configuration as indicated or as required to control the loads as indicated.
- B. Wired Control Stations:
 - 1. General Requirements:
 - a. Power: Class 2 (low voltage).
 - b. UL listed.
 - c. Provide faceplates with concealed mounting hardware.
 - d. Borders, logos, and graduations to use laser engraving or silk-screened graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.
 - e. Finish: See section 262726 Wiring Devices.

13.1 WIRED SENSORS

- A. Wired Occupancy Sensors:
 - 1. General Requirements:
 - a. Connects directly to compatible ballasts and modules without the need of a power pack or other interface.
 - b. Turns off or reduces lighting automatically after reasonable time delay when a room or area is vacated by the last person to occupy the space.
 - c. Accommodates all conditions of space utilization and all irregular work hours and habits.
 - d. Comply with UL 94.

Ethos Engineering Cameron County Parks Olmito Park Complex

- e. Self-Adaptive Sensors: Continually adjusts sensitivity and timing to ensure optimal lighting control for any use of the space; furnished with field-adjustable controls for time delay and sensitivity to override any adaptive features.
- f. Provide capability to:
 - 1) Add additional timeout system-wide without need to make local adjustment on sensor.
 - 2) Group multiple sensors.
- g. Power Failure Memory: Settings and learned parameters to be saved in nonvolatile memory and not lost should power be interrupted and subsequently restored.
- h. Furnished with all necessary mounting hardware and instructions.
- i. Class 2 devices.
- j. Ceiling-Mounted Sensors: Indicate viewing directions on mounting bracket.
- k. Wall-Mounted Sensors: Provide swivel-mount base.
- l. Color: White.
- 2. Wired Passive Infrared Sensors:
 - a. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
 - b. Ceiling-Mounted Sensors: Provide customizable mask to block off unwanted viewing areas.
 - c. Product(s):
- 3. Wired Dual Technology Sensors:
 - a. Passive Infrared: Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
 - b. Ultrasonic: Utilize an operating frequency of 32 kHz or 40 kHz, crystalcontrolled to operate within plus/minus 0.005 percent tolerance.
 - c. Ceiling-Mounted Sensors: Provide customizable mask to block off unwanted viewing areas.
 - d. Isolated Relay: Provide an internal additional isolated relay with Normally Open, Normally Closed, and Common outputs for use with HVAC control, Data Logging and other control options where indicated.
 - e. Integral Photocell: Provide an integral photocell with adjustable sensitivity to prevent lights from turning on when there is sufficient natural light where indicated.
 - f. Product(s), Without Isolated Relay and Integral Photocell:
 - <<Type _____- ->>Ceiling-Mounted Dual Technology Sensor, 2000 square feet (186 sq m); Lutron Model LOS-CDT-2000-WH; or Lutron Model ULOS-CDT-2000-WH: Coverage of 2000 square feet (186 sq m) with ceiling height of 8 to 12 feet (2.4 to 3.7 m); 360 degree field of view; self-adaptive.
 - 2) <<Type _____- ->>Wall-Mounted Dual Technology Sensor; Lutron Model LOS-WDT-WH; Coverage of 1600 square feet (149 sq m) with ceiling height of 8 to 12 feet (2.4 to 3.7 m); 110-degree field of view;

14.1 ACCESSORIES

- A. Emergency Lighting Interface:
 - 1. Product: Lutron Model LUT-ELI.
 - 2. Provides total system listing to UL 924 when used with lighting control system.
 - 3. Senses all three phases of building power.

- 4. Provides an output to power panels or digital ballast interfaces if power on any phase fails and sends all lights controlled by these devices to an emergency light level setting; 100 percent intensity. Lights to return to their previous intensities when normal power is restored.
- 5. Accepts a contact closure input from a fire alarm control panel.

15.1 SOURCE QUALITY CONTROL

- A. See Section 01 4000 Quality Requirements, for additional requirements.
- B. Factory Testing; Lutron Standard Factory Testing:
 - 1. Perform full-function factory testing on all completed assemblies. Statistical sampling is not acceptable.
 - 2. Perform full-function factory testing on 100 percent of all LED drivers.
 - 3. Perform factory audit burn-in of all dimming assemblies and panels at 104 degrees F (40 degrees C) at full load for two hours.
 - 4. Perform factory burn-in of 100 percent of all ballasts at 104 degrees F (40 degrees C).

PART 2 EXECUTION

1.1 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- D. Verify that conditions are satisfactory for installation prior to starting work.

2.1 INSTALLATION

- A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130Install products in accordance with manufacturer's instructions.
- B. Sensor Locations:
 - 1. Sensor locations indicated are diagrammatic. Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage, in accordance with manufacturer's recommendations.
- C. Mount exterior daylight sensors to point due north with constant view of daylight.

- D. Ensure that daylight sensor placement minimizes sensor view of electric light sources. Locate ceiling-mounted and luminaire-mounted daylight sensors to avoid direct view of luminaires.
- E. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.1 FIELD QUALITY CONTROL

- A. See Section 01 4000 Quality Requirements, for additional requirements.
- B. Correct defective work and adjust for proper operation, and retest until entire system complies with contract documents.

4.1 ADJUSTING

A. Adjusting and Tuning service is not specified, Contractor to provide fine-tuning of sensor calibration.

5.1 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

6.1 COMMISSIONING

A. See Section 260800 – General Commissioning Requirements for commissioning requirements.

7.1 CLOSEOUT ACTIVITIES

- A. See Section 01 7800 Closeout Submittals, for closeout submittals.
- B. See Section 01 7900 Demonstration and Training, for additional requirements.

8.1 **PROTECTION**

A. Protect installed products from subsequent construction operations.

9.1 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION 260936

Ethos Engineering Cameron County Parks Olmito Park Complex

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:1. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. MCCB: Molded-case circuit breaker.
- E. SPD: Surge protective device.
- F. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
 - 1. Include materials, switching and overcurrent protective devices, accessories, and components indicated.
 - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details.
 - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
 - 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
 - 4. Detail bus configuration, current, and voltage ratings.
 - 5. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 6. Include evidence of NRTL listing for series rating of installed devices.
 - 7. Include evidence of NRTL listing for SPD as installed in panelboard.

- 8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- 9. Include wiring diagrams for power, signal, and control wiring.
- 10. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Two spares for each type of panelboard cabinet lock.
 - 2. Circuit Breakers: As noted on schedules.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 FIELD CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above panelboards is complete.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
 - b. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
 - 1. Ambient temperatures within limits specified.
 - 2. Altitude not exceeding 6600 feet.

1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
 - 1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D Co.
 - 2. Eaton Corporation.
 - 1. Siemens
 - 2. General Electric ABB

2.2 PANELBOARDS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.
- F. Enclosures: Surface-mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 4X SS.
 - 2. Height: 84 inches maximum.
 - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
 - 4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
 - 5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 - 6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 7. Finishes:
 - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Same finish as panels and trim.
- G. Incoming Mains:
 - 1. Location: coordinated on the field by the electrical contractor.
 - 2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.
- H. Phase, Neutral, and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - a. Plating shall run entire length of bus.
 - b. Bus shall be fully rated the entire length.
 - 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
 - 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
 - 5. Split Bus: Vertical buses divided into individual vertical sections.
- I. Conductor Connectors: Suitable for use with conductor material and sizes.

- 1. Material: Hard-drawn copper, 98 percent conductivity.
- 2. Terminations shall allow use of 75 deg C rated conductors without derating.
- 3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
- 4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
- 5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
- J. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- K. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
 - 1. Percentage of Future Space Capacity: Ten percent.
- L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
 - 1. Panelboards and overcurrent protective devices rated 240 V or less shall have shortcircuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: Circuit breaker or Lugs only (as noted on plans).
- C. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers:

- a. Inverse time-current element for low-level overloads.
- b. Instantaneous magnetic trip element for short circuits.
- 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with frontmounted, field-adjustable trip setting.
- 3. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
- 4. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
- 5. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
- 6. Subfeed Circuit Breakers: Vertically mounted.
- 7. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.
 - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - e. Application Listing: Appropriate for application.
 - f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional with field-adjustable 0.1- to 0.6-second] time delay.
 - i. Multipole units enclosed in a factory assembled to operate as a single unit.
 - j. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - k. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.5 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
 - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NECA 407 and NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NECA 407 and NEMA PB 1.1.
- D. Equipment Mounting:
 - 1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete." and or Section 033053 "Miscellaneous Cast-in-Place Concrete."
 - 2. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- F. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- G. Mount panelboard cabinet plumb and rigid without distortion of box.

- H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- I. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.
- J. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.
- K. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
 - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- L. Make grounding connections and bond neutral for services to ground. Make connections to grounding electrodes, and connections to separate ground bars.
- M. Install filler plates in unused spaces.
- N. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

- C. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- D. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers and low-voltage surge arrestors stated in NETA ATS, Paragraph 7.6 Circuit Breakers and Paragraph 7.19.1 Surge Arrestors, Low-Voltage. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
 - c. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- E. Panelboards will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.
 - 1. Measure loads during period of normal facility operations.
 - 2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.

4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.6 **PROTECTION**

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Tamper-resistant receptacles.
 - 3. Weather-resistant receptacles.
 - 4. Snap switches.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packinglabel warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Eaton.
 - 2. Wiring Device-Kellems; a division of Hubbell.
 - 3. Leviton Mfg. Company Inc.
 - 4. Pass & Seymour; a division of LeGrand.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
- B. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

2.4 GFCI RECEPTACLES

- A. General Description:
 - 1. Straight blade, feed-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
 - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
- C. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

- 2.5 TOGGLE SWITCHES
 - A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
 - B. Switches, 120/277 V, 20 A:
 - 1. Single Pole
 - 2. Three Way
 - C. Key-Operated Switches, 120/277 V, 20 A:
 1. Description: Single pole, Corbin type with factory-supplied key in lieu of switch handle.

2.6 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Tamper proof metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Type 302 stainless steel, 0.04-inch thick.
 - 3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.7 FINISHES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: White or as selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. 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 boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

- 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right 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.
- D. Device Installation:
 - 1. Replace devices that have been in temporary use during construction and that 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, two-thirds to three-fourths of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 - When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 - 8. Tighten unused terminal screws on the device.
 - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black -filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Test Instruments: Use instruments that comply with UL 1436.
 - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display 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 unacceptable.
 - 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. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Test straight-blade convenience outlets in patient-care area and hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.
- D. Wiring device will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 262726

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600 V ac and less for use in the following:
 - a. Enclosed switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles. Include the following for each fuse type indicated:
 - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 3. Current-limitation curves for fuses with current-limiting characteristics.
 - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in electronic format suitable for use in coordination software and in PDF format.
 - 5. Coordination charts and tables and related data.
 - 6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017700 "Closeout Procedures," and or Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Ambient temperature adjustment information.
 - 2. Current-limitation curves for fuses with current-limiting characteristics.

- 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit in PDF format.
- 4. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.6 FIELD CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Industries, Inc.; Bussmann Div.
 - 2. Mersen
- B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

2.3 FUSE COVER

SECTION 262813 - FUSES

A. Fuse cover shall be BUSSMANN "SAMI"

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. Main Service:
 - a. 70-600A: Class RK1, time delay, current limiting.
 - 1) 250volts Bussmann LOW-PEAK LPN-RK dual element.
 - 2. Other Branch Circuits: Class RK1, time delay.
 - 3. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers (MCCBs).
 - 4. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of NRTL listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.
- 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.

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. 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.
- D. Manufacturer's field service report.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "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.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. 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.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member Company of NETA or an NRTL.

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- C. 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.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NFPA 70.

1.9 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 and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.

1.10 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Square D Co.
 - 2. Eaton Corporation.
 - 3. Siemens
 - 4. General Electric ABB

2.2 FUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac (as per connected voltage), 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.

- B. 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. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - 5. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 6. Service-Rated Switches: Labeled for use as service equipment.

2.3 NONFUSIBLE SWITCHES

- A. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac (as per connected voltage), 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- B. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Hookstick Handle: Allows use of a hookstick to operate the handle.
 - 3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.4 MOLDED-CASE CIRCUIT BREAKERS

- A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- B. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
- C. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- D. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application.
 - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type.

2.5 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.

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
- 2. Outdoor Locations: NEMA 250, Type 4X S.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection 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.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

END OF SECTION 262816

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior LED luminaires and drivers.
 - 2. Luminaire supports.
- B. Related Requirements:
 - 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 DEFINITIONS

- A. BIM: Building information model.
- B. CAD: Computer-aided design.
- C. CCT: Correlated color temperature.
- D. CRI: Color Rendering Index.
- E. LED: Light-emitting diode.
- F. Fixture: See "Luminaire."
- G. IP: International Protection or Ingress Protection Rating
- H. Lumen: Measured output of lamp and luminaire, or both.
- I. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.

- 3. Include physical description and dimensions of luminaires.
- 4. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
- 5. Include photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the luminaire as applied in this Project. For LED light fixtures the adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project IES LM-79 and IES LM-80
 - a. Retain or "Manufacturers' Certified Data" or "Testing Agency Certified Data" Subparagraph below. Retain first subparagraph if photometric data, based on testing by accredited manufacturers' laboratories, is considered adequate for luminaires in this Project. Retain second subparagraph if photometric data for one or more luminaires are based on independent laboratory tests; coordinate with the Interior Lighting Fixture Schedule on Drawings to indicate which units shall meet this requirement. See the Evaluations. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.
 - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
- 6. Include documentation verifying light fixture efficiency by providing one of the following:
 - a. Screenshot of DLC website listing the light fixture. Can be found at <u>https://www.designlights.org</u>
 - b. Screenshot of Energy Star website listing the light fixture. Can be found at <u>https://www.energystar.gov</u>
 - c. Part efficiency documentation in the form of 3rd party certified lab tested LM-79 or LM-80 documents with additional supporting documents linking the part model to the light fixture model.
- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, and required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.
- D. Qualification Data: For testing laboratory providing photometric data for luminaires.
- E. Product Certificates: For each type of ballast for bi-level and dimmer-controlled luminaires, from manufacturer.
- F. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

G. Sample warranty.

1.5 PRIOR APPROVAL SUBMITTAL REQUESTS

- A. Full submittal data , by type, clearly highlighted and arrowed to identify the specific proposed manufacturer's nomenclature
- B. Full submittal data of lamp and proposed manufacturer.
- C. Full submittal data of ballast/driver (LED) data of proposed manufacturer
- D. LED lumen data will include
 - 1. Lumen output
 - 2. L70 and L90 testing
 - 3. Confirmation of independent test lab data ITL
 - 4. Color temperature and CRI with quantity of McAdam Ellipse steps
 - a. Data shall include sphere and goniometer results for total lumen, total power, luminaire efficacy, CRI and junction temperature for the specified color temperature
 - 5. Make and brand of LED diode should be clearly identified on submittal data
- E. All substitutions must meet specified fixtures certifications (UL,ETL,CE,CSA, RoHS, DLC, Energy Star)
- F. Provide lighting calculations with the prior approval request based on reflectance values and light loss factors provided by the engineer and displayed on lighting calculation drawings. (may be unique by area) Calculations shall be shown on one sheet with dimensions as shown on construction set. Data will be submitted electronically in dxf format on a flash drive and with printed calculations on Architectural E size sheets to scale with construction set sheets.
 - 1. Discrepancies between prior approval data calculations and the original design calculations will result in immediate disqualification of review due to time based constraints on the bid process
- G. Prior approval request may require a sample of both the proposed and specified fixtures provided by the alternate manufacturer at NO additional cost to the project. Samples of both specified and proposed must be provided within 10 working days of request.
- H. All data will be submitted electronically and in a bound format
- I. Bound data will be secured in hard binder with 3" rings for ease of review or PDF file.
 - 1. Types will be marked with a tab by type and indexed for ease of reference
- J. LED warranty information MUST be included by type and marked in RED to clearly identify the manufacturer's warranty terms. Warranty data MUST meet or exceed the specified manufacturers terms
- K. Prior approvals MUST be received and acknowledged to the specifier's office no less than 10 days prior to bid.

- L. ALL prior approval data must be submitted in one package with complete information. Information that is incomplete will be rejected without review.
- M. The prior approval will be returned marked approved or rejected by type with no explanation. If any specification is deemed not equal the review will be stopped, the type rejected with no explanation.
- N. Lumen output for the proposed fixture must be highlighted in yellow for clear identification.
- O. LED warranty information must be included by type and marked in red to clearly identify the manufacturer's warranty terms. Warranty data must meet or exceed the specified manufacturer's terms.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- A. LED luminaires
 - 1. Provide from a single manufacturer for each luminaire type.
 - 2. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace (materials and labor) components of luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five year(s) from date of Substantial Completion

PART 2 - PRODUCTS

2.1 LUMINAIRE 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. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598.
- E. Lamp base complying with ANSI C81.61 or IEC 60061-1.
- F. Recessed Luminaires: Comply with NEMA LE 4.
- G. EMI Filters: Factory installed to suppress conducted EMI according to MIL-STD-461E. Fabricate luminaires with one filter on each ballast indicated to require a filter.

2.2 EMERGENCY POWER UNIT

- A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast. Comply with UL 924.
 - 1. Emergency Connection: Operate LED's continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire driver.
 - 2. Test Push Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 3. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - 4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

- 5. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
- 6. Integral Self-Test: Factory-installed electronic device automatically initiates coderequired test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.3 LED LIGHTING FIXTURES AND LED LAMPS

- A. All LED products must be UL, ETL and/or CSA listed.
- B. All LED products must have LM-79 and LM-80 testing noted on specification sheet by an independent test lab.
- C. All LED products should be identified as L70 and/or L90 ratings based on independent test lab data.
- D. All outdoor and wet location listed products must clearly state the IP rating carried on the fixture based on independent test lab data.
- E. Bulb shape complying with ANSI C79.1.
- F. CRI of Minimum 80. CCT of 4100 K.
- G. Rated lamp life of **50,000** hours.
- H. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- I. Nominal Operating Voltage: as noted on light fixture schedule.
- J. All LED products must be serviceable for accessible for field repair needs.
- K. All indoor lighting color rendering should be within a 3 step McAdams ellipse. All indoor lighting should be 4000-4100 kelvin unless specifically noted.
- L. All control systems that interface with an LED product will be supported by a project "integrator" until project completion. This includes contact with the installer prior to installation, availability during installation, and final checkout and startup after installation. The quantity of days required for startup will be based on the manufacturer/agent's discretion and need.
 - 1. The project integrator must be capable of performing low voltage and dmx terminations. High voltage terminations are performed solely by the electrical subcontractor.
 - 2. Reporting of final startup completion of the controls system back to the engineer is mandatory.
 - 3. Invitation to attend the training with the owner's representative should be made to the engineer no less than 5 days prior to training
 - 4. Signature confirmation of training and startup is required within 5 business days after completion back to the engineer's office.

- M. All LED drivers should be capable of 0-10 volt controls and DMX control and shall dim to 1% of total lumen output. Where specifically specified the dimming driver may be required to dim to .1% of lumen output, otherwise known as "dim to dark"
- N. Driver manufacturers must have a 5 year history producing dimmable electronic LED drivers for the North American market.
- O. Ambient driver temperatures must be within -20 degrees to 50 degrees C (-4 degrees to 122 degrees F)
- P. Driver (internal) must limit inrush current.
 - 1. Base specification: meet or exceed NEMA 410 driver inrush standard of 430 amp per 10 amps load with a maximum of 370 amps/2 seconds
 - 2. Preferred specification : Meet or exceed 30ma's at 277 VAC for up to 50 watts of load and 75A at 240us att 277 VAC for 100 watts of load
 - 3. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A
 - 4. No visible change in light output with a variation of plus/minus 10percent line voltage input.
 - 5. Total harmonic distortion less than 20%, and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD

2.4 SURFACE MOUNT, LINEAR

- A. Universal mounting bracket.
- B. Integral junction box with conduit fittings.

2.5 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. 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.
- C. Diffusers and Globes:
 - 1. Tempered Fresnel glass, prismatic glass or prismatic acrylic, refer to light fixture schedule.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.

- 3. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- 4. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- D. Housings:
 - 1. Extruded-aluminum housing and heat sink or as noted on light fixture schedule.
 - 2. Powder-coat finish.
- E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI for all luminaires.

2.6 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.7 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish shall match luminaire.
- C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation.
- C. Examine walls, floors, roofs, and ceilings for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Remote Mounting of Ballasts: Distance between the ballast and luminaire shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- C. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- D. Install lamps in each luminaire.
- E. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them.
- F. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- G. Flush-Mounted Luminaire Support:
 - 1. Secured to outlet box.
 - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - 3. Trim ring flush with finished surface.
- H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
- B. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- C. Luminaire will be considered defective if it does not pass operation tests and inspections.
- D. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265116

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Exit signs.
 - 2. Luminaire supports.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.
- D. Fixture: See "Luminaire" Paragraph.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.
 - 1. Include data on features, accessories, and finishes.
 - 2. Include physical description of the unit and dimensions.
 - 3. Battery and charger for light units.
 - 4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
 - 5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.
 - a. Testing Agency Certified Data: For indicated luminaires and signs, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires and signs shall be certified by manufacturer.
 - b. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, and required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule:
 - 1. For exit signs. Use same designations indicated on Drawings.
- D. Qualification Data: For testing laboratory providing photometric data for luminaires.
- E. Product Certificates: For each type of luminaire.
- F. Product Test Reports: For each luminaire for tests performed by manufacturer and witnessed by a qualified testing agency.
- G. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Luminaire-mounted, emergency battery pack: One for every 20 emergency lighting units. Furnish at least one of each type.
 - 2. Diffusers and Lenses: two for every 100 of each type and rating installed. Furnish at least one of each type.

1.7 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace (materials and labor) components of luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two year(s) from date of Substantial Completion.
- B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Power Unit Batteries: **5** years from date of Substantial Completion. Full warranty shall apply for first year and prorated warranty for the remaining four years.
 - 2. Warranty Period for Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year and prorated warranty for the remaining six years.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- 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. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Comply with UL 1598 for fluorescent luminaires.
- F. Lamp Base: Comply with ANSI C81.61 or IEC 60061-1.
- G. Bulb Shape: Complying with ANSI C79.1.

- H. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast.
 - 1. Emergency Connection: Operate two lamp(s) continuously at an output of 1100 lumens each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
 - 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
 - b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
 - c. Humidity: More than 95 percent (condensing).
 - d. Altitude: Exceeding 3300 feet.
 - 4. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - 5. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - 6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 - 7. Integral Self-Test: Factory-installed electronic device automatically initiates coderequired test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.2 EMERGENCY LIGHTING

- A. General Requirements for Emergency Lighting Units: Self-contained units.
- B. Emergency Luminaires:
 - 1. Emergency Luminaires: as indicated on Drawings, with the following additional features:
 - a. Rated for installation in damp locations, and for sealed and gasketed luminaires in wet locations.

2.3 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

- B. Internally Lighted Signs:
 - 1. Lamps for AC Operation: Fluorescent, two for each luminaire; 20,000 hours of rated lamp life.
 - 2. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
 - 3. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

2.4 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access:
 - 1. Smooth operating, free of light leakage under operating conditions.
 - 2. Designed to permit relamping without use of tools.
 - 3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Housings:
 - 1. Powder coat finish.

2.5 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Support Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, and 12 gage.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

- C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.

D. Supports:

- 1. Sized and rated for luminaire and emergency power unit weight.
- 2. Able to maintain luminaire position when testing emergency power unit.
- 3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
- 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.
- E. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls, or a minimum 20 gauge backing plate attached to wall structural members, or using through bolts and backing plates on either side of wall.
 - 2. Do not attach luminaires directly to gypsum board.
- F. Ceiling Grid Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
 - 3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

- A. Perform startup service:
 - 1. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

3.6 ADJUSTING

- A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:
 - 1. Inspect all luminaires. Replace lamps, emergency power units, batteries, signs, or luminaires that are defective.
 - a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 2. Conduct short-duration tests on all emergency lighting.

END OF SECTION 265219

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Poles and accessories for support of luminaires.
 - 2. Luminaire-lowering devices.

1.3 DEFINITIONS

- A. EPA: Equivalent projected area.
- B. Luminaire: Complete lighting fixture.
- C. Pole: Luminaire-supporting structure, including tower used for large-area illumination.
- D. Standard: See "Pole."

1.4 ACTION SUBMITTALS

- A. Product Data: For each pole, accessory, and luminaire-supporting and -lowering device, arranged as indicated.
 - 1. Include data on construction details, profiles, EPA, cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.
 - 2. Include finishes for lighting poles and luminaire-supporting devices.
 - 3. Anchor bolts.
 - 4. Manufactured pole foundations.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, and required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Detail fabrication and assembly of poles and pole accessories.
 - 4. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the state of installation.
 - 5. Anchor bolt templates keyed to specific poles and certified by manufacturer.
- 6. Method and procedure of pole installation. Include manufacturer's written installations.
- C. Samples: For each exposed lighting pole, standard, and luminaire-supporting device and for each color and texture specified.

1.5 INFORMATIONAL SUBMITTALS

- A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.
- B. Qualification Data: For testing agency.
- C. Material Test Reports:
 - 1. For each foundation component, by a qualified testing agency.
 - 2. For each pole, by a qualified testing agency.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Sample Warranty: Manufacturer's standard warranty.
- G. Soil test reports

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For poles to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include pole inspection and repair procedures.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Pole repair materials.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for foundation testing.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

- B. Store poles on decay-resistant skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- C. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.
- D. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of pole(s) 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 a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
 - 2. Warranty Period for Corrosion Resistance: Five years from date of Substantial Completion.
 - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products as listed on light fixture schedule and plans.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design pole foundation and pole power system.
- B. Structural Characteristics: Comply with AASHTO LTS-6-M.
- C. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied according to AASHTO LTS-6-M.
- D. Live Load: Single load of 500 lbf distributed according to AASHTO LTS-6-M.
- E. Ice Load: Load of 3 lbf/sq. ft., applied according to AASHTO LTS-6-M for applicable areas on the Ice Load Map.
- F. Wind Load: Pressure of wind on pole and luminaire, calculated and applied according to AASHTO LTS-6-M.

- G. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of 1.1 to obtain the EPA to be used in pole selection strength analysis.
- H. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

2.3 ALUMINUM POLES

- A. Poles: Seamless, extruded structural tube complying with ASTM B 221, Alloy 6061-T6, with access handhole in in pole wall.
 - 1. Shape: round tapered, round, straight, square, straight (as noted on drawings)
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- B. Mast Arms: Aluminum Single-arm type, continuously welded to pole attachment plate. Material and finish same as plate.
- C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 - 1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with stainless steel bolts.
 - 2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.
- D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- E. Grounding and Bonding Lugs: Bolted 1/2-inch threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- F. Fasteners: Stainless steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.
 - 1. Materials: Compatible with poles and standards as well as to substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
- G. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.
- H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- I. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
 - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

- 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
- 3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I clear coating of 0.018 mm or thicker), complying with AAMA 611.
- 4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
- J. Powder-Coat Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair powder coat bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, according to SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
 - 2. Powder coat shall comply with AAMA 2604.
 - a. Electrostatic applied powder coating; single application with a minimum 2.5- to 3.5-mils dry film thickness; cured according to manufacturer's instructions. Coat interior and exterior of pole for equal corrosion protection.
 - b. Color: As selected by Architect from manufacturer's full range.

2.4 POLE ACCESSORIES

A. Nut Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover only the pole's mounting bolts and nuts.

2.5 MOUNTING HARDWARE

- A. Anchor Bolts: Manufactured to ASTM F 1554, Grade 55, with a minimum yield strength of 55,000 psi.
 - 1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
 - 2. Bent or Headed rods, diameter and length as required by manufacturer.
 - 3. Threading: Uniform National Coarse or Uniform National 8, Class 2A.
- B. Nuts: ASTM A 563, Grade A, Heavy-Hex
 - 1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
 - 2. Four nuts provided per anchor bolt, shipped with nuts pre-assembled to the anchor bolts.
- C. Washers: ASTM F 436, Type 1.
 - 1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
 - 2. Two washers provided per anchor bolt.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine poles, luminaire-mounting devices, lowering devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.
- C. Examine roughing-in for foundation and conduit to verify actual locations of installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 POLE FOUNDATION

- A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123 M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- B. Anchor Bolts: Install plumb using manufacturer-supplied plywood template, uniformly spaced.

3.3 POLE INSTALLATION

- A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on drawing.
 - 1. Fire Hydrants and Water Piping: 60 inches.
 - 2. Water, Gas, Electric, Communications, and Sewer Lines: 10 feet.
 - 3. Trees: 15 feet from tree trunk.
 - 4. Overhead Utility lines: 15 feet from nearest conductor (confirm with utility company prior to rough in).

- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts and tighten top nuts to torque level according to pole manufacturer's written instructions.
 - 1. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 - 2. Install base covers unless otherwise indicated.
 - 3. Use a short piece of 1/2 -inch diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6-inchwide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch below top of concrete slab.
- F. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

3.4 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum using insulating fittings or treatment.
- B. Steel Conduits: Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipewrapping plastic tape applied with a 50-percent overlap.

3.5 GROUNDING

- A. Ground Metal Poles and Support Structures: Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.6 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

- Inspect poles for nicks, mars, dents, scratches, and other damage. System function tests. 1.
- 2.

END OF SECTION 265613

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
- B. Related Requirements:
 - 1. Section 265613 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. Lumen: Measured output of lamp and luminaire, or both.
- E. Luminaire: Complete lighting unit, including lamp, reflector, and housing.
- F. Pole: Luminaire support structure, including tower used for large-area illumination.
- G. Standard: See "Pole."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.
 - 1. Arrange in order of luminaire designation.
 - 2. Include data on features, accessories, and finishes.
 - 3. Include physical description and dimensions of the luminaires.
 - 4. Lamps, including life, output (lumens, CCT, and CRI), and energy-efficiency data.
 - 5. Photometric data and adjustment factors based on laboratory tests, complying with IES "Lighting Measurements Testing and Calculation Guides," of each luminaire type. The adjustment factors shall be for lamps, driver, and accessories identical to those indicated for the luminaire as applied in this Project.

For LED luminaires the adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-79 and IES LM-80.

- a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
- b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
- 6. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
- B. Shop Drawings: For nonstandard or custom luminaires.
 - 1. Include plans, elevations, sections, and mounting and attachment details.
 - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, and required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Include diagrams for power, signal, and control wiring.
- D. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Luminaires.
 - 2. Structural members to which equipment and luminaires will be attached.
 - 3. Underground utilities and structures.
 - 4. Existing underground utilities and structures.
 - 5. Above-grade utilities and structures.
 - 6. Existing above grade utilities and structures.
 - 7. Building features.
 - 8. Vertical and horizontal information.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Product Certificates: For each type of the following:
 - 1. Driver.
 - 2. Lamp.
- E. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

F. Sample warranty.

1.6 PRIOR APPROVAL SUBMITTAL REQUESTS

- A. Full submittal data, by type, clearly highlighted and arrowed to identify the specific proposed manufacturer's nomenclature.
- B. Full submittal data of lamp and proposed manufacturer.
- C. Full submittal data of driver of proposed manufacturer.
- D. LED lumen data will include
 - 1. Lumen output
 - 2. L70 and L90 testing
 - 3. Confirmation of independent test lab data ITL
 - 4. Color temperature and CRI with quantity of McAdam Ellipse steps
 - a. Data shall include sphere and goniometer results for total lumen, total power, luminaire efficacy, CRI and junction temperature for the specified color temperature
 - 5. Make and brand of LED diode should be clearly identified on submittal data.
- E. LED dimming shall be equal in range and quality to the specified drivers, Quality of dimming to be defined by dimming range, freedom from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experience in a commercial environment.
- F. All substitutions must meet specified fixtures certifications (UL, ETL, CE, CSA, RoHS, DLC, Energy Star)
- G. Provide lighting calculations with the prior approval request based on reflectance values and light loss factors provided by the engineer and displayed on lighting calculation drawings. (may be unique by area). Calculations shall be shown on one sheet with dimensions as shown on construction set. Data will be submitted electronically in dxf format on a flash drive and with printed calculations on Architectural E size sheets to scale with construction set sheets.
 - 1. Discrepancies between prior approval data calculations and the original design calculations will result in immediate disqualification of review due to time-based constraints on the bid process.
- H. Prior approval request may require a sample of both the proposed and specified fixtures provided by the alternate manufacturer at NO additional cost to the project. Samples of both specified and proposed must be provided within 10 working days of request.
- I. All data will be submitted electronically and in a bound format.
- J. Bound data will be secured in hard binder with 3" rings for ease of review or PDF file.
 - 1. Types will be marked with a tab by type and indexed for ease of reference.

- K. LED warranty information MUST be included by type and marked in RED to clearly identify the manufacturer's warranty terms. Warranty data MUST meet or exceed the specified manufacturers terms.
- L. Prior approvals MUST be received and acknowledged to the specifier's office no less than 10 days prior to bid.
- M. ALL prior approval data must be submitted in one package with complete information. Information that is incomplete will be rejected without review.
- N. The prior approval will be returned marked approved or rejected by type with no explanation. If any specification is deemed not equal the review will be stopped, the type rejected with no explanation.
- O. Lumen output for the proposed fixture must be highlighted in yellow for clear identification.
- P. All inverter systems supply power to LED fixtures must have pure PWM sine wave function and work with any type of lighting load.
- Q. LED warranty information must be included by type and marked in red to clearly identify the manufacturer's warranty terms. Warranty data must meet or exceed the specified manufacturers terms.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires to include in [operation] and maintenance manuals.
 - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Glass, Acrylic, and Plastic Lenses Covers and Other Optical Parts: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.9 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturers' laboratory accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as

defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.11 FIELD CONDITIONS

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
- B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.12 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace (labor and material) components of luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including luminaire support components.
 - b. Faulty operation of luminaires, driver, and accessories.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- B. Warranty Period: Two year(s) from date of Substantial Completion.
- A. LED luminaires Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE 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. NRTL Compliance: Luminaires shall comply with UL 1598 and be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. Lateral Light Distribution Patterns: Comply with IES RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

- E. UL Compliance: Listed for wet location (UL 1598).
- F. Lamp base complying with ANSI C81.61 or IEC 60061-1.
- G. EMI Filters: Factory installed to suppress conducted EMI as required by MIL-STD-461E. Fabricate luminaires with one filter on each driver indicated to require a filter.
- H. In-line Fusing: Install on the driver primary for each luminaire.
- I. Lamp Rating: Lamp marked for outdoor use and in enclosed locations.
- J. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- K. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 LED LIGHTING FIXTURES AND LED LAMPS

- A. All LED products must be UL, ETL and/or CSA listed.
- B. All LED products must have LM-79 and LM-80 testing noted on specification sheet by an independent test lab.
- C. All LED products should be identified as L70 and/or L90 ratings based on independent test lab data.
- D. All outdoor and wet location listed products must clearly state the IP rating carried on the fixture based on independent test lab data.
- E. Bulb shape complying with ANSI C79.1.
- F. CRI of Minimum 80. CCT of 4100 K.
- G. Rated lamp life of **50,000** hours.
- H. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- I. Nominal Operating Voltage: as noted on light fixture schedule.
- J. All LED products must be serviceable for accessible for field repair needs.
- K. All outdoor pole mounted products must have surge suppression within each fixture.
- L. All outdoor lighting color rendering should be within a 7 step McAdams Ellipse. All outdoor lighting should be 4000 kelvin unless specifically noted
- M. All control systems that interface with an LED product will be supported by a project "integrator" until project completion. This includes contact with the installer prior to installation, availability during installation, and final checkout and startup after installation.

The quantity of days required for startup will be based on the manufacturer/agent's discretion and need.

- 1. The project integrator must be capable of performing low voltage and dmx terminations. High voltage terminations are performed solely by the electrical subcontractor.
- 2. Reporting of final startup completion of the controls system back to the engineer is mandatory.
- 3. Invitation to attend the training with the owner's representative should be made to the engineer no less than 5 days prior to training.
- 4. Signature confirmation of training and startup is required within 5 business days after completion back to the engineer's office.
- N. All LED drivers should be capable of 0-10 volt controls and DMX control and shall dim to 1% of total lumen output. Where specifically specified the dimming driver may be required to dim to .1% of lumen output, otherwise known as "dim to dark".
- O. Driver manufacturers must have a 5-year history producing dimmable electronic LED drivers for the North American market.
- P. Ambient driver temperatures must be within -20 degrees to 50 degrees C (-4 degrees to 122 degrees F)
- Q. Driver (internal) must limit inrush current.
 - 1. Base specification: meet or exceed NEMA 410 driver inrush standard of 430 amps per 10 amps load with a maximum of 370 amps/2 seconds.
 - 2. Preferred specification: Meet or exceed 30ma's at 277 VAC for up to 50 watts of load and 75A at 240us att 277 VAC for 100 watts of load
 - 3. Withstand up to a 1,000-volt surge without impairment of performance as defined by ANSI C62.41 Category A
 - 4. No visible change in light output with a variation of plus/minus 10percent line voltage input.
 - 5. Total harmonic distortion less than 20% and meet ANSI C82.11 maximum allowable THD requirements at full output. THD shall at no point in the dimming curve allow imbalance current to exceed full output THD.
- 2.3 LUMINAIRE TYPES See light fixture schedule on plans.

2.4 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Sheet Metal Components: Corrosion-resistant aluminum or Stainless steel unless otherwise indicated. Form and support to prevent warping and sagging.
- C. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

- D. 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. Driver shall automatically disconnect driver when door opens.
- E. Exposed Hardware Material: Stainless steel.
- F. Diffusers and Globes:
 - 1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - 2. Glass: Annealed crystal glass unless otherwise indicated.
 - 3. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.
- G. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- H. 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.
- I. Housings:
 - 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
 - 2. Provide filter/breather for enclosed luminaires.
- J. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
 - 1. Label shall include the following lamp characteristics:
 - a. CCT and CRI for all luminaires.

2.5 METAL FINISHES

- A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. 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.
- C. 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. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
- 3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker), complying with AAMA 611.
- 4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Examine walls, roofs, and canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Remote Mounting of Drivers: Distance between the driver and luminaire shall not exceed that recommended by manufacturer. Verify the following with manufacturer:
 - 1. Maximum distance between driver and luminaire.
 - 2. Wire size between driver and luminaire.

- E. Wiring Method: Install cables in raceways. Conceal raceway and cables.
- F. Fasten luminaire to indicated structural supports.
- G. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Support luminaires without causing deflection of finished surface.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- H. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls, or a minimum 1/8-inch backing plate attached to wall structural members or using through bolts and backing plates on either side of wall.
- I. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height indicated on Drawings.
- J. Coordinate layout and installation of luminaires with other construction. Refer to architectural elevations prior to rough-ins.
- K. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
- L. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems;" for wiring connections and wiring methods.

3.4 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 Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Photoelectric Control Operation: Verify operation of photoelectric controls.
- C. Illumination Tests:
 - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
 - a. IES LM-5.
 - b. IES LM-50.
 - c. IES LM-52.
 - d. IES LM-64.
 - e. IES LM-72.
- D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

3.8 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner.

3.9 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
 - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265621

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. This document is intended to specify the requirements for the provision of all equipment, materials, labor, documentation and services necessary to furnish and install a complete and operational integrated security access control and alarm monitoring (ACAM) system. The system shall consist of a fully automated and integrated computer-based security system, including, but not limited to the following functions and capabilities:
 - a. Security alarm monitoring and reporting of alarm and trouble conditions detected by sensors and/or devices in local and remote locations
 - b. Control panel shall be expandable or networked to connect the future buildings.

1.3 DEFINITIONS

- A. LCD: Liquid-crystal display.
- B. LED: Light-emitting diode.
- C. PIR: Passive infrared.
- D. RFI: Radio-frequency interference.
- E. UPS: Uninterruptible power supply.
- F. Protected or Protection Zone: A space or area for which an intrusion must be detected and uniquely identified, the sensor or group of sensors assigned to perform the detection, and any interface equipment between sensors and communication link to central-station control unit.

1.4 SUBMITTALS

- A. Product Data: Components for sensing, detecting, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.

- 1. Functional Block Diagram: Show single-line interconnections between components including interconnections between components specified in this Section and those furnished under other Sections. Indicate control, signal, and data communication paths. \
- 2. Raceway Riser Diagrams: Detail raceway runs required for intrusion detection and for systems integration. Include designation of devices connected by raceway, raceway type, and size, and type and size of wire and cable fill for each raceway run.
- 3. Device Address List: Coordinate with final system programming.
- 4. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
- 5. Details of surge-protection devices and their installation.
- 6. Sensor detection patterns and adjustment ranges.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For intrusion detection system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
 - 1. Data for each type of product, including features and operating sequences, both automatic and manual.
- E. Warranty: Special warranty specified in this Section.
- F. Other Information Submittals:
 - 1. Test Plan and Schedule: Test plan defining all tests required to ensure that system meets technical, operational, and performance specifications.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

- 1. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Intrusion Detection Systems Integrator Qualifications: An experienced intrusion detection equipment supplier who has completed systems integration work for installations similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. FMG Compliance: FMG-approved and -labeled intrusion detection devices and equipment.
- D. Comply with NFPA 70.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace (labor and materials) components of intrusion detection devices and equipment that fails in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. Supervision: System components shall be continuously monitored for normal, alarm, supervisory, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.
 - 1. Alarm Signal: Display at central-station control unit and actuate audible and visual alarm devices.
 - 2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or controller failure.
 - 3. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or controller.
- B. System Control: Central-station control unit shall directly monitor intrusion detection units and connecting wiring.
- C. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.
- D. Operator Commands:
 - 1. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
 - Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
 - 3. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.
 - 4. Protected Zone Test: Initiate operational test of a specific protected zone.
 - 5. System Test: Initiate system-wide operational test.
- E. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from central-station control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at central-station control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.
- F. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times. Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance. Manual secure-access control stations shall override programmed settings.

2.3 SYSTEM COMPONENT REQUIREMENTS

- A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.
 - 1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Division 16 Section "Transient Voltage Suppression."
 - 2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Comply with requirements in Division 16 Section "Transient Voltage Suppression" as recommended by manufacturer for type of line being protected.
- B. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V RMS injected into power supply lines at 10 to 10,000 MHz.
- C. Tamper Protection: Tamper switches on detection devices, controllers, annunciators, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or disconnected.
- D. Manufacturers:
 - 1. Bosch
 - 2. Napco
- E. Keypad and Display Module:
 - 1. Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.
 - 2. 13 Character Alpha Numeric display.
 - 3. Furnish with STI6560 protective cover with keyed lock.
- F. Cellular Communicator:
 - 1. Provide and install Napco Starlink NAP-SLEGSM34GFREE cellular communicator and provide monitoring for 1 year. Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through this cellular communicator.

2.4 DOOR AND WINDOW SWITCHES

- A. Description: Balanced-magnetic switch, complying with UL 634, installed on frame with integral overcurrent device to limit current to 80 percent of switch capacity. Bias magnet and minimum of two encapsulated reed switches shall resist compromise from introduction of foreign magnetic fields.
- B. Flush-Mounted Switches: Unobtrusive and flush with surface of door and window frame.

2.5 MICROWAVE-PIR DUAL-TECHNOLOGY MOTION SENSORS

- A. Description: Single unit combining a sensor that detects changes in microwave signals and a PIR sensor that detects changes in ambient level of infrared emissions caused by standard-intruder movement within detection pattern.
- B. Device Performance: An alarm is transmitted when either sensor detects a standard intruder within a period of three to eight seconds from when the other sensor detects a standard intruder.
 - 1. Minimum Detection Pattern: A room 20 by 30 feet.
 - 2. PIR Sensor Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F or less, and standard-intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps across 2 adjacent segments of detector's field of view.
 - 3. Microwave Sensor Sensitivity: Adjustable, able to detect standard-intruder movement within sensor's detection pattern at any speed between 0.3 to 7.5 fps. Sensor sensitivity adjustments shall be accessible only when sensor housing is removed, and sensors shall comply with 47 CFR 15.
 - 4. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test enabling switch under sensor housing cover.

2.6 ACOUSTIC-TYPE, GLASS-BREAK SENSORS:

- A. Detect unique, airborne acoustic energy spectrum caused by breaking glass.
 - 1. Sensor Element: Microprocessor-based, digital device to detect breakage of plate, laminate, tempered, and wired glass while rejecting common causes of false alarms. Detection pattern shall be at least a 20-foot range.
 - 2. Hookup Cable: Factory installed, not less than 72 inches.
 - 3. Activation Indicator: LED on sensor housing that lights when responding to vibrations, remaining on until manually reset at sensor controller or at central-station control unit.
 - 4. Controller: Integral with sensor housing or in a separate assembly, locally adjustable by control under housing cover.

2.7 AUDIBLE AND VISUAL ALARM DEVICES

- A. Siren: 30-W speaker with siren driver, rated to produce a minimum sound output of 103 dB at 10 feet from central-station control unit.
 - 1. Outdoor Enclosure: Weather-resistant steel box with tamper switches on cover and on back of box.

PART 3 - EXECUTION

3.1 SYSTEM INSTALLATION

A. Comply with UL 681.

3.2 WIRING INSTALLATION

- A. Installation: UL 681.
- B. Wiring Method: Install wiring in raceways except in accessible indoor ceiling spaces. Secure from building structure steel (no from walls) by means of J-hooks. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch. Control and data transmission wiring shall not share conduit with other building wiring systems.
- C. Where available lay out cables in cable tray.
- D. Wiring shall not be exposed below ceiling.
- E. Raceway system shall comply with Section 16130.
- F. Each security device is to have an individual cable from the device to the Control Panel.
- G. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- H. Wires and Cables:
 - 1. Conductors: Size as recommended in writing by system manufacturer, unless otherwise indicated.
 - 2. 120-V Power Wiring: Install according to Division 16 Section "Conductors and Cables," unless otherwise indicated.
 - 3. Control and Signal Transmission Conductors: Install unshielded, twisted-pair cable, unless otherwise indicated or if manufacturer recommends shielded cable.
 - 4. Provide rated for return open plenum.
 - 5. Underground cabling: Please provide water resistant/water blocking type, equal to West Penn "Aquaseal".
- I. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- J. Install power supplies and other auxiliary components for detection devices at controllers, unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.
- K. Identify components with engraved, laminated-plastic or metal nameplate for central-station control unit and each terminal cabinet, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 16 Section "Electrical Identification."

3.3 ZONES

A. Each building area shall be zoned by occupancy areas (office area, kitchen, science lab, computer lab, first floor classrooms, second floor classrooms) and interior and exterior zones

3.4 GROUNDING

- A. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide 5-ohm ground. Measure, record, and report ground resistance.
- C. Install grounding electrodes of type, size, location, and quantity indicated. Comply with installation requirements in Division 16 Section "Grounding and Bonding."

3.5 FIELD QUALITY CONTROL

- A. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting.
 - 1. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.
- B. Perform the following field tests and inspections and prepare reports:
 - 1. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
 - 2. Operational Tests: Schedule tests after pretesting has been successfully completed. Test all modes of system operation and intrusion detection at each detection device. Test for detection of intrusion and for false alarms in each protected zone. Test for false alarms by simulating activities outside indicated detection patterns.
- C. Report of Tests and Inspections: Prepare a written record of tests, inspections, and detailed test results in the form of a test log.
- D. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.

3.6 MONITORING

A. Include in bid proposal the cost for 1 year remote monitoring. Monitoring station shall UL listed and 24 hour 365 days operation.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain intrusion detection. Refer to Division 1 Section "Demonstration and Training."
- B. Train Owners maintenance personnel on programming equipment for starting up and shutting down, troubleshooting, servicing, and maintaining equipment. Provide a minimum of two 2 hours training.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

END OF SECTION 267240

PART 1 - GENERAL

1.1 SUMMARY

A. Furnishing and installation of electric hand dyers.

1.2 SUBMITTALS

A. Product Data: For each type of product.

1.5 WARRANTY

A. Provide a 7-year warranty from date of acceptance of project.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Excel Dryer, Inc.

2.2 MINIMUM FEATURES

- B. Hand dryer cover shall be a one-piece, heavy-duty, rib-reinforced, lightweight unbreakable, rustproof, die-cast zinc alloy. All exposed surfaces shall be bright chrome plated or finished with chip-proof, electrostatically applied epoxy paint and fastened to a wall plate by two chrome plated tamper-proof bolts.
- C. Hand dryer wall plate shall be equipped with (3) 7/8" diameter holes, one of which shall be suitable for use with surface conduit, for ease of wiring. All internal hand dryer parts shall be coated according to Underwriters' Laboratories, Inc. requirements.
- D. Entire mechanism shall be internally grounded.
- E. Hand dryer motor shall be a series commutated through-flow discharge vacuum motor/blower (5/8 HP / 20,000 RPM) which provides air velocity of 16,000 LFM (linear feet per minute) at the air outlet and 14,000 LFM at the hands (4 inches below air outlet).
- F. No heat technology.
- G. Hand dryer Control assembly is activated by an infrared optical sensor located next to the air outlet. The dryer shall operate as long as hands are under the air outlet. There is a 35-second lockout feature if hands are not removed.
- H. ADA-Compliant recess kit.

SECTION 268050 - HAND DRYERS

2.3 OPERATION

- A. Touch-free infra-red operation activation.
- B. Hand dry time measurement: 10 seconds.
- C. Operation lock out period: 30 seconds.
- D. Operation airflow: 43-65 CFM.
- E. Rated operating noise power: 65-75dB(a) Average

2.4 ELECTRICAL

- A. Voltage: 110-120V.
- B. Power Consumption: 4.5 AMPS. Entire unit shall be internally grounded.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's recommendations and instructions.

END OF SECTION 268050